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MİMAR SİNAN FINE ARTS UNIVERSITY
INSTITUDE OF SCIENCE AND TECHNOLOGY

SUSTAINABLE BUILDING ASSESMENT SYSTEMS AND APLICATIONS IN TURKEY

Graduate Thesis By

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SÜRDÜRÜLEBİLİR YAPI DEĞERLENDİRME SİSTEMLERİ VE TÜRKİYE'DEKİ UYGULAMALARI

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Selen Cevahir tarafından hazırlanan "SÜRDÜRÜLEBİLİR YAPI DEĞERLENDİRME SİSTEMLERİ VE TÜRKİYEDEKİ UYGULAMALARI" adlı araştırmanın Yüksek Lisans Tezi olarak uygun olduğunu onaylarım.

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Bu çalışma, jürimiz tarafından Mimar Sinan Güzel Sanatlar Üniversitesi Fen Bilimleri Enstitüsü Yapı Mühendisliği Anabilim Dalı, Yapım Proje Yönetimi Programında Yüksek Lisans Tezi olarak kabul edilmiştir.

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ÖZET

Günümüzde küresel ısınma konusunun gündeme gelmesi ile dünyada küresel ısınmanın yol açtığı iklim değişikliğine çok büyük etkisi olan sera gazı salımlarını düşürmek için çeşitli girişimlerde bulunulmaktadır. Küresel ısınmanın dışında endüstri ve teknolojinin gelişimi ile birlikte dünya üzerindeki doğal kaynakların da hızla tükendiği görülmektedir. Bu etkileri en aza indirmek için sürdürülebilirlik adı altında bir takım girişimlere başlanmış olup inşaat sektörü de bu girişimlere duyarsız kalmamıştır. Sera gazı salımında ve tükenen doğal kaynakların üzerinde inşaat endüstrisinin payı hissedilir derecede fazladır. Son zamanlarda yapı sektörü de sürdürülebilir mimarlık üzerine bazı girişimlerde bulunmaya başlamıştır.

Sürdürülebilir mimarlık başlığında tasarlanan projelerde enerji, su ve malzeme verimliliği düşünülerek çalışmalara başlanmıştır. Her işletme kendi imkânları ve bilgisi doğrultusunda çevresel ve sosyal bilinci göz önünde bulundurarak sürdürülebilir mimarlık çerçevesinde çalışmalarını sürdürürken, bu durumu daha verimli hale getirmek üzere başta Amerika ve İngiltere olmak üzere çeşitli yeşil bina sertifika sistemleri geliştirilmeye başlanmıştır. Sertifikalar tamamen gönüllü olarak kullanılmak üzere yapılanmıştır. BREEAM CASBEE ECO-QUANTUM, ECOPROFILE, GBC, GREENSTAR, LCAid, LEED, SBtool ve DGNB gibi tamamen gönüllü olarak kullanılmak üzere sertifika sistemleri oluşturulmuştur. Ancak bu örneklerde malzeme çeşitliliğine, iklim farklılıklarına, coğrafi farklılıklara, enerji üretimine, kültürel adaptasyona ve hukuki alt yapıya uyumlu bir sistem tam anlamda geliştirilemediği için bir sertifika diğer bölge veya ülkelerce kullanılması yeterince verimli olmamaktadır.

Türkiye'de sertifika sahibi olmak isteyen inşaat firmaları şu aşamada dünyaca kabul gören LEED ve BREEAM sertifikaları üzerinde yoğunlaşmıştır. Hali hazırda Türkiye'de bu sertifikaları almış binalar ve bu sürecin içinde inşası süren yapılar bulunmaktadır. Türkiye'de daha çok yeni olarak talep gören bu sistemleri mevcut sistemler içinde uygulamak, çeşitli adaptasyon zorluklarına ve revizyonlara neden olmaktadır.

Geleneksel mimari projelerle karşılaştırıldığında sürdürülebilir mimarlık sistemi, sürdürülebilir mimari projelerinde rol alan aktörlere (mimar, işveren, yüklenici, proje yöneticileri, kullanıcılar vb.) ek yükler getirmektedir. Bu kapsamda sürdürülebilir mimarlık işleyişi süreci ve yönetiminde alınan bu yeni sorumluluk ve görevlerin ne kadar ve ne şekilde yerine getirildiği tartışma konusudur.

Türkiye'nin kendisine özgü bir sertifika sistemi henüz bulunmamaktadır. Sürdürülebilir bina yapımında dünya genelinde kabul gören dünya genelinde kabul gören LEED ve BREEAM sertifika sistemleri temel alınmaktadır. Bununla birlikte ekolojik değerler göz önünde bulundurularak çevreye duyarlı, ekonomik, sosyokültürel iklim farklılıklarına duyarlı bir sertifika sistemi üzerinde çeşitli dernek ve kuruluşlar tarafından çalışmalar yapılmaktadır.

Bu çalışmada öncelikle tasarım ve yapımda sürdürülebilirlik konuları incelenmiştir. Daha sonra mevcut sürdürülebilir bina değerlendirme sistemleri irdelenmiş, Türkiye'de bu alanda yapılan çalışmalara yer verilmiştir. Son olarak Türkiye'de uygulanmış sürdürülebilir projelerin sertifika danışmanlarıyla görüşerek elde edilen veriler değerlendirilmiş ve rol alan aktörlerin karşılaştığı zorluklar, sürdürülebilir proje yönetimi kapsamındaki ihtiyaçlar vurgulanmıştır.

Anahtar Kelimeler: Sürdürülebilir mimarlık, sürdürülebilir mimarlık sertifikaları

SUMMARY

As far as global warming is concerned, there are several initiatives to reduce the greenhouse gas emissions which have a great effect on climate change around the world. Apart from global warming along with the development of industry and technology, quickly running out of natural resources are observed in the world. In order to minimize these effects there are some initiatives under the name of sustainability. Construction sector also did not stay indifferent to this initiative. The share of the construction sector is appreciably high on greenhouse gas emission and the depletion of natural resources. So that some initiatives have also begun in the field of design and construction. In sustainable architectural projects it is set to work with the idea of water energy and materials efficiency in the beginning.

All enterprises with their own potential and information, continued to their studies in the frame of sustainable architecture. In accordance with environmental and social consciousness, a variety of sustainable building certification systems have been developed. The certification systems such as BREEAM, CASBEE, ECO-QUANTUM, ECOPROFILE, GBC, GREENSTAR LCAid, LEED and DGNB are used voluntarily.

Unfortunately, there is not any fairly compatible system for the diversity of materials, climate differences, geographical differences, energy production, and cultural adaptation and there is no legal infrastructure to use the certificate adequately productive in other regions or countries.

In Turkey, the companies willing to get a certificate for their projects currently focused on the LEED and BREEAM certification systems recognized by many countries in the world. In Turkey there are some buildings which have already got one of these certifications and there are also ongoing building projects that are candidate to get sustainable certification.

These systems are newly demanded in Turkey and to implement these new systems to existing one raises a variety of adaptation and revision.

When it is compared with traditional projects, sustainable architecture projects bring additional changes and responsibilities to the actors such as architects, employers, contractors, project managers, users etc. In this context, the management of sustainable architecture process and also how responsibilities and duties fulfilled are open to discussion. In Turkey a specific certification system does not exist, but LEED and BREEAM certification systems are taken in account in the construction of sustainable buildings. However many associations and organizations have initiated some works to develop a system which is environmentally sensitive, economic, socio-cultural and sensitive to climatic variations.

In this study, previously sustainability in design and construction are investigated. Then current sustainable building assessment systems are analyzed and attempts in this area in Turkey are presented. Finally, the results of the interviews carried out with the certification consultant of sustainable building projects are discussed. Problem encountered by the actors and also the requirements of sustainable project management are highlighted.

Key words: Sustainable architecture, sustainable architecture certificates.

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September, 2010 Selen CEVAHİR

Architect

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LIST OF ABBREVIATIONS

LCD Life Cycle Design
SABD Sustainable Architecture and Building Design
RES Renewable Energy Sources
EML Electricity Market Law
EMRA Energy Market Regulatory Authority
BREEAM Building Research Environmental Assessment Method Establishment
CASBEE Comprehensive Assessment System for Built Environment Efficiency
LEED Leadership in Energy and Environmental Design
SBtool Sustainable Building Tool
DGNB Deutsche Gesellschaft für Nachhaltiges Bauen
SBAT Sustainable Building Assessment Tool
SPeAR Sustainable Project Appraisal Routine
GBTool Green Building Tool
BEES Building for Environmental and Economic Sustainability
GBC Green Building Challenge
BOT Built-Operate-Transfer
ASHRAE The American Society of Heating, Refrigerating and Air-Conditioning Engineers

INTRODUCTION

Climate change is a global problem requiring the cooperation of all countries to be addressed effectively. The principle of common but differentiated responsibilities between industrialized and developing countries is well established in the negotiations. Development is a key priority for decision-makers in developing countries, so that building climate change policy on development priorities would make it attractive to these stakeholders. Starting from development objectives and then describing paths of more sustainable development that also address climate change may be the easiest way for many developing countries to take the first steps in longer-term action on climate change. The approach has a basis in the convention, which, together with a proposed reporting structure, would provide sufficient stringency for a first step (Winkler, 2006).

For making the sustainable development more productive the sustainable building certificates are developed and they bring additional works for this improvement. The applicability of sustainable building certified construction requires the use of some innovative approaches in the process of the project from design to the end of the construction. (Winkler, 2006) This innovations effects every phase in the life cycle of the project. There are new demands, needs, responsibilities, positions, efforts, and information. Sustainable building project actors should consider these differences from the beginning of the concept. These principles can be effectively incorporated in the building processes through the adoption of suitable project management practices.

AIM OF THE STUDY

The aim of this study is to analyze the current applications of sustainability in Turkey and to find out the difficulties and problems encountered by architects, consultants, contractors, employers, users etc. during the implementation of sustainable building certification systems.

RESEARCH METHODOLOGY

In order to obtain the aim of the study the following research methodology had been established:

− Literature search on sustainable design and construction, and also sustainable assessment systems.

− Investigation of current situation in Turkey.

− Interviewing with consultant of certified sustainable buildings in Turkey to analyze the problems encountered during the implementation of certification systems.

These methods are followed to gain an overall knowledge about sustainable architecture. Also, especially by the help of the interviews, a contribution to the clarification of the broad range of perspectives is established.

1 SUSTAINABILITY IN DESIGN AND CONSTRUCTION

1.1 SUSTAINABLE ARCHITECTURE

What Is Sustainability?

Sustainability is policies and strategies that meet society's present needs without compromising the ability of future generations to meet their own needs. It is the potential for long-term maintenance of wellbeing, which in turn depends on the wellbeing of the natural world and the responsible use of natural resources.

Sustainability has many definitions which are vague and ambiguous, thus underlining the diversity of perspectives related to the concept whose power resides in the integration of economic, social and ecological systems, previously treated in a separate manner (Grunkemeyer, 2000). However, the environmental situation of our planet is greatly compromised by human activities, so everybody has to think in terms of sustainable development. The great differences among places in the world have led towards the concept of local sustainable development as a contribution to global sustainability, and developed countries can and must help developing countries (Maiellaro, 2001).

Ways of living more sustainably can take many forms from reorganizing living conditions (e.g., ecovillages, eco-municipalities and sustainable cities), reappraising economic sectors (perm culture, green building, sustainable agriculture), or work practices (sustainable architecture), using science to develop new technologies (green technologies, renewable energy), to adjustments in individual lifestyles that conserve natural resources.

Climate change is a global problem requiring the cooperation of all countries to be addressed effectively. Climate change is not seen as a priority by developing countries, which are preoccupied by the challenges of meeting basic development needs. As discussions on actions beyond the first commitment period under the Kyoto Protocol draws closer, the question of how developing countries might participate in the effort against global warming becomes more urgent.

Most national governments have signed and ratified the Kyoto Protocol aimed at reducing greenhouse gas emissions.

The greenhouse effect is the process by which absorption and emission of infrared radiation by gases in the atmosphere warm a planet's lower atmosphere and surface. It was discovered by Joseph Fourier in 1824 and was first investigated quantitatively by Svante Arrhenius in 1896 (Weart, 2008) Existence of the greenhouse effect as such is not disputed, even by those who do not agree that the recent temperature increase is attributable to human activity. The question is instead how the strength of the greenhouse effect changes when human activity increases the concentrations of greenhouse gases in the atmosphere.

What Is Sustainable Architecture?

We mentioned about CO2 emission reductions importance in sustainability in the definition of sustainability. And building sector has a big role on it. Building sector lies at the origin of global problems like global warming and climate change.
In European Union Countries [EU] more than 40% of total energy use, 30% of CO2 emissions and 40% of synthetic waste is caused by the building sector. (Ashford, 1998 and1999)

Materials and energy are used in the form of large amounts in building industry. Also buildings cause destruction of forest lands, degradation of clean water sources, and deformation of the ozone layer.
Approximately 50% of the materials which are extracted from the earth are used by building sector (Working Group for Sustainable Construction [WGSC], 2004).
It can be seen that consumption is above of the sustainability level (Özmehmet, 2007).

In Figure 1.1 50% of produced energy is consumed in buildings. (Erengezgin, 2005).

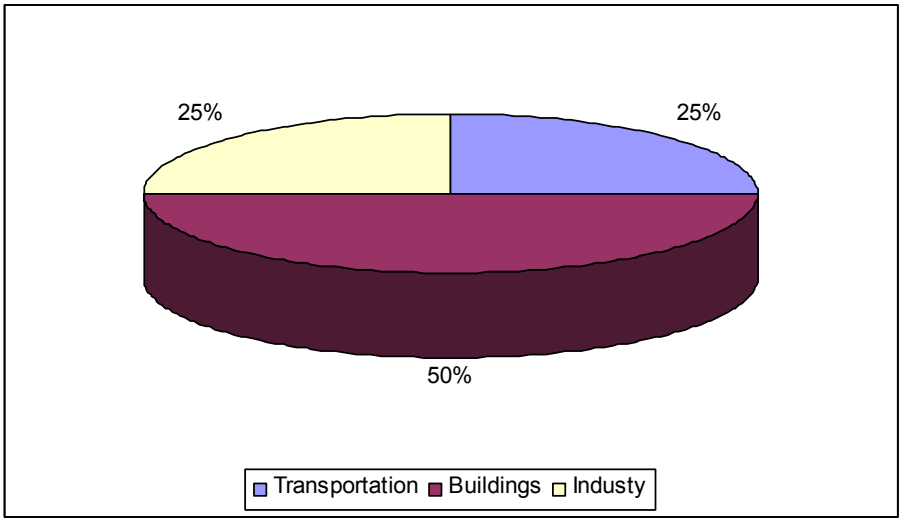

Figure 1.1 Consumption of produced energy according to different sectors of the world (Erengezgin, 2005).

And sustainable architecture aims to minimize these negative impacts of buildings to the environment by using design techniques that consider enhancing use of materials, energy and development space for the future generations.

Every building project requires change to ecological systems and uses energy and resources; a perfectly green building is not truly possible. Instead, every building project presents the opportunity to improve its environmental performance, within the inevitable constraints of budget and building codes.

Sustainable architecture is a general term that describes environmentally-conscious design techniques in the field of architecture. Sustainable architecture is framed by the larger discussion of sustainability and the pressing economic and political issues of our world. In the broad context, sustainable architecture seeks to minimize the negative environmental impact of buildings by enhancing efficiency and moderation in the use of materials, energy, and development space. Most simply, the idea of sustainability, or ecological design, is to ensure that our actions and decisions today do not inhibit the opportunities of future generations

(URL-1).This term can be used to describe an energy and ecologically conscious approach to the design of the built environment (URL-2).

1.1.1 Sustainable Building Approaches

The origin of the green architecture movement stems back to the green political movements during the 1970's and 80's. Key events include the energy crisis of the 1970's, the formation of the Greenpeace organization in 1971, as well as conception of the Green Party in European and United States governments during the 70's and 80's. These events were causing people to become more educated on the effects our industrial society was having on the environment (URL-3).

1.1.2 Sustainable Design Framework

The three levels of the framework (Principles, Strategies, and Methods) correspond to the three objectives of architectural environmental education: creating environmental awareness, explaining the building ecosystem, and teaching how to design sustainable buildings. The overall conceptual diagram for sustainable design is shown in Table 1.1 (Kim, 1998).

Table 1.1 Conceptual framework for Sustainable Design and Pollution Prevention in Architecture

SUSTAINABLE DESIGN AND POLLUTION PREVENTION		
Principles		
Economy of Resources	**Life Cycle Design**	**Humane Design**
Strategies		
Energy Conservation	**Pre building Phase**	**Preservation of Natural Conditions**
Water Conservation	**Building Phase**	**Urban Design Site Planning**
Material Conservation	**Post building Phase**	**Design for Human Comfort**
METHODS		

There are three principles of sustainability in architecture. Economy of Resources is concerned with the reduction, reuse, and recycling of the natural resources that are input to a building. Life Cycle Design provides a methodology for analyzing the building process and its impact on the environment. Humane Design focuses on the interactions between humans and the natural world. These principles can provide a broad awareness of the environmental impact, both local and global, of architectural consumption.

1.1.3 Principles of Sustainable Design

Principle 1: Economy of Resources

By economizing resources, the architect reduces the use of nonrenewable resources in the construction and operation of buildings. There is a continuous flow of resources, natural and manufactured, in and out of a building. This flow begins with the production of building materials and continues throughout the building's life span to create an environment for sustaining human well-being and activities. After a building's useful life, it should turn into components for other buildings. When examining a building, consider two streams of resource flow (see Figure 1.2). Upstream, resources flow into the building as input to the building ecosystem. Downstream, resources flow out of the building as output from the building ecosystem. In a long run, any resources entered into a building ecosystem will eventually come out from it. This is the law of resource flow conservation.

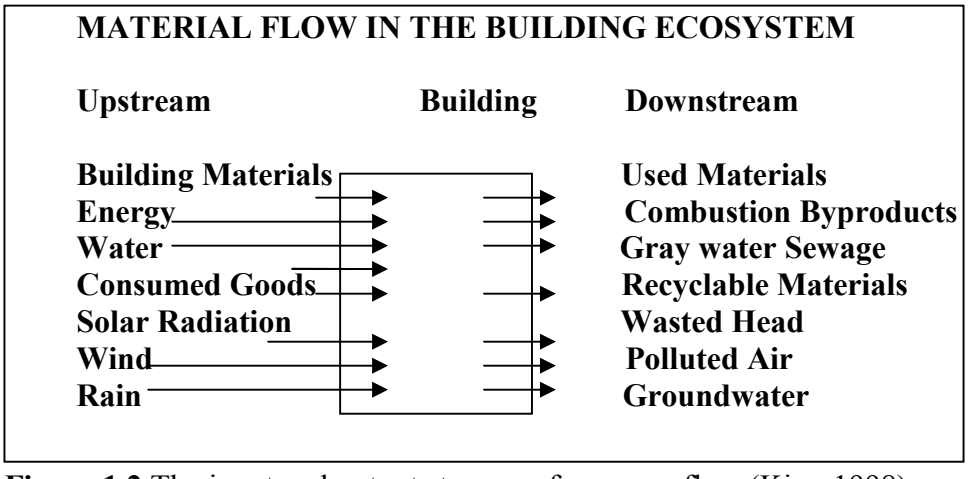

Figure 1.2 The input and output streams of resource flow (Kim, 1998).

For a given resource, its forms before entry to a building and after exit will be different. This transformation from input to output is caused by the many mechanical processes or human interventions rendered to the resources during their use in buildings.

The input elements for the building ecosystem are diverse, with various forms, volumes, and environmental implications.

The three strategies for the economy of resources principle are energy conservation, water conservation, and material conservation. Each focuses on a particular resource necessary for building construction and operation.

Energy Conservation

After construction, a building requires a constant flow of energy input during its operation. The environmental impacts of energy consumption by buildings occur primarily away from the building site, through mining or harvesting energy sources and generating power. The energy consumed by a building in the process of heating, cooling, lighting, and equipment operation cannot be recovered.

The type, location, and magnitude of environmental impacts of energy consumptions in buildings differ depending on the type of energy delivered. Coal-fired electric power plants emit polluting gases such as SO2 , CO2 , CO, and NOx into the atmosphere. Nuclear power plants produce radioactive wastes, for which there is currently no permanent management solution. Hydropower plants each require a dam and a reservoir which can hold a large body of water; construction of dams' results in discontinuance of river ecosystems and the loss of habitats for animals and plants.

Water Conservation

A building requires a large quantity of water for the purposes of drinking, cooking, washing and cleaning, flushing toilets, irrigating plants, etc. All of this water requires treatments and delivery, which consume energy. The water that exits the building as sewage must also be treated.

Material Conservation

A range of building materials are brought onto building sites.

The influx of building materials occurs primarily during the construction stage. The waste generated by the construction and installation process is significant. After construction, a low-level flow of materials continues in for maintenance, replacement, and renovation activities. Consumer goods flow into the building to support human activities. All of these materials are eventually output, either to be recycled or dumped in a landfill.

Principle 2: Life Cycle Design

The conventional model of the building life cycle is a linear process consisting of four major phases: design; construction; operation and maintenance; and demolition (see Figure 1.3).

The problem with this model is that it is too narrowly defined: it does not address environmental issues (related to the procurement and manufacturing of building materials) or waste management (reuse and recycling of architectural resources).

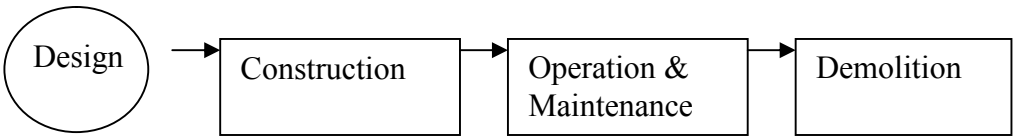

Figure 1.3 Conventional model of the building life cycle (Rigdon 1998).

The second principle of sustainable architecture is life cycle design (LCD). This "cradle-to-grave" approach recognizes environmental consequences of the entire life cycle of architectural resources, from procurement to return to nature. LCD is based on the notion that a material transmigrates from one form of useful life to another, with no end to its usefulness.

For the purpose of conceptual clarity, the life cycle of a building can be categorized into three phases: pre-building, building, and post-building, as shown in Figure 1.4. These phases are connected, and the boundaries between them are not obvious. The phases can be developed into LCD strategies that focus on minimizing the environmental impact of a building. Analyzing the building processes in each of these three phases provides a better understanding of how a

building's design, construction, operation, and disposal affect the larger ecosystem.

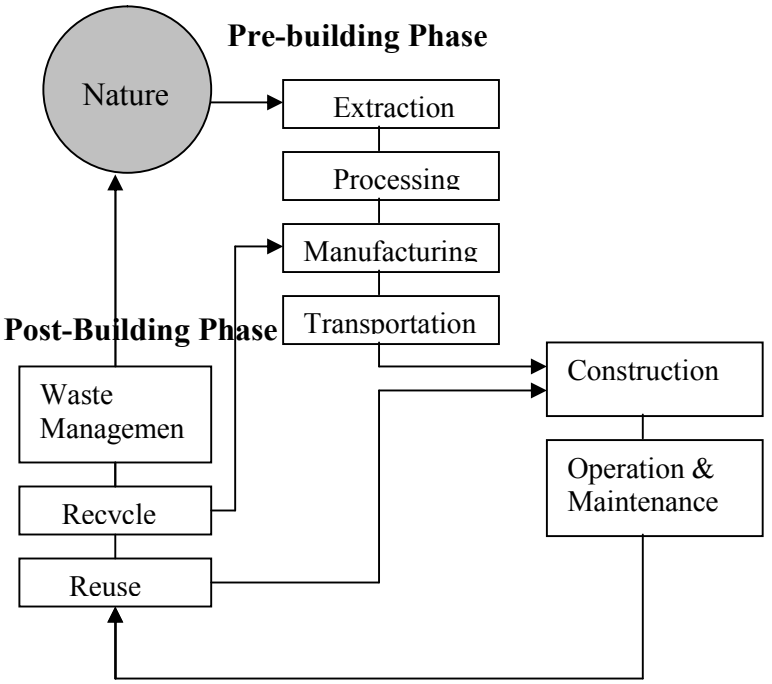

Figure 1.4 The sustainable building life cycle (Rigdon 1998).

Pre-Building Phase

This phase includes site selection, building design, and building material processes, up to but not including installation. Under the sustainable-design strategy, we examine the environmental consequences of the structure's design, orientation, impact on the landscape, and materials used.

The procurement of building materials impacts the environment: harvesting trees could result in deforestation; mining mineral resources (iron for steel; bauxite for aluminum; sand, gravel, and limestone for concrete) disturbs the natural environment; even the transport of these materials can be a highly polluting activity, depending on their weight and distance from the site. The manufacturing of building products also requires energy and creates environmental pollution: for example, a high level of energy is required to manufacture steel or aluminum products.

Building Phase

This phase refers to the stage of a building's life cycle when a building is physically being constructed and operated. In the sustainable-design strategy, we examine the construction and operation processes for ways to reduce the environmental impact of resource consumption; we also consider long-term health effects of the building environment on its occupants.

Post-Building Phase

This phase begins when the useful life of a building has ended. In this stage, building materials become resources for other buildings or waste to be returned to nature. The sustainable design strategy focuses on reducing construction waste (which currently comprises 60% of the solid waste in landfills1) by recycling and reusing buildings and building materials.

Site and Building Interactions

The LCD concept calls for consideration of the environmental consequences of buildings in all three phases of the life cycle.

Each phase of building life cycle is associated with two groups of ecological elements: site and building (see Figure 1.5). The principal domain of architectural design is in the building phase, but sustainable building can be achieved by finding ways to minimize environmental impacts during all three phases of building life cycle.

	SITE: Elements of the site ecology that exist within or in the vicinity of a building site, including sunlight, wind, precipitation, water table, soil, flora, fauna, etc…	**BUILDING:** Natural or manufactured resources, such as building materials, water, or energy…
Pre-Building	…before construction	…before they arrive at the site
Building	…from the time construction begins through the duration of the building's useful life	…from the time arrive at the site for installation or operation through the duration of the building' useful life.
Post-Building	…after the building's useful life	…after the building's useful life

Figure 1.5 Ecological elements of Site and Building associated with the building life-cycle phases (Rigdon 1998).

Principle 3: Humane Design

Humane design is the third, and perhaps the most important, principle of sustainable design. While economy of resources and life cycle design deal with efficiency and conservation, humane design is concerned with the livability of all constituents of the global ecosystem, including plants and wildlife. This principle arises from the humanitarian and altruistic goal of respecting the life and dignity of fellow living organisms. Further examination reveals that this principle is deeply rooted in the need to preserve the chain elements of the ecosystems that allow human survival.

In modern society, more than 70% of a person's lifespan is spent indoors. An essential role of architecture is to provide built environments that sustain

occupants' safety, health, physiological comfort, psychological well-being, and productivity.

Because environmental quality is intangible, its importance has often been overlooked in the quest for energy and environmental conservation, which sometimes seemed to mean "shivering in the dark." Compounding the problem, many building designers have been preoccupied with style and form-making, not seriously considering environmental quality in and around their built environments. Remember the performance factor of design. When a product saves energy, does it perform as well as what it is replacing? And how does it affect the performance of building occupants? For instance, early fluorescent lighting systems were more efficient than their incandescent counterparts; however, some fluorescents were known to buzz. The bulb might save 60TL in annual energy costs, but if the noise irritated the employee working nearby, the employee's resulting drop in productivity could cost the employer a lot more, thereby wiping out any financial benefits gained from lighting energy conservation.

A general rule of thumb in such comparisons is that the annual energy bill of a typical office building amounts to around five hours of employee labor cost; therefore, any building energy conservation strategy that annually reduces productivity by more than five hours per employee defeats its purpose. This is not to say that energy conservation can't be financially beneficial, just that it should be kept in holistic perspective, taking other pertinent factors into account.

The following three strategies for humane design focus on enhancing the coexistence between buildings and the greater environment, and between buildings and their occupants,

Preservation of Natural Conditions

An architect should minimize the impact of a building on its local ecosystem (e.g., existing topography, plants, and wild life).

Urban Design and Site Planning

Neighborhoods, cities, and entire geographic regions can benefit from cooperative planning to reduce energy and water demands. The result can be a more pleasant urban environment, free of pollution and welcoming to nature.

Human Comfort

As discussed previously, sustainable design need not preclude human comfort. Design should enhance the work and home environments. This can improve productivity, reduce stress, and positively affect health and well-being.

1.1.4 Strategies of Sustainable Buildings

The ultimate goal and challenge of sustainable design is to find win-win solutions that provide quantitative, qualitative, physical, and psychological benefits to building users. There are many possibilities for achieving this seemingly difficult goal. The three principles of sustainable design economy of resources, life cycle design, and humane design provide a broad awareness of the environment issues associated with architecture. The strategies within each principle focus on more specific topics. These strategies are intended to foster an understanding of how a building interacts with the internal, local, and global environments.

A) Economy of Resources

Conserving energy, water, and materials can yield specific design methods that will improve the sustainability of architecture (see Table 1.2). These methods can be classified as two types.

Table 1.2 "Economy of Resources" methods of application (Kim, 1998).

SUSTAINABLE DESIGN AND POLLUTION PREVENTION		
Principle 1: Economy of Resources Strategies		
Energy Conservation	**Water Conservation**	**Material Conservation**
Methods		
Energy-conscious urban planning Energy-conscious site planning Alternative sources of energy Passive heating and cooling Avoidance of heat gain or heat loss Use of low-embodied-energy materials Use of energy efficient appliances with timing devices	Reduction: - Indigenous landscaping - Low-flow showerheads - Vacuum-assist toilets or smaller toilet tanks Reuse: - Rainwater collection - Gray water collection	Material conserving design and construction Proper sizing of building systems Rehabilitation of existing structures Use of reclaimed or recycled materials and components Use of nonconventional building materials

1) Input-reduction methods reduce the flow of nonrenewable resources input to buildings. A building's resource demands are directly related its efficiency in utilizing resources.

2) Output-management methods reduce environmental pollution by requiring a low level of waste and proper waste management.

a) Energy Conservation

Energy conservation is an input-reduction method. The main goal is to reduce consumption of fossil fuels. Buildings consume energy not only in their operation, for heating, lighting and cooling, but also in their construction. The materials used in architecture must be harvested, processed, and transported to the building site. Construction itself often requires large amounts of energy for processes ranging from moving earth to welding.

Energy-Conscious Urban Planning

Cities and neighborhoods that are energy-conscious are not planned around the automobile, but around public transportation and pedestrian walkways. These cities have zoning laws favorable to mixed-use developments, allowing people to live near their workplaces. Urban sprawl is avoided by encouraging redevelopment of existing sites and the adaptive reuse of old buildings. Climatic conditions determine orientation and clustering. For example, a very cold or very hot and dry climate might require buildings sharing walls to reduce exposed surface area; a hot, humid climate would require widely spaced structures to maximize natural ventilation.

Energy-Conscious Site Planning

Such planning allows the designer to maximize the use of natural resources on the site. In temperate climates, open southern exposure will encourage passive solar heating; deciduous trees provide shade in summer and solar heat gain in winter. Evergreens planted on the north of a building will protect it from winter winds, improving its energy efficiency.

Buildings can be located relative to water onsite to provide natural cooling in summer.

Passive Heating and Cooling

Solar radiation incident on building surfaces is the most significant energy input to buildings. It provides heat, light, and ultraviolet radiation necessary for photosynthesis. Historically, architects have devised building forms that provide shading in summer and retain heat in winter. This basic requirement is often overlooked in modern building design. Passive solar architecture offers design

schemes to control the flow of solar radiation using building structure, so that it may be utilized at a more desirable time of day.

Shading in summer, by plants or overhangs, prevents summer heat gain and the accompanying costs of air-conditioning. The wind, or the flow of air, provides two major benefits: cooling and hygienic effects. Prevailing winds have long been a major factor in urban design. For instance, proposals for Roman city layouts were primarily based on the direction of prevailing winds.

Insulation

High-performance windows and wall insulation prevent both heat gain and loss. Reducing such heat transfer reduces the building's heating and cooling loads and thus its energy consumption. Reduced heating and cooling loads require smaller HVAC equipment, and the initial investment need for the equipment will be smaller.

Aside from these tangible benefits, high-performance windows and wall insulation create more comfortable thermal environments. Due to the insulating properties of the materials, the surface temperatures of windows and walls will be higher in the winter and lower in the summer. The installation of smaller HVAC equipment reduces mechanical noise and increases sonic quality of the indoor space.

Alternate Sources of Energy

Solar, wind, water, and geothermal energy systems are all commercially available to reduce or eliminate the need for external energy sources. Electrical and heating requirements can be met by these systems, or combination of systems, in all climates.

Day lighting

Building and window design that utilizes natural light will lead to conserving electrical lighting energy, shaving peak electric loads, and reducing cooling energy consumptions.

At the same time, day lighting increases the luminous quality of indoor environments, enhancing the psychological wellbeing and productivity of indoor occupants. These qualitative benefits of day lighting can be far more significant than its energy-savings potential.

Energy-Efficient Equipment & Appliances

After construction costs, a building's greatest expense is the cost of operation. Operation costs can even exceed construction costs over a building's lifetime. Careful selection of high efficiency heating, cooling, and ventilation systems becomes critical. The initial price of this equipment may be higher than that of less efficient equipment, but this will be offset by future savings.

Appliances, from refrigerators to computers, not only consume energy, they also give off heat as a result of the inefficient use of electricity. More efficient appliances reduce the costs of electricity and air-conditioning. The U. S. Environmental Protection Agency has developed the "Energy Star" program to assist consumers in identifying energy efficient electronic equipment.

Choose Materials with Low Embodied Energy

Building materials vary with respect to how much energy is needed to produce them. The embodied energy of a material attempts to measure the energy that goes into the entire life cycle of building material. For instance, aluminum has a very high embodied energy because of the large amount of electricity that must be used to manufacture it from mined bauxite ore; recycled aluminum requires far less energy to re fabricate. By choosing materials with low embodied energy, the overall environmental impact of a building is reduced. Using local materials over imported materials of the same type will save transportation energy.

b)Water Conservation

Methods for water conservation may reduce input, output, or both. This is because, conventionally, the water that is supplied to a building and the water that leaves the building as sewage is all treated by municipal water treatment plants. Therefore, a reduction in use also produces a reduction in waste.

Reuse Water Onsite

Water consumed in buildings can be classified as two types: gray water and sewage. Gray water is produced by activities such as hand washing. While it is not of drinking-water quality, it does not need to be treated as nearly as intensively as sewage.

In fact, it can be recycled within a building, perhaps to irrigate ornamental plants or flush toilets. Well-planned plumbing systems facilitate such reuse. In most parts of the world, rainwater falling on buildings has not been considered a useful resource. Buildings are typically designed to keep the rain from the occupants, and the idea of utilizing rain water falling on building surfaces has not been widely explored. Building envelopes, particularly roofs, can become rainwater collecting devices, in combination with cisterns to hold collected water. This water can be used for irrigation or toilet-flushing.

Reduce Consumption

Water supply systems and fixtures can be selected to reduce consumption and waste. Low-flow faucets and small toilet tanks are now required by code in many areas of the country.Vacuum-assisted and biocomposting toilets further reduce water consumption. Biocomposting toilets, available on both residential and commercial scales, treat sewage on site, eliminating the need for energy-intensive municipal treatment.

Indigenous landscaping — using plants native to the local ecosystem — will also reduce water consumption. These plants will have adapted to the local rainfall levels, eliminating the need for additional watering. Where watering is needed, the sprinkler heads should be carefully placed and adjusted to avoid watering the sidewalk and street.

c) Materials Conservation

The production and consumption of building materials has diverse implications on the local and global environments. Extraction, processing, manufacturing, and transporting building materials all cause ecological damage to some extent. There are input and output reduction methods for materials conservation. As with water, some of these methods overlap.

Adapt Existing Buildings to New Uses

One of the most straightforward and effective methods for material conservation is to make use of the resources that already exist in the form of buildings. Most buildings outlive the purpose for which they were designed. Many, if not all, of these buildings can be converted to new uses at a lower cost than brand-new construction.

Incorporate Reclaimed or Recycled Materials

Buildings that have to be demolished should become the resources for new buildings. Many building materials, such as wood, steel, and glass, are easily recycled into new materials.Some, like brick or windows, can be used whole in the new structure. Furnishing, particularly office partition systems, are also easily moved from one location to another.

Use Materials That Can Be Recycled

During the process of designing the building and selecting the building materials, look for ways to use materials that can themselves be recycled. This preserves the energy embodied in their manufacture.

Size Buildings and Systems Properly

A building that is oversized for its designed purpose, or has oversized systems, will excessively consume materials. When a building is too large or small for the number of people it must contain, its heating, cooling, and ventilation systems, typically sized by square footage, will be inadequate or inefficient. This method relates directly to the programming and design phases of the architectural process. The client's present and future space needs must be carefully studied to ensure that the resulting building and systems are sized correctly.

Architects are encouraged to design around standardized building material sizes as much as possible. In the U. S., this standard is based on a 4'x8' sheet of plywood. Excess trimming of materials to fit non-modular spaces generates more waste.

Reuse Non-Conventional Products as Building Materials

Building materials from unconventional sources, such as recycled tires, pop bottles, and agricultural waste, are readily available. These products reduce the need for new landfills and have a lower embodied energy that the conventional materials they are designed to replace.

Consumer Goods

All consumer goods eventually lose their original usefulness. The "useful life" quantifies the time of conversion from the useful stage to the loss of original usefulness stage. For instance, a daily newspaper is useful only for one day, a phone book is useful for one year, and a dictionary might be useful for 10 years. The shorter the useful life of consumer goods, the greater the volume of useless goods will result. Consequently, more architectural considerations will be required for the recycling of short-life consumer goods. The conventional term for consumer goods that have lost their original usefulness is waste. But waste is or can be a resource for another use. Therefore, in lieu of waste, it is better to use the term "recyclable materials." One way buildings can encourage recycling is to incorporate facilities such as on-site sorting bins.

B)Life Cycle Design

As discussed earlier, the Life Cycle Design principle embodies three strategies: pre-building, building, and post-building.These strategies, in turn, can yield specific design methods that will improve the sustainability of architecture.

Table 1.3 shows how each method relates to the main strategies of Life Cycle Design. These methods focus mainly on reducing input. Consuming fewer materials lessens the environmental impact of the associated manufacturing processes. This then reduces the eventual output of the building ecosystem.

Table 1.3 "Life Cycle Design" methods of application (Kim, 1998).

SUSTAINABLE DESIGN AND POLLUTION PREVENTION		
Principle 2: Life Cycle Design Strategies		
Pre-Building	**Building**	**Post-Building**
Methods		
Use materials that are ... -made of renewable resources - harvested or extracted without ecological damage - recycled - recyclable - long-lasting and low maintenance Minimize energy needed to distribute materials.	Schedule construction to minimize site impact. Provide waste separation facilities. Use nontoxic materials to protect construction workers as well as end users. Specify regular maintenance with nontoxic cleaners.	Adapt existing structures to new users and programs. Reuse building components and materials. Recycle building components and materials. Reuse the land and existing infrastructure.

a) Pre-Building Phase

During the Pre-Building Phase, the design of a building and materials selected for it are examined for their environmental impact. The selection of materials is particularly important at this stage: the impact of materials processing can be global and have long-term consequences.

Use Materials Made From Renewable Resources

Renewable resources are those that can be grown or harvested at a rate that exceeds the rate of human consumption. Using these materials is, by definition, sustainable. Materials made from nonrenewable materials (petroleum, metals, etc.) are, ultimately, not sustainable, even if current supplies are adequate. Using renewable materials wherever possible reduces the need for nonrenewable materials.

Use Materials Harvested or Extracted without Causing Ecological Damage

Of the renewable materials available, not all can be obtained without significant environmental effects. Therefore, the architect must be aware of how various raw materials are harvested and understand the local and global ramifications.

Use Recycled Materials

Using recycle materials reduces waste and saves scarce landfill space. Recycled materials also preserve the embodied energy of their original form, which would otherwise be wasted. This also reduces the consumption of materials made from virgin natural resources. Many building materials, particularly steel, are easily recycled, eliminating the need for more mining and milling operations.

Use Materials with Long Life and Low Maintenance

Durable materials last longer and require less maintenance with harsh cleansers. This reduces the consumption of raw materials needed to make replacements and the amount of landfill space taken by discarded products. It also means occupants receive less exposure to irritating chemicals used in the installation and maintenance of materials.

b) Building Phase

The methods associated with the Building Phase strategy are concerned with the environmental impact of actual construction and operation processes.

Minimize Site Impact

Careful planning can minimize invasion of heavy equipment and the accompanying ecosystem damage to the site. Excavations should not alter the

flow of groundwater through the site. Finished structures should respect site topology and existing drainage. Trees and vegetation should only be removed when absolutely necessary for access. For sensitive sites, materials that can be hand-carried to the site reduce the need for excessive road-building and heavy trucks.

Employ Nontoxic Materials

The use of nontoxic materials is vital to the health of the building's occupants, who typically spend more than three quarters of their time indoors. Adhesives used to make many common building materials can outgas — release volatile organic compounds into the air — for years after the original construction. Maintenance with nontoxic cleansers is also important, as the cleaners are often airborne and stay within a building's ventilation system for an extended period of time.

c) Post-Building Phase

During this phase, the architect examines the environmental consequences of structures that have outlived their usefulness. At this point, there are three possibilities in a building's future: reuse, recycling of components, and disposal. Reuse and recycling allow a building to become a resource for new buildings or consumer goods; disposal requires incineration or landfill dumping, contributing to an already overburdened waste stream.

Reuse the Building

The embodied energy of a building is considerable. It includes not only the sum of energy embodied in the materials, but also the energy that went into the building's construction. If the building can be adapted to new uses, this energy will be conserved. Where complete reuse of a building is not possible, individual components can be selected for reuse — windows, doors, bricks, and interior fixtures are all excellent candidates.

Recycle Materials

Recycling materials from a building can often be difficult due to the difficulty in separating different substances from one another. Some materials, like glass and

aluminum, must be scavenged from the building by hand. Steel can easily be separated from rubble by magnets. Concrete can be crushed and used as aggregate in new pours.

Reuse Existing Buildings and Infrastructure

It has become common for new suburbs to move farther and farther from the core city as people search for "space" and "nature." Of course, the development of new suburbs from virgin woods or fertile agricultural fields destroys the very qualities these suburbanites are seeking. Moreover, in addition to the materials for new houses, new development requires massive investments in material for roads, sewers, and the businesses that inevitability follow. Meanwhile, vacant land and abandoned structures in the city, with its existing infrastructure, go unused, materials wasted.

C) Humane Design

As described in the introduction, this principle embodies three strategies: preservation of natural conditions, urban design and site planning, and design for human comfort.

These strategies, in turn, yield specific design methods that will improve the sustainability of architecture.

Table 1.4 shows how each method relates to the three strategies of Humane Design. These methods focus primarily on improving the quality of life for humans and other species.

Table 1.4 "Humane Design" methods of application (Kim, 1998).

SUSTAINABLE DESIGN AND POLLUTION PREVENTION		
Principle 3: Humane Design Strategies		
Preservation of Natural Conditions	**Urban Design Site Planning**	**Design for Human Comfort**
Understand the impact of design on nature Respect topographical contours Do not disturb the water table Preserve existing flora and fauna	Avoid pollution contribution Promote mixed-use development Create pedestrian pockets Provide for human-powered transportation Integrate design with public transportation	Provide thermal, visual, and acoustic comfort Provide visual connection to exterior Provide operable windows Provide clean, fresh air Accommodate persons with differing physical abilities Use nontoxic, non out gassing materials

a) Preservation of Natural Conditions

Respect Topographical Contours

The existing contours of a site should be respected. Radical terraforming is not only expensive but devastating to the site's microclimate. Alteration of contours will affect how water drains and how wind moves through a site.

Do Not Disturb the Water Table

Select sites and building designs that do not require excavation below the local water table. Placing a large obstruction (the building) into the water table will disturb natural hydraulic process. If the water table is exposed during construction, it will also become more susceptible to contamination from polluted surface runoff.

Preserve Existing Flora and Fauna

Local wildlife and vegetation should be recognized as part of the building site. When treated as resources to be conserved rather than as obstacle to be overcome, native plants and animals will make the finished building a more enjoyable space for human habitation.

b) Urban Design and Site Planning

The methods associated with the Urban Design and Site Planning strategy apply sustainability at a scale larger than the individual building.

Integrate Design with Public Transportation Sustainable architecture on an urban scale must be designed to promote public transportation. Thousands of individual vehicles moving in and out of area with the daily commute create smog, congest traffic, and require parking spaces.

Promote Mixed Use Development

Sustainable development encourages the mixing of residential, commercial, office and retail space. People then have the option of living near where they work and shop. This provides a greater sense of community than conventional suburbs. The potential for 24-hour activity also makes an area safer.

c) Design for Human Comfort

Provide Thermal, Visual, and Acoustic Comfort

People do not perform well in spaces that are too hot or too cold. Proper lighting, appropriate to each task, is essential. Background noise from equipment or people can be distracting and damage occupants' hearing. Acoustic and visual privacy also need to be considered (Kim, 1998).

Provide Visual Connection to Exterior

The light in the sky changes throughout the day, as the sun and clouds move across the sky. Humans all have an internal clock that is synchronized to the cycle of day and night.

From a psychological and physiological standpoint, windows and skylights are essential means of keeping the body clock working properly,

Provide Operable Windows

Operable windows are necessary so that building occupants can have some degree of control over the temperature and ventilation in their workspace.

Provide Fresh Clean Air

Fresh air through clean air ducts is vital to the well-being of building occupants. The benefits of fresh air go beyond the need for oxygen. Continuous recirculation of interior air exposes people to concentrated levels of bacteria and chemicals within the building.

Use Nontoxic, Non-Out gassing Materials

Long-term exposure to chemicals commonly used in building materials and cleaners can have a detrimental effect on health.

Accommodate Persons with Differing Physical Abilities

One aspect of sustainable design is its longevity. Buildings that are durable and adaptable are more sustainable than those that are not. This adaptability includes welcoming people of different ages and physical conditions.

1.2 SUSTAINABLE CONSTRUCTION

Sustainable construction is defined as "the creation and responsible management of a healthy built environment based on resource efficient and ecological principles". Sustainably designed buildings aim to lessen their impact on our environment through energy and resource efficiency. It includes the following principles:

-minimizing non-renewable resource consumption

-enhancing the natural environment

-eliminating or minimizing the use of toxins

"Sustainable building" may be defined as building practices, which strive for integral quality (including economic, social and environmental performance) in a very broad way. Thus, the rational use of natural resources and appropriate management of the building stock will contribute to saving scarce resources, reducing energy consumption (energy conservation), and improving environmental quality (Maiellaro, 2001).

Sustainable building involves considering the entire life cycle of buildings, taking environmental quality, functional quality and future values into account. In the past, attention has been primarily focused on the size of the building stock in many countries. Quality issues have hardly played a significant role.

However, in strict quantity terms, the building and housing market is now saturated in most countries, and the demand for quality is growing in importance. Accordingly, policies that contribute to the sustainability of building practices should be implemented, with recognition of the importance of existing market conditions. Both the environmental initiatives of the construction sector and the demands of users are key factors in the market. Governments will be able to give a considerable impulse to sustainable buildings by encouraging these developments (Maiellaro, 2001). Five objectives for sustainable buildings:

-Resource Efficiency

-Energy Efficiency (including Greenhouse Gas Emissions Reduction)

-Pollution Prevention (including Indoor Air Quality and Noise Abatement)

-Harmonization with Environment (including Environmental Assessment)

-Integrated and Systemic Approaches (including Envir. Management System)

1.2.1 Process of the sustainable construction system

Developing research on sustainable construction basically means facing and solving problems linked to the development and use of design and technological materials and solutions that may reduce the impact of construction works on the built-up environment (Maiellaro, 2001).
The range of researches that can be carried out as a result of this situation is very wide; it is however possible to identify three priority trends:

-methods and new technological solutions for the envelope and technological plants aiming at drastically reducing energy consumption of construction works;
-assessment of the impact of traditional, innovative and recycled construction materials on the indoor environment;
-study of the impact of construction works on the environment by means of new computer-based tools to be used for its survey and assessment.
It must not be forgotten that there is a very important problematic field that in any case in the common denominator for all the research trends whose importance is evident on the way towards the sustainability of the realization of construction works: durability.

This factor is in fact fundamental to forecast over the time the management criteria and maintenance interventions up to the complete replacement of the realized works.
-application of the performance-based criteria for the development and assessment of both new materials and technological solutions for construction and models for forecasting the behavior of constructions under service conditions also as a support to national and community Public Administrations;
-new methods and technological solutions for the improvement of constructions' safety with particular regard to the structural and fire behavior;
-new methods and technological solutions for the improvement of quality of the thermal-acoustic behavior and air change in buildings;
-methods and tools for a non-destructive or moderately destructive diagnosis of the performance behavior of constructions.

The value of such activities could be greatly increased through an action to be carried out within the specific field of the recovery of existing buildings, for which a feasibility study about a goal-oriented Project named 'Innovation and recovery of the building heritage' already exists and is awaiting funding. Its field of application also takes into account the link with the tools used to plan the integration of construction in towns and in the territory.

Re-engineering the construction process

As remarked at international level, this is the field where a rapid introduction of innovative methods and criteria becomes necessary, since it proved to be more tied to tradition and not linked to the evolution of technical and scientific knowledge.

For instance, the building process lacks in well-structured strategies for the application of quality and safe concepts as well as in information applications, which are only partially used in a non-structured way during some stages of the process itself.

The technical and scientific activity to be carried out is therefore aimed at re-designing the process for the realization of construction works (planning, design, execution, management, maintenance) so that such a design takes into account these new factors in order to be perfectly integrated with them.

This objective can be attained over the medium-term. The identified priority research activities are the following:

-Sustainable quality in the construction process;

-Safety of manufacturing and of the equipment used during the construction process;

-Information applications dedicated to the design process, to import-export movements and to management;

-New criteria and methods for technical information and permanent training;

-Feasibility study aimed at simplifying and integrating legislation with the construction process.

The latest point certainly involves the action of the different Public Administrations responsible for constructions. It is however necessary to face this

point in order to avoid (and this is the case of many countries) that drawing too much attention to legal problems, mainly linked to a great number of legislative provisions, containing conflicting concepts and solutions, eventually leads to a diminution or distortion of the objective that is to realize technically sound construction works (Maiellaro, 2001).

1.2.2 Environmental (Ecological), Social and Economical Assessments

Taking the broader ecological economics perspective, we must consider the relationship between three systems:

-The economic system, including production, exchange, and consumption.
-The human (social) system, including biological life processes, culture, aesthetics, and morality.
-The natural (environmental) system, within which both the economic and human systems are included.
Themes of the systems are in Table 1.5

Table 1.5 Environmental economic and social themes (Harris, 2001).

Theme	**Environmental**	**Economic**	**Social**
Sub theme	-Global -Local and site -Internal	-Construction -Materials -Infrastructure	-Equity -Community
Issues	-Climate change -Resources -Internal Environment -External Environment -Wildlife	-Profitability -Employment -Productivity -Transport and utilities -Building stock value	-Poverty -Minorities -Inner cities -Transport Communications

The expansion of the economics subsystem is limited by the size of the global ecosystem. The idea that there are limits to the scale of the economic systems leads to a concept of strong sustainability, according to which some elements of natural capital are considered critical, and not readily substituble by human-made capital. These critical elements of natural capital must be sustained over time in physical, not economic, terms. This is the theoretical basis for satellite accounts,

which record physical stock or flow indices of important resources and environmental functions (Harris, 2001).

According to the thermodynamic law of entropy, resources are degraded and energy used up in all physical and life processes. Complete recycling of materials is impossible, and economic systems are dependent on adequate availability of energy. At the same time, the large-scale use of energy causes increased disposal of wastes into the ecosystem. All theories of development must therefore respect these natural limits on planetary economic scale.

A) Economic Dimensions of Sustainability:

• Creation of new markets and opportunities for sales growth

• Cost reduction through efficiency improvements and reduced energy and raw material inputs

• Creation of additional added value

B) Environmental Dimensions of Sustainability

The idea of environmental sustainability is to leave the Earth in as good or better shape for future generations than we found it for ourselves. By a definition, human activity is only environmentally sustainable when it can be performed or maintained indefinitely without depleting natural resources or degrading the natural environment.

• Resource consumption would be minimal

• Materials consumed would be made entirely 100% of post-consumer recycled materials or from renewable resources (which were harvested without harm to the environment and without depletion of the resource base)

• Recycling of waste streams would be 100%

• Energy would be conserved and energy supplies would be entirely renewable and non-polluting (solar thermal and electric, wind power, biomass, etc.)

• Reduced waste, effluent generation, emissions to environment

• Reduced impact on human health

• Use of renewable raw materials

• Elimination of toxic substances

C) Social dimensions of sustainability

• Improved occupant health and safety: design of sunny and wellvented spaces, use of non-toxic materials and furnishings.

• Positive impact on the local community and its quality of life.

• Providing benefits to disadvantaged groups, e.g., the disabled.

• Stewardship: It is one thing to have a spectacular and sustainable building that exceeds all expectations when it opens. It is another to keep these qualities over the long term. The key is stewardship, the ongoing love and protection of your facility, continuing for years after it opens. Inclusive design and decision-making process will contribute to creating the institutional memory required here from long-serving members of the board and staff (URL-4).

1.3 IMPACTS OF SUSTAINABILITY ON THE ENVIRONMENT

Even taking a minimal, instrumental position, the need to consider environmental impact is an indisputable aspect of producing sustainable architecture. The question is, however, exactly what are we referring to here: the greenhouse effect, the thinning of the ozone layer, carcinogens produced by building products, heavy metals pollution of waterways, the mounting problems of waste disposal or conserving precious water resources? Or should our concern be with the exhaustion of mineral resources, the long term storage of radioactive waste or the survival of trees and frogs? Both emissions in the way of pollution and extraction are forms of impact on the environment and are inputs and outputs to the subsystem. In the historical development of the environment discourse, these two aspects of environmental impact are generally treated as separate issues. Emissions involve the release of a substance into the environment, while the use of raw materials involves the extraction of substances from the environment for application in buildings (Williamson, 2003).

1.4 ENVIRONMENTAL ASSESSMENT OF BUILDINGS

As a significance of the environmental performance of buildings grows so the need for systems that can assess environmental performance becomes more important. The basic aim of any building environmental assessment scheme is to set criteria against which to rate a building and then to provide a score or descriptive rating for that building. This rating can be used to show the building's environment credentials and can have commercial value in terms of promoting a sustainable, eco-friendly image. In addition, a rating system allows a comparison to be made between the performances of similar building types. Although most assessment schemes were originally voluntary and optional, there is a trend in some countries to make assessment and rating mandatory to complement existing legislation on the minimum standards required by regulations and codes.

There are typically four key elements to an assessment system. The first element consists of identifying those environmental criteria that will be used in the procedure. These criteria are chosen for their impact upon natural, human and built environments and their contribution to sustainable development. There are some obvious criteria for buildings, such as energy use, materials and waste management, but there are also more subjective items that can be included, such as health and well-being. The choice of environmental criteria may reflect prevailing conditions or construction customs in a particular country (Bougdah, 2009).

2 SUSTAINABLE BUILDING ASSESSMENT SYSTEMS

At the beginning of the computer revolution in the early 1970s, Odum swathe building of electronic system models' as a possible way of bringing together well understood parts to comprehend the group phenomena. Numbers of computer models of varying intricacy have been developed with the aim of simulating the complex environmental behavior of buildings. While many building performance assessment programs deal with a single criterion such as energy use, a number of programs (or schemes) exist that attempt to combine various factors, using inputs from a variety of sources, into a single measure of performance (URL-5).

2.1 CERTIFICATION FOUNDATIONS

The dynamic character of the concept of sustainable development requires a continuous improvement of specific environmental performance in the building sector. Ecological construction that goes beyond general standards therefore needs voluntary engagement at the highest possible level. At the same time, outstanding ecological ''better practice'' in the construction industry often can not be sufficiently distinguished by the general public from the growing number of overblown private eco-labeling schemes. Self-determined labels declaring a building (product) to be 'ecological' 'environmentally friendly' or 'sustainable' often appear largely arbitrary or highlight just single aspects of the overall environmental impact of a building. At the same time, existing assessment and labeling schemes are of an extremely varied nature, rendering comparison even more difficult (Maiellaro, 2001).

The 'Environmental Standard Award- Homes for greener world' is provided by the British Building Research Establishment (BRE) (Prior, Bartlett 1995). BRE is a former public research institution, which is a present under privatization, but still most of BRE's work is funded by the Department of the Environment.

So the Environmental Standard Award may be regarded as publicly authorized. Nevertheless it rests on the BREEAM which originally was developed by BRE

reacting on a demand out of the office building industry for certification of superior ecological performance. The scope of the award encompasses the three levels global local and indoor. Main addressee of the award is housebuilders and especially developer of larger groups of buildings (Maiellaro, 2001).

In 1990, BREEAM assessment process was created in the UK and after this American origin LEED certification system was created in 1998.In 2003 Australians GreenStar and in 2004 Japanese CASBEE followed LEED respectively and it is followed by other major countries to build their own systems. Initially, the idea was to create own local standards, construction methods, climate data and a unique system considering their cultures for each country. However, in recent years, with their attacks LEED and BREEAM gained an international identity and they are accepted in several countries like Turkey which doesn't have its own green evaluation systems. Even many countries with their own systems, began to copy or to adapt this system to their own countries.

2.2 INTERNATIONAL AND LOCAL SUSTAINABLE BUILDING ASSESMENT SYSTEMS

There are improved models or certifications in different countries. They have their own specialties for their own local conditions and requirements. These are;

- SBAT: Sustainable Building Assessment Tool
- SPeAR: Sustainable Project Appraisal Routine
- SBtool (Sustainable Building Tool-Canada)
- GBTool
- Green Globes™ US
- BEES (Building for Environmental and Economic Sustainability),
- BREEAM (Building Research Establishment Environmental Assessment Method),
- CASBEE
- DGNB (German Sustainable Building Council),
- ECO-QUANTUM (simulation based model), Life Cycle and Greenhouse Gas Assessment

- ECOPROFILE ,Life Cycle Assessment
- GBC (Green Building Challenge),
- GREENSTAR
- LCAid
- LEED

2.2.1 SBAT: Sustainable Building Assessment Tool

The Sustainable Building Assessment Tool (SBAT) is being developed as a way of supporting the implementation of more sustainable practices in the building and construction industry in developing countries and in South Africa in particular. In order to reflect the priorities in developing countries the tool places a strong emphasis on social and economic aspects of sustainability as well as environmental issues. The tool also aims to develop awareness and support for sustainability among building stakeholders, including clients, building users, facilities managers and design teams (Gibberd, 2002).

2.2.2 SPeAR: Sustainable Project Appraisal Routine

In response to the challenge of moving sustainability from theory into practice, ARUP engineers have developed a tool to demonstrate the sustainability of a project, process or product to be used either as a management information tool or part of a design process. The Sustainable Project Appraisal Routine, SPeAR®, is based on four quadrant model that structures the issues of sustainability into a framework, from which an appraisal of performance can be undertaken (URL-6).

The base of the SPeAR® model is the four-quadrant model that is illustrated in Figure 2.1. This model unify the four main sectors that any sustainability analyze must consider, societal, economic, natural resources, environment are join together in this model with equal conditions and influence over the design.

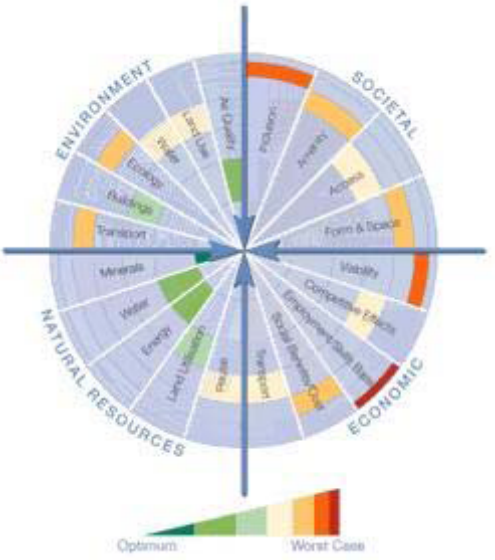

Figure 2.1. Four-quadrant model design by ARUP Engineers (URL-6).

SPeAR makes use of a group of indicators that have been derived from the principles of sustainability. Moreover, the SPeAR® uses software which is capable of including indicators that reflect the context and scope of the project and so create a bespoke appraisal. The appraisal is based on the performance of each indicator against a scale of best and worst cases. With this appraisal, the decisions about the project, technique or product can be taken with all transparency and ensure the sustainability character of the project.

According with ARUP, the SPeAR® has been applied to a range of projects within a range of sectors. To date appraisals have been undertaken for urban regeneration schemes, development plans, manufacturing process and products and has also been used to support a strategy formulation process. It can be apply into project that involves geotechnical issues, though, the SPeAR® model is still to general for these issues and even for civil engineering projects (URL-6).

This model can be use as a model to follow, in order to create a specific evaluation model for geotechnical aspects. Moreover, the set of indicator employed by the SPeAR® can be modified to make them more specific for the dissertation interests.

2.2.3 GBTool

GBTool was developed by the International Framework Committee for the Green Building Challenge, an international project that has involved more than 25 countries since 1998. GBTool is designed to be adapted by sponsors to reflect regional conditions and context. It includes criteria in categories such as

-Site Selection,
-Project Planning and Development;
-Environmental Loadings;
-Energy and Resource Consumption;
-Indoor Environmental Quality;
-Functionality;
-Long-Term Performance; and
-Social and Economic Aspects.

Criteria are assessed using scales that are based on local benchmarks of typical practice; buildings can score -1 if below typical practice or from +1 to +5, representing good to very high performance. All criteria must be scored, thus providing a complete assessment of the building. Both benchmarks of typical practice and weightings of criteria are established by the sponsoring organization to represent national, regional, or local codes, practice, context, conditions, and priorities. GBTool has evolved over time as it has been tested by participating countries and results have been presented at a series of international conferences. Originally addressing only an as-designed assessment, GBTool is developing versions to address pre-design, design, as built, and operations. The tool itself comprises two spreadsheets, one for data entry (to be completed by the project team) and one for establishing weights and benchmarks and completing the assessment (to be completed by third party sponsors or assessors).

GBTool major categories of criteria include the following:

• Energy consumption is assessed through total use of non-renewable energy (Embodied and operational), electrical peak demand for operations, use of renewable energy, and commissioning.
• Resource consumption is assessed through materials use (salvaged, recycled, bio-based and sustainably harvested, locally produced, designed for disassembly, re-use, or recycling) and water use for irrigation, building systems, and occupant use.
• Environmental loadings include greenhouse gas emissions, other atmospheric emissions, solid wastes, stormwater, wastewater, site impacts, and other local and regional impacts.
• Indoor environmental quality is assessed through indoor air quality, ventilation, temperature and relative humidity, daylight and illumination, and noise and acoustics.
• Other criteria include selection of appropriate site (in terms of land use, brownfields, access to transportation and amenities), project planning, urban design (density, mixed uses, compatibility, native plantings, and wildlife corridors), building controls, flexibility and adaptability, maintenance of operating performance, and a few social and economic measures (URL-7).

2.2.4 Green Globes™ US

Green Globes™ US was adapted from the Green Globes Canada rating system in 2004. Green Globes Canada was developed as a web-based version of the combination of BREEAM Canada and Green Leaf. The development of Green Globes™ US is funded by The Green Building Initiative. The Green Globes™ US system is an on-line tool designed for use by architects and builders for any size commercial building. The preliminary assessment occurs after conceptual design and the final assessment occurs after the construction documentation stage.

Green Globes allows its users to evaluate their systems based on the amount of applicable available points, having the option of “not applicable” in some categories.

Projects that are third-party verified and have achieved over 35% of the points can earn a rating of 1 to 4 Green Globes. Unless otherwise noted, this review used the text form of Green Globes™ US Version 1.0 (April 2006 release). Version 0 was the text form version available when this review began, and as of May 2006. Version 0 is the only version available for on-line interactive use. During the rating system review, there was a period of time (approximately 6 weeks) when no text form of a rating system was available on-line.

Green Globes major categories of criteria include the following:

• Project Management (integrated design, environmental purchasing commissioning, emergency response plan)
• Site (site development area, reduce ecological impacts, enhancement of watershed features, site ecology improvement)
• Energy (energy consumption, energy demand minimization, "right sized" energy-efficient systems, renewable sources of energy, energy-efficient transportation)
• Water (flow and flush fixtures, water-conserving features, reduce off-site treatment of water)
• Indoor Environment (effective ventilation systems, source control of indoor pollutants, lighting design and integration of lighting systems, thermal comfort, acoustic comfort)
• Resource, Building Materials and Solid Waste (materials with low environmental impact, minimized consumption and depletion of material resources, re-use of existing structures; building durability, adaptability and disassembly; and reduction, re-use and recycling of waste) (URL-8).

2.2.5 CASBEE: Comprehensive Assessment System for Building Environmental Efficiency

CASBEE was developed in Japan, beginning in 2001. The family of assessment tools is based on the building's life cycle: pre-design, new construction, existing

buildings, and renovation. CASBEE presents a new concept for assessment that distinguishes environmental load from quality of building performance. By relating these two factors, CASBEE results are presented as a measure of eco-efficiency or BEE (Building Environmental Efficiency). Results are plotted on a graph, with environmental load on one axis and quality on the other – the best buildings will fall in the section representing lowest environmental load and highest quality. Each criterion is scored from level 1 to level 5, with level 1 defined as meeting minimum requirements, level 3 defined as meeting typical technical and social levels at the time of the assessment, and level 5 representing a high level of achievement. The CASBEE Technical Manual presents detailed definitions of each level for each criterion and includes reference material and calculation tools where needed. CASBEE major categories of criteria include the following:

Building Environmental Quality and Performance

• Indoor environment (noise and acoustics, thermal comfort, lighting and illumination, and air quality)

• Quality of services (functionality and usability, amenities, durability and reliability, flexibility and adaptability)

• Outdoor environment on site (preservation and creation of biotope, townscape and landscape, and outdoor amenities)

Building Environmental Loadings

• Energy (thermal load, use of natural energy, efficiency of systems, and efficient operations)

• Resources and materials (water conservation, recycled materials, sustainably harvested timber, materials with low health risks,

• Reuse and reusability, and avoidance of CFCs and halons)

• Off-site environment (air pollution, noise and vibration, odor, sunlight obstruction, light pollution, heat island effect, and local on local infrastructure) (CASBEE, 2009)

2.2.6 BREEAM: Building Research Establishment Environmental Assessment Method

The BREEAM assessment process was created in 1990 with the first two versions covering offices and homes. Versions are updated regularly in line with UK Building Regulations and different building versions have been created since its launch to assess various building types.

BREEAM is an assessment method designed to aid construction professionals in the creation of environmentally friendly buildings, both new and existing. It is regarded by the UK's construction and property sectors as the benchmark system in environment design and management, and widely used across the globe.

The system is owned and operated by the Building Research Establishment (BRE) Trust Companies, who make it their mission to build a better world by helping developers create safe, high quality and sustainable environments that are sympathetic to broader green issues such as global warming and diminishing resources. BREEAM evaluates buildings according to set criteria and then concludes by providing an overall assessment score.

Anything that could have an impact on the environment at all levels of its construction and lifecycle is featured in the criteria, from the building's carbon emissions and energy efficiency to its recycling facilities and location - for example a brownfield site construction will be awarded more points than a greenfield one.

The final assessment score will fall within one of the four rating bands; 'PASS', 'GOOD', 'VERY GOOD' and 'EXCELLENT'. A development with an 'EXCELLENT' rating is a rare achievement, as it must have excelled in all 8 of the BREEAM environment categories:

- Management
- Health and Well-being
- Energy
- Transport
- Water
- Land Use and Site Ecology
- Materials
- Waste and Pollution

Such an accolade means the building is in the coveted position of being one of the UK's finest examples of sustainable design.

Nevertheless, whatever the rating, the certificate awarded upon completion of the evaluation will be a badge of quality for the development and provide a recognized display of its sustainable environment credentials (BREEAM, 2008).

2.2.7 LEED: Leadership in Energy and Environmental Design

LEED is an internationally recognized green building certification system, providing third-party verification that a building or community was designed and built using strategies aimed at improving performance across all the metrics that matter most: energy savings, water efficiency, CO_2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts.

Developed by the U.S. Green Building Council (USGBC), LEED provides building owners and operators a concise framework for identifying and implementing practical and measurable sustainable building design, construction, operations and maintenance solutions.

LEED is flexible enough to apply to all building types – commercial as well as residential. It works throughout the building lifecycle – design and construction, operations and maintenance, tenant fit out, and significant retrofit. And LEED for

Neighborhood Development extends the benefits of LEED beyond the building footprint into the neighborhood it serves.

Sustainable building strategies should be considered early in the development cycle. An integrated project team will include the major stakeholders of the project such as the developer/owner, architect, engineer, landscape architect, contractor, and asset and property management staff. Implementing an integrated, systems-oriented approach to green project design, development and operations can yield synergies and improve the overall performance of a building. Initial LEED assessment will bring the project team together to evaluate and articulate the project's goals and the certification level sought.

There are both environmental and financial benefits to earning LEED certification.
LEED-certified buildings are designed to:

- Lower operating costs and increase asset value.
- Reduce waste sent to landfills.
- Conserve energy and water.
- Be healthier and safer for occupants.
- Reduce harmful greenhouse gas emissions.
- Qualify for tax rebates, zoning allowances and other incentives in hundreds of cities.
- Demonstrate an owner's commitment to environmental stewardship and social responsibility.

LEED Benefits and Disadvantages

LEED certified buildings are supposed to use resources more efficiently when compared to conventional buildings which are simply built to code. LEED certified buildings often provide healthier work and living environments, which contributes to higher productivity and improved employee health and comfort. The USGBC has compiled a long list of benefits of implementing a LEED strategy which ranges from improving air and water quality to reducing solid waste, benefiting owners, occupiers, and society as a whole.

Often when a LEED rating is pursued, this will increase the cost of initial design and construction. One reason for the higher cost is that sustainable construction principles may not be well understood by the design professionals undertaking the project. This could require time to be spent on research. Some of the finer points of LEED (especially those which demand a higher-than-orthodox standard of service from the construction team) could possibly lead to misunderstandings between the design team, construction team, and client, which could result in delays. Also, there may be a lack of abundant availability of manufactured building components which meet LEED standards. Pursuing LEED certification for a project is an added cost in itself as well. This added cost comes in the form of USGBC correspondence, LEED design-aide consultants, and the hiring of the required Commissioning Authority (CxA) – all of which would not necessarily be included in an environmentally responsible project unless it were also seeking a LEED rating.

However, these higher initial costs can be effectively mitigated by the savings incurred over time due to the lower-than-industry-standard operational costs which are typical of a LEED certified building. Additional economic payback may come in the form of employee productivity gains incurred as a result of working in a healthier environment. Studies have suggested that an initial up-front investment of 2% extra will yield over ten times the initial investment over the life cycle of the building.

Although the deployment of the LEED standard has raised awareness of green building practices, its scoring system is skewed toward the ongoing use of fossil fuels. More than half of the available points in the standard support efficient use of fossil fuels, while only a handful are awarded for the use of sustainable energy sources. Further, the USGBC has stated support for the Architecture 2030, an effort that has set a goal of using no fossil-fuel, greenhouse gas-emitting energy to operate by 2030.

In addition to focusing on efficient use of fossil fuels, LEED focuses on the end product. For example, because leather does not emit VOCs they are deemed

healthy for environments, disregarding the use of extremely harmful chemicals in the process of tanning leather. Other products that do not use harmful chemicals and focus on more sustainable production do not earn any additional points for their attention to environmental concerns.

LEED is a measurement tool and not a design tool. It is also not yet climate-specific. Because of this, designers may make materials or design choices that garner a LEED point, even though they may not be the most site or climate-appropriate choice available (LEED, 2009).

3 SUSTAINABILITY APPLICATIONS IN TURKEY

3.1 SUSTAINABLE MOVEMENT IN TURKEY

Recently Turkey's sustainable building industry has been in a process of rapid development. Government policy is becoming more aligned with Turkey's energy deficit and external pressures further encourage environmentally responsible development. Also, international investors and non-profits are importing an environmentally conscious ethos to some of Turkey's high-profile developments.

Turkish Green Building Association has been established with intentions to be a Green Building Council (GBC) in October 2007. The association has been lobbying on green buildings since then (Erten 2009).

Commercial Sector: The recent development of sustainable building in the Turkish commercial sector has been closely tied to the international architectural community. In the Kaplankaya project, nearly 5 million m2 eco-tourism resort is planned near Milas in southwestern Turkey. Two of Turkey's largest retail developers, Metro and the Dutch-based REDEVCO, have corporate-wide sustainability policies and construction companies like SOYAK, ZORLU, TEKFEN and ECZACIBASI are developing theirs. Also, Turkish-owned Kanyon Mall both won the 2006 Cityscape Architectural Review Award and the London-based firm ARUP, which specialized in advanced green engineering, employed as project engineers. More locally, in 2007 Erginoglu & Calislar Architects built an ecologically designed telecommunications company headquarters in the Tübitak Marmara Research Center Zone near Istanbul.

Education and Research: Turkey's educational sector also has a limited but productive investment in sustainable building. The faculty at Istanbul Technical University, part of the Sustainable Energy Research Group (SERG), has researched energy efficiency and passive conditioning strategies since the 1950s. Their work includes building technology research laboratories and pairing with corporate partners such as the Kanyon Mall to research energy modeling

techniques. Turkey's other major technical school, the Middle Eastern Technical University, has also long inquired into sustainable design. Students at METU built the Ankara Solar House in 1975, and current research tracks in the Architecture Department include "Architecture and Environment" and "Sustainable Architecture: Green Design, Community Design and Universal Design in Architecture." While the specific research inquiries may be mixed, it is clear that the rhetoric and agenda of sustainable architecture are being incorporated into some of Turkey's highest academic institutions (Erten 2009).

Government: As a political entity, Turkey first engaged with the environment in 1978 with the establishment of the Under secretariat for the Environment. Five years later, the 1982 Constitution included the "right to live in a healthy, balanced environment," and in 1983, the first Environmental Law was passed. Several environmentally directed laws followed, including regulations on pollution and the Mass Housing Law of 1984. Then in 1992, responsibility for Turkey's environmental management was given to the new Ministry of the Environment, which still exists today. A key piece of legislation was the Environmental Impact Assessment law of 1992, requiring municipal approval of all public land development. Generally, however, development interests have trumped the environmental intent of this law (Calguner 1999). Recently, regulations for Turkey's accession into the EU have increased incentive on environmental reform, though little progress has been found (Turkey Progress Report). Another motivating factor for sustainable building and environment came from the UN-HABITAT II forum, held in Istanbul in 1996. This international event was a watershed for ideas on improved urban habitat and building.

Turkey's energy dependence and the need for energy efficiency has also prompted regulatory and rhetorical changes. In 2008, the central government finished implementing insulation requirements for both commercial and residential buildings. One hundred percent compliance would be expected to save billions of dollars and 70% of the country's heating energy. Though not directly related to the environment, these measures to represent an advancement of the building industry (Erten 2009).

3.2 SUSTAINABLE ARCHITECTURE INITIATIVES

A) Experimental Sun Houses

The METU Solar House in Ankara, built in 1975-6, is Turkey's first sustainable building case study. Several solar houses followed, including Cukurova University Solar House and the (MTA) Solar House in 1981, the Greater Ankara Municipality Solar House in 1993, TUBITAK National Observatory.

Guest-House and the Erciyes Active Solar House in 1996. The Diyarbakir Solar House, sponsored by the Diyarbakir Municipal government in 2008, shows a recent continuation of this trend. The houses use a variety of solar technologies such as direct-heated ventilation air, solar flat-plate collectors, photovoltaic cells, and passive solar heating systems. Besides the METU example, they were all built to display the potential to use solar energy in Turkey's residential development (Hepbasli, 2004).

B) Eco Villages

Ankara Güneş Village was founded on 21 September 2000 in Ankara. It has been established as a cooperative by 9 members. Several of the members of the organization are either from Middle East Technical University, or graduates of the university. Güneşköy has 84 hectares of land in Kirikkale Province, Yahşihan County, Hisarköy. Güneşköy is a member of European Eco-village Network (GEN-Europe). The aim of the cooperative is to develop and apply a healthy, natural and ecological lifestyle.

The activities of the group will extend the development energy efficient houses for living, perm culture, collection of endangered plants in a botanical garden, use of renewable energy sources, and recycling. One of the aims of the cooperative is to educate the children and the people living in rural areas and show them the new ways of sustainable living. Currently, a location near Ankara is decided for settlement and purchasing and/or renting of some fields in this locality is underway.

Eco-village makes widely ecological architecture and uses local seed and provides sharing.

- It makes studies for improving use of renewable energy sources.
- It practices ecologic architecture compatible with nature.
- It works for the development of transportation system.
- It works to repair damaged natural structures.
- It works necessarily to re-establish the natural balance impairment.
- It improves recovery systems for improving the efficient use of resources (URL-9).

C) Holistic Examples

The Eco-Center at Kerkenes was originally founded as a research outpost for a nearby archeological dig. Francoise Summers, a member of the Middle East Technical University's faculty of architecture, developed the site into several buildings in 2002. METU students and local entrepreneurs use the facility for studying sustainable building techniques, low-tech uses of renewable energy, and local economic integration. Nevzat Sayin, one of Turkey's most respected architects, also designed locally-sensitive buildings for the town of Yaşibey in 1997. While they are not advertised as "green," the modern summer homes aesthetically and urbanistically fit into the fabric of the traditional town. Furthermore, in both high cases the structures are built with locally supplied materials and knowledge, and traditional building techniques. By these standards, their environmental sustainability can be considered on par with many of their modern commercial counterparts. There is also an Eco-Building designed by HAS architecture to be built at Istanbul Technical University Maslak Campus in 2009. This project works on the "zero energy" principle. The building is planning to apply for an international sustainable building certification system (Erten 2009).

D) Earthquake areas

Earthquake and sustainable building design in Turkey

In order to determine the parameters of sustainable building design for the settlements subject to earthquakes, the phenomenon should be discussed in a broader sense at urban scale in priority (Erdogan, Dilaver, Benzer, 2009).

Sustainable development of a settlement means to search for an alternative development process with the following principles:

- Transferring the urban environment and the building stock from generation to generation.
- A balance among settlements; cities and villages and socio-economic sense.
- Nature, environment, building interaction and their integration.

Severely damaging earthquakes in Turkey have repeatedly demonstrated the importance of improving the quality of urban environments, earthquake designs and construction systems. Avoiding serious damage has to be the main goal of earthquake-resistant construction. The seismic-resistant design provisions of most approaches are concerned only with assuring an effective design and construction of structures against damage that might be induced by the vibratory response of the structure to the shaking introduced at their foundations by the ground. While in certain cases of ground failure it is possible to design safe structures by proper design of their foundation, while in other cases the only natural solution is a change of site (Erdogan, Dilaver, Benzer, 2009).

Sustainable building design which covers both long-term and short-term design criteria is the establishment of new buildings or the conservation of existing ones to sustain their existence fulfilling the requirements of actual uses while compromising the needs of the future uses.

The geotechnical aspects should be considered at every phase of building process. From site selection to design and constructions, geotechnical information is crucial in the decision making. Besides, the geology of the region, the site, it's

relation to the subsurface conditions, the ground water levels, local construction practice, the location of sources of fill materials should be analyzed before the design phase of the buildings. Even recently constructed houses, there are features that have proven to be vulnerable to earthquake damage, most of them relate to the building configuration particular configurations have been associated with damage in past earthquakes: house over garage, many large windows or doors particularly at building corners, large overhangs, split levels and complex geometry, silts supporting structure (as on a hillside site). Unusual configurations are not necessarily hazardous but if they are designed or constructed poorly they can be particularly vulnerable to earthquake damage (Martin, 2008).

During the 2 November 12, 1999 Duzce Earthquake, numerous apartment blocks constructed with reinforced concrete were severely damaged or ruined because of improper reinforcement, which could not be considered as seismic-resistant construction, and also land failures. On the other hand, many of the structures existing after the earthquake were the traditional timber skeleton structures built in local character. These types of constructions easily mitigate earthquake hazards. They can be considered as earthquake-resistant structures in a way that can easily built with the local material by the builders and sustained by the qualities and properties that they are carrying (Erdogan, Dilaver, Benzer, 2009).

3.3 REGULATIONS AND LAWS

3.3.1 Turkey's Law on Utilization of Renewable Energy Sources

The Law is a typical sample of the adaptation process to be part of EU membership. This part also will analyze Turkey's ability to assume the obligations of membership and its administrative capacity to implement the acquits in the field of renewable energy sources ‘RES’ (Gaupp, 2007).

RES is not a brand-new topic in Turkey, as both the Electricity Market Law ("EML"), which was enacted in March 2001, and the Electricity Market License Regulation demonstrates. According to the EML, the Energy Market Regulatory Authority ("EMRA") is authorized to take the necessary measures to encourage the utilization of RES. Financial incentives for RES are specified in the

Regulation. The regulation stipulates that legal entities, which generate electricity from RES, may purchase electricity from private sector wholesale companies under certain conditions.

Finally, it provides that the Turkish Electricity Transmission Company and/or legal entities with a distribution license shall assign priority to system connection of generation facilities based on RES (Gaupp, 2007).

Objective and Scope of the Law

The purpose of the Law is to expand the utilization of RES for generating electricity in a dependable and economic manner, to increase the diversification of energy resources, to protect the environment and to develop the related manufacturing sector for the realization of these objectives. The Law encompasses wind, solar, geothermal, biomass, biogas, wave, current and tidal energy resources, canal and river type hydroelectric generation facilities and hydroelectric generation facilities with a reservoir area of less than fifteen square kilometers (Gaupp, 2007).

A) RES Certificate

Principles of Implementation

The Law provides for a purchase obligation for retail sales companies with regards to electricity generated from RES. The purchase obligation ratio is the proportion of the previous year's sales of the company to the total amount of energy of the company. The amount of RES certified electricity will be published annually by the EMRA. If there is a sufficient amount of RES certified electricity within the market, then the purchase obligation ratio may not be lower than 8% of the sales in the previous calendar year. Public distribution companies holding a retail sales license were exempted from the purchase obligation until 1 January 2007.Until the end of the year 2010, the price for electrical energy generated from RES, which is to be purchased in accordance with the provisions of the Law, shall be the average wholesale electricity price of the previous year determined by the EMRA. The Law gives the Council of Ministers the authority to increase this price up to 20% at the beginning of each year. After 2011, the above price mechanism shall not be applicable to RES certified energy plants operating for

more than seven years. The price is set by bilateral market agreements and the purchase obligation for retail sales companies applications.

Moreover, the Law contains incentives in terms of the investment periods of energy projects. For instance, investments in energy generation facilities, procurement of electro-mechanic systems within Turkey, investments on research, development and production regarding solar energy units and investments on research and development concerning biomass energy, may benefit from incentives determined by the Council of Ministers. Additionally, in the municipalities and governorates with sufficient geothermal resources, the need for heat energy shall be met mainly by geothermal or solar thermal resources. Finally, the Law provides implementations related to the acquisition of land for the purpose of generating electricity based on RES. 50% deduction shall be implemented for rent, right of access and usage permission in the investment period (Gaupp, 2007).

Sanctions

In the event of violation of the principles of implementation of the Law, legal entities holding retail sales licenses shall be charged an administrative fine of 250.000 TL (Turkish Lira – approximately 177.000 USD) by the EMRA and warned to eliminate the violation within sixty days. With regards to repetition of violations, the Law provides for more serious financial sanctions and cancellation of the license to perform activities in the energy sector.

Analysis and Conclusion

The problematic aspect is the division of tasks between the EMRA and the Ministry of Energy and Natural Resources. Hence, the EMRA, as the independent regulatory authority in the field of energy, should have all powers to act as the competent authority regarding the implementation of the Law. Moreover, no tax advantages are given under the Law to entities generating electric energy based on RES. This is an important issue, as it will take some time until RES will be economically competitive with conventional energy sources. Finally, in its 2005 Progress Report concerning Turkey, the Commission criticized the Law for not

setting a target for electricity generated from RES by 2010, as foreseen by the appropriate EU legislation.

The Law, basically modeled after Germany's Renewable Energy Act, is welcome news. It is a first step in the alignment with and implementation of the relevant acquits and has the potential to strengthen the role of RES for Turkey's energy supplies and, thus, to decrease the dependence on energy imports from other countries. According to the latest statistics from the International Energy Agency for Turkey, RES contributed 13.2% to the total primary energy supply of 81.9 Million tons of oil equivalent in 2004. Due to Turkey's geographic conditions, and the steady increase of the energy requirement as a result of the growth in both population and industrialization, electricity production from many RES is expected to grow significantly. This will also attract new investments within Turkey.

However, Turkey should undertake a comprehensive effort to abolish the above deficiencies, especially as regards the partial non-compliance with the legal framework of the EU.

Turkey has made progress in aligning with the *acquis* and in its preparations for the internal energy market through the adoption of two major framework laws for the electricity and gas sectors concerning in particular restructuring and the players in the sectors. However, those two laws should be aligned to a greater extent with the two key Community directives concerning the internal energy market. Following the adoption of the 2002 Electricity Market Law, around 20% of the electricity market was opened up in 2002. The aim is to complete the opening up of the market by 2011. Five new implementing regulations have been adopted since the last report. The threshold for eligible consumers has moreover been reduced to 3 GWh. In July 2008, a cost-based pricing mechanism entered into force to enable enterprises operating in the field of energy to reflect changes in production costs in their sale prices. The 2008 report also notes that the privatization of electricity distribution has been successful in four regions and that the market share of autonomous electricity producers have increased from 30 to 50 % (Gaupp, 2007).

Turkey has also set up an Energy Regulatory Board to monitor the energy sector. It should be noted that the adoption of the two key laws and the establishment of an Energy Regulatory Board were conditions for IMF (International Monetary Fund) support for Turkey. In general, Turkey's priority in restructuring the energy sector is to attract investment and reduce State control. The two laws have paved the way for this but much remains to be done.

In 2002, the Energy Market Regulatory Authority (EMRA) began to issue licenses for various activities in the electricity sector and to approve companies' tariffs. The independence and administrative capacity of this authority need to be strengthened, including in terms of the number of qualified staff it employs.

Further legislative and administrative steps need to be taken to ensure the proper functioning of a competitive electricity market in line with the *acquis*. The dominant position of the State trading company in the wholesale market should be adjusted, the current restrictions for cross-border trading removed and the matter of existing long-term power purchase agreements addressed. In this connection, distribution rights have been granted to several new regional distribution companies.

The gas market was opened up in 2002. A regulation on licenses was adopted in 2002. Other texts have been adopted on tariffs, transport and distribution networks, infrastructure, consumer services and internal installations. Turkey should continue the reform of this sector, including privatization, which is already under way. Alignment with the *acquis* in this field is satisfactory but the delays in implementation need to be made up. The 2008 report emphasizes that little progress has been made in liberalizing the natural gas market (Gaupp, 2007).

On security of supply, Turkey has already introduced major measures and its oil reserves are more or less at the level of the 90 days required by the *acquis*. Turkey also has an important role to play in the EU's security of supply since it is a transit country for oil and gas from the Caspian Sea, the Black Sea and Central Asia. The construction of the Blue Stream gas pipeline to bring natural gas from Russia to Turkey is continuing. In 2002, Turkey took steps to further diversify its

supply resources and to strengthen its role as a transit country for the transportation of oil and gas.

Implementing legislation on gas market licensing was adopted in September 2002. In 2003 Turkey and Greece signed an agreement on the construction of a gas interconnector between the two countries. The new Petroleum Law of 2004 is a step forward in terms of alignment with the oil stocks *acquis*. However, oil stocks are still not calculated according to EU methodology. The 2008 report notes that the natural gas pipeline between Turkey and Greece is now operational.

With regard to energy efficiency, Turkey has made some progress by adopting a framework law on energy efficiency, in order to reduce the high energy intensity of the Turkish economy. The law does not, however, contain any objectives and the provisions on high-efficiency cogeneration do not comply with the *acquis*. The 2008 report describes the adoption of a regulation implementing the Framework Law on energy efficiency for the transport sector. 2008 was declared the year of energy efficiency and an action plan was adopted to coordinate action in this field.

In the area of renewable energy sources, Turkey had already adopted a Law on the use of renewable energy sources for energy production and an implementing regulation on the guarantee of origin. The framework law also increases the potential for promoting the production of electricity from renewable energy sources. This legal framework still needs to be supplemented by ambitious objectives in order to exploit the vast unused potential of renewable energy sources in Turkey (Gaupp, 2007).

Where nuclear safeguards are concerned, Turkey has concluded a comprehensive safeguards agreement and an additional protocol with the International Atomic Energy Agency (IAEA). Several implementing provisions have been adopted on radiological protection, the basic safety requirements for nuclear power plants, nuclear safety inspections and penalties, and exports of nuclear materials. Substantial upgrading of existing facilities is however needed, including radioactive waste management and storage facilities. A Framework Law on the establishment and operation of nuclear power plants and energy sales has been

adopted. This is a major change in Turkey's energy policy. However, Turkey must continue to make its legislation compliant with international requirements on the management of nuclear waste and storage installations. The 2008 report notes that Turkey has not acceded to the Joint Convention on the safety of spent fuel management and radioactive waste management.

3.3.2 Responsible Institutions in Development of Hydropower in Turkey

Hydropower is clean, domestic and renewable resource. It pertains undeniable benefit in sustainable life and development through proper planning and management. Taking into consideration of steadily increasing negative impacts of green house emissions and global warming, effective and reliable use of hydropower resources will rise tomorrow as in case of today, and contribute to the sustainable life in local, regional and global scale.

The value of the water, earth and air in lives of human being has the equal importance with the value of energy in development of the societies. The founder of Republic of Turkey, Atatürk, being aware of this fact, stated " Turkey must be a country capable of utilizing electricity in electrification and in industrial development.

For this reason, an Electrical Affairs Administration should be established" (Gürbüz, 2007). Therefore, by the directives of Atatürk, Electrical Power Resources Survey and Development

Administration (EIE) was founded on June 24,1935 under the Law No: 2819. In 1980s, energy shortage was emerged and privatization discussions in energy sector were started again. Especially, to overcome difficulties of public financial potential, which was started in the early 1980s and to improve investment and operations of private part of the energy sector many regulations of law were laid down, different privatization models were implemented, rebuild of sector was brought on the agenda.

Considering the situation, while EIE delivered the projects, which were come out at the end of the studies, to DSI for doing construction in the past, at the 1980s, law numbered 3096 and with the scope of Built-Operate-Transfer model it served the projects to investors who accepted doing construction of plant and transferring to the public after operating for a while. To finance energy projects which require great finance and have slow rate of feedback, finance was obtained from inside and/or outside of the country, BOT model and the models, BO, auto production, which were variation of BOT were used, and DSI made a deal for credit within international cooperation for construction of large projects. Besides, to get the plants worked more efficiently, executions like "Operation Right Transfer" were formed. To accelerate these executions and to increase the interest of foreign capital, arbitration was taken into scope of Constitution by changing of Constitution which was implemented in 13th August of 1999. By the law numbered 4501 enacted soon after these changes, mechanism of international arbitration could be used in the contracts about activities of electricity energy. But, this execution has not been succeeded with expected level furthermore investment and contribution, expected from private sector, has not been realized on time and desirable level too. Because, beside the legal and bureaucratic prevention, in recent time treasury guarantee was not given. Electricity Market Law no. 4628 was enacted to accelerate operation of electricity sector and to obtain free market system formation by providing competition (Gürbüz, 2007).

By effectuating the law numbered 4628, EIE opened up its all projects in the portfolio to application of private sector for investment. By both the law numbered 4628 and the law numbered 5346 related to "Renewable Energy Resources Used for Generation of Electricity Energy" which was effectuated in 18th May of 2005, our hydroelectric potential is soon taken in operation, opportunities of 'constructed by private sector' and economic benefit are made possible.

EIE taking into consideration decrees of United Nations and European Union about the minimization of atmospheric emissions from fossil fired power plants and sustainable development in local regional and global scale, protection of environment has undertaken energy efficiency studies since 1981 and thus

prepared Draft Law of Energy Efficiency and delivered to Prime Ministry for approval and enacting by National Assembly of Turkey after negotiations.

There is an extensive benefit to operate all renewable hydropower resources immediately so as to boost the economy and to create employment fields not taking into consideration the scale of the HPP whether it is large or small, thus in turn to protect the the environment (Gürbüz, 2007).

3.4 ÇEDBİK

Çedbik was founded by Ali Nihat, Nihat Gökyiğit and Duygu Erten in 2007. Eco-Friendly Green Building Association was founded to contribute the construction sector in the light of the principles of sustainable development.

This association is working inside the current increasing ecological problem with a belief to meet healthier living environments through buildings and placements which were built with a holistic approach and ecological awareness.

Çedbik organizes training programs to increase social awareness and to encourage construction sector in the light of these principles. Local governments, universities etc. are developing models and examples of projects and they are working to spread this with all the relevant issues.

The systems which evaluate buildings and settlements according to environmental impact are effective tool for targeted green conversation process. Çedbik is following the national and international developments in this area and started working on national circumstances in order to create an evaluation system to fill an important gap (URL-10).

4 CASE STUDIES
–ANALYSIS OF CERTIFICATED BUILDINGS IN TURKEY

In Turkey, there is an attempt recently to construct sustainable buildings. Some of these buildings have also got the certification of an assessment system, LEED or BREEAM. Table 1.6 provides some of sustainable buildings with certification.

Table 1.6 Sustainable buildings and degrees of certificates

Name of the Project	**Certification Type**	**Degree**
Erzurum Shopping Mall	BREEAM	Very good
Gordion Shopping Mall	BREEAM	Very good
Siemens Factory	LEED	Gold
Unilever Office Building	LEED	Silver
Philips Office Building	LEED	Silver
THY-Pratt Whitney	LEED	Gold
Tekfen –ecologic-	-	-
RMİ -ecologic-	-	-
Sapphire –ecologic-	-	-

In order to find out the problems encountered during the implementation of sustainable buildings and obtaining certification, interviews are carried out with consultant of three certified sustainable buildings.

4.1 SIEMENS FACTORY BUILDING

Building Type: Factory

Location: Kocaeli / Gebze

Contractor: Yeni Teknik Yapı

Employer: Siemens Sanayi ve Ticaret A.Ş

Sustainable Building Certification: LEED-gold-

Picture 4.1 Siemens Factory Building (Yaman, 2010).

Certification Necessity Reasons: Energy and water saving is the first aim of Siemens both for their products and for the buildings. The factory building was designed to be sustainable as in the direction of their aims. Then it was decided to get a sustainable building certificate for their factory building. LEED certification system was chosen because LEED is a well known certification system by construction sector in Turkey. It is more applicable for engineers, clients, designers and contractors. LEED uses ASHREA standards and Turkish construction sector is conversant with it.

Difficulties Encountered: Ensuring the conditions of the certificate was not too difficult for Siemens. Difficulties could be seen because of the employer's request. It is a different point for each unit project. There are some specific materials that are hard to find in Turkey such as urea formaldehyde composite wood materials.

Benefits: There are many sustainability benefits of the building. On its landscape and indoor 20% water saving was supplied. 30% energy saving was supplied.

Used local materials were contributed to the economy. Recycled materials are used and this is very efficient for the protection of natural sources. The waste management is beneficial as the mean of sustainability. The building is more is healthy because the amount and quality of the fresh air inside of the building is high-class. Day light is mostly used. There are detectable views. Materials are more respectful to human health.

Project Management Strategies: Sustainable building system is a system that the important part of the management is in design. However, in the construction site, some applications must be remarkably under control. One concerned person was needed in the construction phase for supervising the sustainable building certification requirements (Yaman, 2010).

4.2 UNILEVER OFFICE BUILDING

Building Type: Office

Location: İstanbul

Contractor: SİSTEMA TEKN.YAPI TAAH. SERVİS LTD.ŞTİ

Employer: Unilever Turkey

Sustainable Building Certification: LEED-silver-(commercial interiors)

Picture 4.2 Unilever Office building Exterior & Interior (Somalı, 2010).

Certification Necessity Reasons: Unilever Turkey brought its brand agenda to sustainability strategies for decreasing the effects of the global warming.Unilever brand has a target to be differentiated from the other Unilever's in the world. LEED was selected because in Unilever Office Building the certificate is used in the branch of commercial interiors.

Difficulties Encountered: To find the materials FSC and urea formaldehyde is not so easy. There are recycling rates for the materials of the furniture and producers are not well informed about this situation.

Benefits: There are many sustainability benefits of the building. 40% water saving and 30% energy saving was supplied. These were seen by comparing the electricity and water invoice of old building and new sustainable building. Heat and light comfort was controlled by the sensors. The office was designed in such a way that the employers can use the daylight effectively and can see the view.

Project Management Strategies: At the beginning of the design, consultant became part in the project team. The contractor and subcontractors were conscious of the sustainable building certification. In the construction site, one concerned person was needed in this phase for supervising the sustainable building certification requirements (Somalı, 2010).

4.3 GORDION SHOPPING MALL

Building Type: Shopping Mall

Location: Ankara

Contractor: Redevco Turkey

Employer: Redevco Turkey

Sustainable Building Certification: BREEAM-very good-

Picture 4.3 Gordion Shopping Mall (Canbay, 2010).

ERZURUM SHOPPING MALL

Building Type: Shopping Mall

Location: Erzurum

Contractor: Redevco Turkey

Employer: Redevco Turkey

Sustainable Building Certification: BREEAM-very good-

Picture 4.4 Erzurum Shopping Mall (Canbay, 2010).

Certification Necessity Reasons: Redevco (client) has an environmental awareness policy. To be respectful to the environment is a big advantage for their marketing strategy. BREEAM certification system is selected because Redevco is a Dutch firm and there are a lot of shopping malls around Europe which have BREEAM certificates also. They are experienced about adapting shopping malls with using BREEAM certification system.

Difficulties Encountered: Finding special materials is the most important point of the sustainable building certifications systems in Turkey. BREEAM standards are European standards and they are not well known standards by the construction sector in Turkey. There are some rules in the construction phase about site management and these rules are difficult to obey in the conditions of Turkey.

Benefits: 18% of the electricity was supplied by cogeneration system. Cogeneration and absorbs ion cooling system decrease the amount of carbon dioxide emissions per square meter. This system is beneficial for the tenants.

Project Management Strategies: Project management firms incorporate someone who knows enough knowledge about sustainable certification systems.

In this phase for supervising the sustainable building certification requirements he/she controls the applications (Canbay, 2010).

4.4 DISCUSSION

In Turkey there is not any support for sustainable designs from the government. Investors build the project with their own effort. Tübitak or some foundations may give some support according to the energy performances of the project of according to the investment.

Marketing is one of the most important reasons for the investors to get the sustainable building certificate. The other reason is environmental sensibility.

In Turkey the selection of the certification type is related with some different cases. Origin of the constructor or investor of the project is one of the most important factors. Usually American originate firms use LEED European originate firms use BREEAM. Sometimes sustainable building certificate consultants are responsible from the decision. They lead the decision through their experience. And also the type of the project plays a role in the decision phase. These two certification systems have different parts and these parts derive to make the selection.

Sustainable project management needs an integrated management system. That means sustainable building certificate consultants, designers and constructors should work as a team from the beginning of the project. In the meantime this provides better, faster and less costly works. Feasibilities are very important by comparison with the traditional project management. Working as a team with the other departments of the construction sector is another important point. At the beginning sustainability concept should be adopted by the construction project owners. That makes everything easier faster and cheaper. And at the construction phase, a responsible person is needed for the consultant firm to control and supervise the sustainable building certification regulations.

For the registration of the certificated building there is not any rule, regulation for Turkish government or for another corporation.

Adapting the standards to Turkish construction cause some problems. LEED uses ASHREA standards and they are more familiar than BREEAM standards for Turkey. However in BREEAM there are Country Reference Sheets. These are the local standards which are accepted by BREEAM. Turkey's reference sheets are not full because investors don't waste their time for it. They use BREEAM's international standards or ASHREA standards. Involved situations that have to be done in the construction site are another problem. Requisiteness of the disabled wc in the construction site is an example.

Construction Activity Pollution Prevention is a prerequisite in LEED certification system. During construction, there can be a lot of pollution going on, especially when it rains. Pollution on construction sites can be reduced by controlling soil erosion, airborne dust generation, waterway sedimentation. Performing this activity is very hard in Turkey conditions. It is hard to convince the client or constructor.

Materials and Resources Tip is another difficult part to apply in constructions in Turkey. Materials that contain minimum 20% by weight post-consumer recycled content or 40% by weight post-industrial recycled content and minimum 50% of wood-based materials certified in accordance with the Forest Stewardship Council guidelines for wood building components should be used in the construction. To find these kinds of materials in Turkish industry is not easy (Somalı, 2010).

For encouraging the building of residences and businesses closer together and within existing communities to encourage shorter vehicle trips or other modes of transportation such as walking, biking and public transit is in operation in Turkey. However obviously this is not efficiently in use because of the existing transportation system deficiency.

Specializing is an important factor for sustainable management. Project management firms work with experienced people who are informed about the

needs musts etc…And different job sections support the project from the beginning phase to the end of the construction. Coordination of designers and construction team is very important in sustainable building design and in certification process. Even deconstruction phase is under control. And commissioning is one of the important subjects. This commissioning is a process that ensures all the parts and systems are installed, designed, operated and maintained according the client or owner's requirement. The first fundamental requirement for this commissioning is to assign a commissioning authority (CxA) to lead the commissioning process. This authority must be completely independent in terms of the construction management and also the design of the project. The second requirement that is compulsory to be performed is to implement and develop a commissioning plan. This commissioning plan is important as a reference. This plan should include details like number of team members, equipments used, commissioning tasks and also schedule in carrying out the project. Next requirement that has to be followed is to develop a basis of design or BOD and produce paper work for owner's project requirements or OPRs. The documentations can be used as a guideline for the team members so that they will know how to perform their tasks and try to achieve the requirements as close as possible. To ensure that this document is valid, the CxA will review on these documents before initiating the job. The CxA has the authority to amend the documents if they think that the documents are not suitable. Lastly, commissioning specifications need to be developed as well. These specifications are needed to inform the contractors about their responsibilities and these documents should be incorporated into bid documents. This system is not adapting properly in Turkey (Somalı, 2010).

5 CONCLUSION

Intelligent and responsible living leads to new ideas and they are constantly trying to improve to introduce a sustainable living. Fortunately, today's building professionals are creating healthy buildings using sustainable design and construction. And this situation creates a need for assessing the design and construction. Rating systems (LEED and BREEAM) are created to help identify green and sustainable building practices. These systems identify the important components of healthy building and strive to improve the conditions in the areas most vital for sustainable living.

Sustainability, sustainable design and construction are currently under development in Turkey. Adapting the existing sustainable assessment systems to traditional systems require long range experiences. It is substantially early to see the long-termed results of the buildings which have constructed with these systems. However, there are some evaluable results and they are developing in positive direction. Naturally there are stringent factors encountered while constructing the sustainable certificated buildings through the construction sector in Turkey. (In energy performance criteria or in material criteria)

It could be seen that the awareness of the construction sector for sustainable assessment system is increasing. The most important point is that the firms want to have these assessment certificates not only for marketing but also for having principals like environmental sensibility. As Individual projects that do not make any sense for the environment but there are ongoing projects in Turkey and there will be more sustainable buildings in the future. This will show the importance of the number of sustainable buildings for people to live in qualified conditions. Obviously there is not any discernable determent to adapt these assessment systems for Turkey. The important thing is there should be more educated, sensible, curious, sophisticated, interested people in construction sector. This makes everything more clear for client, architect, employer, contractor, consultant, user, etc. And also coordinated study and work is necessary, even in traditional constructions in Turkey. Sustainable constructions canalize to program

or control the project management from the beginning of the design to the end of the construction even to the demolition.

The case study demonstrates that despite both assessment systems have the aim to reach the same final point, they have differences in assessment formats. It is impossible to say a certification system is more difficult or costly than the other one because the situation can show many changes according to the type of the building, the existing status of the project, the targeted level of the certification system.

On the design phase of the sustainable certificated buildings awareness of the design team on certification procedures is the first step for architect. Adopting life cycle cost methodologies in the reduction of budgets, promoting the use of recycled, reclaimed and renewable resources and ensuring maintainability of design are the following missions of the architect. Integrated work is important on that phase. Multiple disciplines should discuss together about the organization of the certificated building proceeds, design solutions, equipment selection. Client, users, suppliers, and key stakeholders could also be included in these meetings for the enhancement of the overall process.

On the construction phase site waste management is the most important point for the constructor in sustainable construction. Awareness of the constructor causes the increase to quality on the other hand decrease to the cost and time. As the design phase in construction phase, the disciplines should work together and the consultant firm should monitor the operation of the applications.

This research emphasize the importance of commissioning and integrated study in sustainable assessment systems in Turkey. By improvement of this framework the sustainable assessment systems could be more understandable and effective.

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7 APPENDIXES

APPENDIX A

Altensis İnşaat Enerji San. ve Tic. Ltd. Şti. kurucularından LEED ve BREEAM uzmanı Enerji Yöneticisi Sn. Berkay SOMALI ile LEED sertifikası almış Unilever ve Philips binaları ve genel olarak LEED ve BREEAM hakkında soru cevap niteliğinde yapılan görüşme.

SORULAR / CEVAPLAR

1A) Yapılan tasarım Türkiye koşullarında ele alındığında sürdürülebilirliği teşvik edici bir unsur ile karşılaşılıyor mu?
1B) Binanın sürdürülebilir olmasına rekabet / pazarlanabilirlik vb durumlar sebep oluyor mu yoksa başka nedenler var mı?

Bunu PR anlamında çok iyi kullanan firmalar var. Unilever ve Philips birer örnektir. Sertifikayı aldıktan sonra bunu tüm dünyada yayınlıyor. Bir takım hedefleri var. Dünya çapındaki Unileverler arasından sıyrılmış oluyor. O anlamda çok değeri var. Onun dışında yatırımcılar açısından bir kiralama ya da satma amacıyla o işi yapanlar açısından da onların da yurt dışından çok uluslu firmaları kendi binalarına çekmelerini sağlıyor. Şimdi yabancı bir firma Türkiye'ye gelip yatırım yapmak istiyor. Bina LEED sertifikalı dendiğinde çekme unsurudur bu çünkü adam diğer standartları bilmez, deprem standardı gibi; ama LEED sertifikasını duyduğu zaman adamlar bunu bile yaptıysa diğerlerini hayli hayli yapmıştır diyebilir. Bazı endüstriyel şirketlerle çalışıyoruz. Onlar da mesela diyorlar ki ben çok uluslu bir firmaya ürün gönderiyorum onlar benden daha sürdürülebilir bir üretim yapmamı istediler ben de o yüzden LEED sertifikasıyla ilgileniyorum. O da direkt müşterisinden gelen talebi değerlendiriyor. Bunlar teşvik edici şeyler.

2A) Sürdürülebilir yapı tasarımının alacağı yeşil bina sertifikasının hangisi olacağına karar aşamasında kimlerin (İşveren / Müteahhit / İnşaat Firması) ya da neyin etkisi oluyor?
2B) Bu kararı verirken ilk aşamada hangi faktörler etkili oluyor?

Mesela Amerikalı bir yatırımcı LEED i tercih ediyor. Avrupalı bir yatırımcıysa ülkesine göre bazen BREEAM bazen LEED i tercih edebiliyor. Bu aslında paranın nereden geldiği ile alakalı.
Biraz da biz orada yönlendirme yapıyoruz. Bize soruyorlar LEED mi alalım BREEAM mi alalım? Projeye bakıyoruz inceliyoruz, proje hangi kriterlere daha yakınsa tabi konsept proje varsa ona göre tercih ediyoruz.
Mesela bir fabrika binasında BREEAM in fabrikalara özel bir bölümü var, sizin binanız da ona daha bir uyuyor isterseniz bunu yapalım diyoruz. O da tamam diyor ve BREEAM oluyor. Bizim tecrübemize göre onlara bir yönlendirme yapıyoruz.
Projenin metrekaresine ne tip sistemler kullanıldığına bakıyorsunuz ve diyorsunuz ki bu bina BREEAM de daha yüksek puanlar alabilir. O şekilde bir değerlendirme yapıyoruz. Genelleme yapmak o konuda sağlıklı olmayabilir.

Unilever de LEED tercih edilmesinin sebebi commercial interiors dalından alınmış olması. o zaman BREEAM in commertial interiors dalı yoktu. Orada bina ile birlikte kendi katları için aldıklarından ona yönlendirdik.
Philips de o şekildeydi.

Ama Türk Hava Yollarının fabrika gibi binasında Amerikalı ortakları olduğu için direkt LEED almayı kafalarına koymuşlardı orada bizim de bir etkimiz olmadı. O yüzden hep proje bazında değişiyor olay.

3A) Geleneksel proje yönetimi ve sürdürülebilir yapım proje yönetimi arasında ne gibi farklar bulunmaktadır?
a) Yapı ömrünün fizibilite aşamasından başlayan ve yapının ömrünün tamamlanması ile son bulan döngünün tüm aşamalarındaki performansının farklı olması gibi…
b) Değişik meslek gruplarından oluşan bir takımı oluşturma gereği…
c) Yapının tesliminden sonra da kullanım ve yıkım safhaları için uygulanacak yönetim…
d) Kullanıcı memnuniyetinin ölçülmesi ile ilgili çalışmalar…

3B) Mimari tasarım grupları, sürdürülebilir sertifikalı bina tasarlamak için ek desteğe ihtiyaç duyuyor mu?

3C) Sürdürülebilir tasarımı oluştururken danışmanlık firması ile mimarın koordinasyon ve iletişim nasıl sağlandı?

Türkiye'de proje yönetimi deyince akla tasarımla ya da planlama ile başlayıp inşaatla biten kısım geliyor. İnşaat sonrası kısım pek proje yönetimi kapsamında değil; ama bir binanın yaşam döngüsü dediğin zaman sen hepsini alıyorsun. O yıkılıp geri dönüştürülünceye kadarki bir dönemden bahsediyorsun.
Proje yönetimi inşaat bitiminde kalıyor. Dolayısıyla tasarımla başlayıp inşaatla biten kısımdan bahsedersek normal proje yönetimi ile sürdürülebilir proje yönetiminin bence aralarındaki en büyük farklılık entegre bir çalışmadan bahsedebiliriz. Yani birlikte çalışma entegre tasarım dedikleri ve bu aşamada hatta tasarımın entegrasyonu ile birlikte inşaatı yapacak kişilerin de bu takıma dahil olması bu süreci en iyi ve hızlı ve maliyetsiz bir şekilde yürütülmesini sağlıyor. Yoksa klasik proje yönetimi anlayışında bir mimari müellif belirlersin, mimari müellif diğer müellifleri belirler, ondan sonra ihaleye çıkılır ve dizayn tamamlanır ya da yarım tamamlanır ondan sonra inşaatta bir takım sorunları çözer. Bundan ziyade daha çok tasarıma zaman ayrılması, bir takım fizibilitelerin çok dikkatli bir şekilde yapılabilmesi, bunun yapılırken sürdürülebilirlik anlamında tasarıma katılması tabi ki süreci çok daha hızlı ve sağlıklı götürmeye yarayan bir şey oluyor.
Değişik meslek gruplarından oluşan bir takımı oluşturma gereği kesinlikle var. Daha henüz mimari tasarım olgunlaşırken diğerlerinin de görüşünün alınıp bazı şeylerin mimari tasarıma aktarılması kesinlikle çok önemli.
Belki de bir binayı diğer binadan ayıran başarı, sürdürülebilirlik anlamındaki en önemli şeylerden bir tanesi de bu. Bir projeye başlarken en başından sürdürülebilirlik konseptinin proje müellifleri tarafından benimsenmesi ve projeye aktarılması. Sonradan bir şeyleri değiştirdiğiniz zaman çok sağlıklı olmuyor. Hem

masraflı oluyor, hem zor oluyor. İstediğiniz sonuçlara ulaşmanız da daha zor oluyor.
Yapı ömrünün fizibilite aşamasından başlayan ve yapının ömrünün tamamlanması ile son bulan döngünün tüm aşamalarında proje yönetimi yok. Sadece başlangıçta bir fizibilite çalışması yapılıyor özellikle yeşil binalarda. Değişik elektrik ve mekanik sistemlerin birbiriyle karşılaştırması yapılıyor.

4A) Sürdürülebilir proje yönetiminde oluşturulması gereken ek birimler neler olmuştur?
4B) Projenin tasarım aşamasından inşaat aşamasına geçiş sürecinde sertifikaya uygunluk için sağlanan koşullar sertifika almayacak proje ile karşılaştırıldığında nasıl farklılıklar içerir?

Proje takımına daha önce dâhil olmayan bir danışman devreye giriyor. İlk başlardan devreye girerek en sağlıklı şekilde sürdürülebilirlik açısından projeyi yönlendirmeye başlıyorlar. Danışmanlığın ötesinde olaylara yatırımcı açısından da bakabiliyoruz. Ne fizibıldır ne yapılabilir ne yapılamaz, neyin yapılması daha az maliyete daha çok fayda sağlar. O anlamda bizim haricimizde kimler devreye giriyor? Tasarım aşamasında çok fazla kişi yok. Mimar için çok fazla bir değişiklik yok. Sadece bazı ufak tefek tasarımda değişiklikler yaptırabiliyoruz. Mesela ne olabiliyor, öyle bir cephe dizayn ediliyor ki, diyoruz ki bu cephe tamamıyla cam olsun mesela ya da bu kadar fazla cam kullanılması gereksiz ya da güneyden ekleyin diyebiliyoruz. Onlar da tamam bakalım diyip bunları zaman zaman gerçekleştirebiliyorlar.
Bu anlamda enerji verimliliği açısından yönlendirmemiz oluyor. Onun dışında ihtiyaç programı çok fazla değişmiyor. Ufak tefek enerji verimliliğini sağlayabilecek ya da daha mekanik anlamda değişikliklere gerek duyuluyor. Tasarım aşamasında böyle.

İnşaat aşamasında müteahhit ve onunla birlikte çalışan taşeronların bu konuda bilinçlendirilmesi gerekiyor. Sonuçta her iki sertifika için de (LEED ve BREEAM) inşaat sırasında yapılması gereken bazı şeyler var bunun bazılarını müteahhit yapıyor bazılarını taşeronlarıyla birlikte yapıyor, bazılarını tedarikçileriyle birlikte yapıyor. Atık yönetimi gibi ve şantiye yönetiminde bilinçlendirilmesi lazım, zaten bizim danışmanlık sürecimiz de projenin başından başlayıp sonuna kadar gidiyor. Şantiye ziyaretleriyle Gerek şantiyede teknik bir takım şeylerin doğru yapılıp yapılmadığını kontrol ediyoruz. Bunları dokümanlan dırarak üretici firmaların iletişim numaralarını alarak direkt materyalcileri arıyoruz. Direkt görüşüldüğü zaman benim malzemem buna uygun ya da değil diyorlar. Diğer projede uygun hale getirmeye çalışacağız diyorlar.
Bu sertifikaların da en büyük amacı sadece binaları resmi olarak sertifikalandırmak değil.

Türkiye'de uygulanmayan ya da uygulanması az olan ''commisioning'' işletmeye alma bu gerekliliklerin tasarıma uygun olup olmadığını kontrol ediyor. Proje yönetim firmaları kısmen yapıyorlar bu işi ama tam anlamıyla da yapmıyorlar. Normalde yurt dışındaki projelerde bu sürdürülebilir yapılara bir de commisioning authotity diye bir adam takıma entegre olur. Çoğunlukla da daha tasarım daha bitmeden entegre olur onun da görüşleri alınır ondan sonra inşaat

kısmında da kontrolleri yapar. Dolayısıyla iki kişi aslında net olarak bu takıma girebiliyor. Danışman ve commisioning agent.

Danışmanlık firması kendi elemanını sürekli şantiyede tutmuyor; ama arada sırada gidip kontroller yapılıyor. Diyoruz ki müteahhitten bir elemanını sen LEED işlerinde görevlendir. Genelde başka işlerin dışında ek olarak görevlendiriliyor.
Mesela her ay ne kadar atık geri dönüşüme gönderildi, ne kadarı çöpe gitti bunun takibini yapıyor. Hava kanalları takılmaya başladığı zaman şantiyede onların ağızları kapalı mı bağlanıyor bunu gibi görevler. Tabi ki bunlardan bir adamın sorumlu olmasını biz istiyoruz genelde.

5A) LEED ve BREEAM süreci, projenin sertifika kurumlarına kaydının yapılmasıyla başlıyor. Bu süreç içerisinde Türkiye açısından herhangi bir zorlukla karşılaşılıyor mu?

Kaydında herhangi bir sorun yok. İstediğiniz projeyi kaydettirebiliyorsunuz. Mimimum program gereklilikleri maddeleri var. Bir bina içerisinde çalışan ya da yaşayan birilerinin olması gerekli mesela bir depo LEED sertifikası alamaz. Mesela arazi ile binanın büyüklüğü arasındaki oran var. Projenin bunlara uygun olması lazım. Kanunlarla inşaat yapılması sakıncalı bulunan alanlara LEED sertifikalı bina yapmayın gibi algılanabilir.

6A) Başvuruların yapıldığına ve projenin bu süreçte işleyeceğine dair Türkiye'de herhangi bir kuruma bilgilendirme yapılması gerekli midir?
Gerekli ise bu kurum için yapılması gerekenler nelerdir?

Herhangi bir kuruma bilgilendirme yapılmıyor. Böyle bir gereklilik yok.

7) LEED/ BREEAM sertifikasında altı adet yerine getirilmesi gereken ana başlıklar bulunuyor. Bunların Türkiye koşullarını yerine getirilmesinde en çok hangi konuda zorluk yaşanıyor.
a) Sürdürülebilir Arazi
Bir tane ön koşul var, arazide inşaat kirliliğinin önlenmesi diye bu Türkiye'de yapılan bir uygulama değil normalde ama aslında önemli bir şey. Construction activity pollution prevention çok fazla Türkiye'de uygulanan bir şey değil. İnsanları ikna etmekte zorlanıyoruz. İçeriğinde inşaat sırasında yağmur suyuyla akan toprağı durdurman lazım, arazinin dışına çıkmaması lazım, oradaki verimli toprağın kaybedilmemesi lazım. Bu Türkiye'de dikkat edilmeyen bir uygulama. Genelde iyi puanlar alınan bir bölüm.
b) Su Tasarrufu
Su tasarrufunda tamamıyla tasarruflu armatür seçilerek, yağmur suyunun kullanılması gibi uygulamalara yer veriliyor. Bunları genelde ikna etmek kolay oluyor. Bazı projelerde maliyetler öne çıkıyor bazılarında oluyor bazılarında olmuyor. Bu çok zorlanılmayan bir konu.
c) Enerji ve Atmosfer
Örneğin LEED'de saha dışındaki yenilenebilir enerji puanının alınabilmesi için ülkedeki yenilenebilir enerji santrallerinin karbon emisyonlarından tasarruf ettikleri miktarları ülke içinde satabilmesi gerekmektedir. Henüz ülkemizde bu yaygınlaşmış bir uygulama değildir.

Yenilenebilir enerji puanının alınabilmesi için sadece karbon sertifikası değil direkt oradan elektrik aldığınız zaman da puan alınıyor. Şu an Türkiye'de de bir rüzgâr santralinden direkt elektrik satın alabiliriz. Bizim projemizde de bu yöntemle bu puanlar alınabiliyor. Onun haricinde enerji ve atmosfer zorlayıcı bir madde. Özellikle yüksek kuleler için birtakım alternatif yöntemler uygulamadan sadece konvansiyonel elektrik mekanik sistemlerle çok fazla puan toplanacak bir yer değil.
LEEDde de BREEAMde de kıyaslama yaptığımız binalar gayet verimli binalar ve onlardan daha iyi sonuçlar almamız gerekiyor. Bunları konvansiyonel sistemlerle yapmak pek mümkün değil. Farklı sistemler, toprak kaynaklı ısı pompaları gibi sistemlerle yapabiliyorsunuz ya da çok iyi bir cepheniz ya da çok verimli bir pasif mimariniz olması lazım. Oradan doğal havalandırma vs. kullanacaksınız, güneşi çok iyi değerlendireceksiniz ki o da çok büyük kulelerde çok fazla uygulanmıyor. O noktada biraz zorlandığımızı söyleyebilirim. İnsanlara chillerin derinliği şu değil de şu demekte zorlanmıyoruz da konvansiyonelin dışına çıkmakta biraz çekingen oluyoruz tabi maliyetler de söz konusu oluyor.

Bir diğer örnek ASHRAE 90.1'in bina kabuğu standardına uygunluğun sağlanması ne tip zorluklar doğuruyor? (ayrı projelerde ne gibi farklılıklar)

Bina kabuğunda yine yüksek binalarda çok fazla cam oranı olan binalarda ASHRAE çok ciddi bir gölgeleme katsayısı istiyor. Bu gölgeleme katsayısını sağlayabilecek cam Türkiye'de çok az. Sadece bir ya da iki üretici üretebiliyor ve diğer camlardan tabi biraz daha pahalı. Eğer cam oranı fazlaysa burada sıkıntı olabiliyor ASHRAE 90.1'i sağlamak açısından. Onun haricinde diğer izolasyon özellikleri duvarların çatının vs. bunlar zaten TSE 825 diye izolasyon standardımız var. Ona uygun yapıldığı sürece çok büyük sıkıntılar çekmiyoruz.

Unilever binasında bu tip bir sorun yaşamadık çünkü camlar şeffaf değildi. Renkli cam kullanılmıştı, onun da gölgeleme katsayısı oldukça iyiydi. Şimdiki yeni tasarımlarda genelde şeffaf cam tercih ediliyor. O açıdan bir sorun yaşıyoruz.

d) Malzeme ve Kaynaklar
Örneğin her iki sistemde (LEED BREEAM) de aranan FSC (Forest Stewardship Council) sertifikalı kereste temini. Bu özelliğe sahip keresteyi bulmak Türkiye'de oldukça zordur.

FSC ve urea formaldehyde bunlar çok zor bulunan malzemeler. Ancak projede az bir yerde varsa bir kısmında bunlar kullanılıyorsa o zaman bunlar ithal edilebiliyor. Projenin genelinde epeyce bir ahşap kullanımı varsa maliyetler yüksek olduğu için bu puanlardan genelde vazgeçiliyor.
Epoksi malzemelerinin voc oranlarında sıkıntı olabiliyor. Mobilyaları işin içine katarsak, mobilyalarda sıkıntı olabiliyor. Üreticiler geri dönüşüm oranlarını bilmiyorlar ya da takip etmiyorlar. Türkiye'de malzeme bulmak biraz daha zor. İmkânsız değil eninde sonunda bulunuyor ama zorlanıyorsunuz. Bu çok normal bir şey ama Amerika'da da bu sistemler ilk çıktığı zaman orada da malzeme bulunamıyordu. Orada da yavaş yavaş endüstri alıştıkça talep geldikçe olacak şeyler bunlar.

—Malzemeleri temini için tedarik yönetim birimi oluşturuldu mu?

Henüz böyle bir birim oluşturulmadı.

e) İç Mekan Yaşam Kalitesi

Yine malzeme sıkıntı konusu bu maddede de. İç mekan yaşam kalitesini etkileyen malzemeler.

f) İnovasyon

Genelde inovasyon puanlarını alıyoruz. Bu bölümde bir sıkıntı yaşamıyoruz.

8)Bu standartları sağlamak, bu ve benzer kıyaslamaların yapılması için "Ülke Referans Tabloları" yayınlamaktadır.
—Türkiye için bu referans tabloları oluşturuldu mu?
—Yoksa uluslararası standartlar mı sağlanmaya çalışılıyor?

Türkiye için yapılan projelerden elimizde biriken referans tablolarını kendi bünyemizde oluşturmaya başladık ama şu anda uluslar arası standartları kullanmaya devam ediyoruz.

9) Sürdürülebilir yapıların getireceği ekonomik faydalar sadece uzun vadede gözlemlenebiliyor. Bu faydaların etkisi (bina bazlı) görülmeye başlandı mı?

Unilever de enerji bazında güzel geri dönüşler oldu. Enerji alanında farklılıklar olduğunu faturalara bakarak kendileri gördüler. Onun haricinde biraz daha sübjektif olarak öyle bir araştırma yapmalarını rica ettik onlardan. Yeni bina ver eski bina arasında çalışan verimliliği nasıl değişti? Onun henüz sonuçları gelmedi ama bir takım anketlerle hafta gün sayısına bakarak uzun vadeli bir çalışma. Olumlu çıkacağını da düşünüyorum.

10) Sürdürülebilir binalar için oluşturulmuş bir tedarik zincirinden faydalanıldı mı?
—Bu süreç sırasında nasıl bir yönetim şekli uygulanmıştır?
—Bu süreç içinde gerekli olan görevli sayısında ve konumunda nasıl değişiklikler olmuştur?

Türkiye'de henüz öyle bir organizasyon kurulmadı.

11) Projenin inşaat aşamasında sertifikaya uygunluğu sağlamak için oluşturulan sistem şantiye yönetim şemasında nasıl değişiklikler meydana getirmiştir?

Şantiye yönetim şemasında da belirgin bir değişiklik yok. Sadece bir sorumlu olması şart. Dediğini yaptırabilen bir sorumlu olması lazım. Şantiye şefi gibi. O bu olacak dediği zaman taşeronların da ona uygun bir şekilde yapmış olması önemli. Yoksa yönetim şemasında bir değişiklik olmuyor yine aynı şekilde sadece bir ya da iki kişiye ek bir sorumluluk geliyor.

12A) Sürdürülebilir bina sertifikası almış binalarda geçen zaman içerisinde kullanıcılardan nasıl tepkiler geliyor?
12B) Binanın sertifika almış olması ya da sertifikasız olması kullanıcı için ne gibi farklar yaratmış?

Unileverden çok olumlu tepkiler alıyoruz. Eski binalarına gelen elektrik su faturaları ile şimdi gelen faturaları arasında görülür miktarlarda düşüş var ve bu memnuniyetlerini bize belirttiler.
Bir de onlardan çalışan verimliliği ile ilgili bir araştırma yapmalarını istedik. Sertifika öncesi ve sonrası ile ilgili. Henüz onun sonuçları gelmedi fakat zaten uzun bir süreç içerisinde değerlendirilmesi gereken bir çalışma olduğu için ve sertifika alan bina sayısı da henüz az olduğundan Türkiye'de alınan sonuçların

13)Türkiye şartlarında mevcut sertifika sistemlerinde tarafınızca görülen eksiklikler nelerdir?

Hiçbir sertifika sistemi mükemmel değil. Zaten mükemmel yapmaya çalışsak her şeyi kapsasın desek büyük olasılıkla birçok bina sertifika alamaz. O yüzden insanları da çok zorlamadan bir takım ilk adımları atmayı sağlayabilmemiz lazım. Tabi ki bir sürü eksiklik var. Ben diyebilirim ki life cycle a daha çok önem versinler diyebilirim. Yıkımı niye hesaba katmıyorlar ya da başka birisi der ki depremi niye hesaba katmıyorlar? Bunlar bitmeyecek konuların listesini yapmak. Bunun çizgisini çizmek lazım. Çok bir eksik görmüyorum.
Zaten eksik ne zaman görülür? Hepsini yaparsın da artık yapacak bir şey kalmaz. Çok kolay alınıyormuş sertifika dersin o zaman eksiklik hissedersin. Daha bunu yapmadan yapılabilecekleri konuşmanın bir anlamı yok bence.

14)Türkiye kendi standartlarına uygun bir sertifikasyon sistemi oluştursa mevcut sisteme eklenmesi ya da çıkartılması gereken maddeler nelerdir?

Şu an BREEAM in Türkiye'ye adaptasyonu söz konusu, onda da deprem konuşuluyor ama zaten deprem zorunluluk bunu yapmazsan olmaz. Burada zorunlu bir şeyden bahsetmiyoruz ki burada gönüllülük hesabı ile yapılan bir şeyden bahsediyoruz. Bence zorunlu olan bir şeye puan vermek anlamsız.
Mesela enerji verimliliğine çok önem verilmeyebilir. Bu insan hayatını tehlikeye atacak bir şey değil.

15)Türkiye koşullarında sertifika sistemlerindeki yerine koşulların yerine getirilmiş olsa bile etkin olarak kullanılamadığı maddeler hangileridir?(bisiklet alanları vb..)

Evet, bisiklet park alanları aktif bir şekilde kullanılamıyor ama çevresel ve kentsel faktörler buna engel oluyor. Çevrede bisiklet yolları yapılırsa insanlar bisiklet kullanmaya da başlar onu park edecek yer ihtiyacı da doğar. Mesela sertifika alacak bir proje kompleksi var alışveriş merkezi ve toplu konutların olduğu. Bu alanda yaşayan insanlar alışveriş merkezine bisikletleriyle gidebilecekler çünkü park yeri olduğunu bilecekler.
Bu tip projeler arttığı sürece bu madde de ileri vadede etkin olarak kullanılacaktır.

APPENDIX B

Entegre Proje Yönetim Dan. Müh. Tic. Ltd. Şti. nden Yetkili LEED Uzmanı Sn. Yük. Mimar Nilay CANBAY ile BREEAM sertifikası almış Gordion ve Erzurum Alışveriş merkezleri, LEED sertifikası almış Unilever binası ve genel olarak LEED ve BREEAM hakkında soru cevap niteliğinde yapılan görüşme.

SORULAR / CEVAPLAR

1A) Yapılan tasarım Türkiye koşullarında ele alındığında sürdürülebilirliği teşvik edici bir unsur ile karşılaşılıyor mu?
1B) Binanın sürdürülebilir olmasına rekabet / pazarlanabilirlik vb durumlar sebep oluyor mu yoksa başka nedenler var mı?

Türkiye'de herhangi bir devlet desteği yok. Yani eğer bir yatırımcıysan ve bu işe gönül verdiysen bunu kendi çabalarınla yapabiliyorsun. Herhangi bir yardım yok; ama tabi bu bina enerji yönetmeliği kapsamında binana enerji verimliliği arttırıcı bir proje yaparsan Tübitak ve benzeri kurumlar bir takım destekler verebiliyorlar harcadığın parayla ilgili. Bunu yeşil bina sertifikasıyla bağlantılandırabilirsen belki bir şey alınabilir devletten ama çok da mümkün değil şu an için çok kolay bir şey değil.

Onun haricinde diğer konu ise bir yeşil bina yapınca sonuçta bu çok ciddi anlamda marketing unsuru olarak kullanılıyor. Türkiye'de yapılan yeşil binaların %90 ının amacı budur.
Örnek olarak biz şimdi balmumcuda bir yeşil otel projesi ile ilgileniyoruz. Balmumcu ve Beşiktaş otellerin çok yoğun olduğu bir bölge ve orada çok iyi otel zincirlerinin otelleri var ve adam ora bir otel zinciri daha yapacak Amerikan orijinli; fakat muadillerine göre alanı küçük, odaları küçük. Dedeman ve Conrad ile kıyaslarsan ne yapacak sonuçta bir farklılık yaratması lazım ki Conrad ya da Çırağanla aynı paraya satabilsin. Bu da biz yeşil binayız her şeyi minimalist kullanıyoruz gibi bir yaklaşıma getirerek bu dezavantajı avantaja çevirmek gibi bir şey söz konusu. Yine aynı şekilde Redevco projelerinde de bunu iyi bir şekilde kullandı. Redevco bunu kiralamada biz yeşil binayız diye deklare etti. Yine bizim Tarsus'ta ilgilendiğimiz başka bir alışveriş merkezi projesi var orada da marketingin işe yarayacağı söyleniyor.

2A) Sürdürülebilir yapı tasarımının alacağı yeşil bina sertifikasının hangisi olacağına karar aşamasında kimlerin (İşveren / Müteahhit / İnşaat Firması) ya da neyin etkisi oluyor?
2B) Bu kararı verirken ilk aşamada hangi faktörler etkili oluyor?

Türkiye ölçeğinde düşünecek olursak, gördüğümüz projelerden yola çıkalım. Bir binanın yatırımcısı var ise ve bu yatırımcı Amerikan ya da Avrupa orijinli bir firma ise sertifika seçiminde rol oynayabiliyor. Redevco nun projelerinde neden LEED değil de BREEAM aldığının sebebi Hollandalı bir firma, Avrupa da başka alışveriş merkezleri daha var. Daha önce bu yapılarda BREEAM sertifikası aldığı için. Avrupa'da, özellikle Almanya İngiltere Fransa'da daha geçerli bir sertifika olduğu için Redevco'nun böyle bir yönlendirmesi oldu.

Leventte yeşil bir binamız var. Orada da mimar İngiliz orijinli olmasına rağmen yatırımcı Amerikalı vs derken o projede de LEED in daha uygun olduğuna karar verildi. Bir de tabi şöyle demek lazım, projenin tipine göre de değişiyor. Ofis binalarında bana sorarsan LEED daha yapılabilir çünkü önermiş olduğu Amerikan Ashrae standardına göre tasarım yapılıyor.
Ama tabi biz napacağız diye gelen yatırımcı projeci de oluyor. Onlara da biz araştırıp öneriyoruz. Mesela Unilever projesinde LEED olmasını önerdik. Unilever de Hollanda İngiliz orijinli bir firma olmasına karşın LEED seçildi. Doğru mimar ve proje yönetim firmalarının yönlendirmesi ile bu iş oluyor. Şu anda Türkiye'de BREEAM in biraz da zor komplike aşılabilir olduğu her ne kadar çevre dostu binalar derneğinin bre ile yaptığı bir anlaşma var. BREEAM i Türkiye'ye adapte etmeye çalışıyoruz. Bu farklı bir şey ama yine de BREEAM diye gelen çok proje olmuyor.

3A) Geleneksel proje yönetimi ve sürdürülebilir yapım proje yönetimi arasında ne gibi farklar bulunmaktadır?
a) Yapı ömrünün fizibilite aşamasından başlayan ve yapının ömrünün tamamlanması ile son bulan döngünün tüm aşamalarındaki performansının farklı olması gibi…
b) Değişik meslek gruplarından oluşan bir takımı oluşturma gereği…
c) Yapının tesliminden sonra da kullanım ve yıkım safhaları için uygulanacak yönetim…
d) Kullanıcı memnuniyetinin ölçülmesi ile ilgili çalışmalar…
3B) Mimari tasarım grupları, sürdürülebilir sertifikalı bina tasarlamak için ek desteğe ihtiyaç duyuyor mu?

Bazen öyle gruplar oluyor ki bize soruyorlar işte böyle bir bina yapacağız ne yapabiliriz. Bazen bizim bulduğumuz ve görüştüğümüz gruplar oluyor. O böyle karşılıklı bir etkileşim çünkü tam olarak ne olduğu bilinmediği için Türkiye'de. Bu işe hiç inanmayan gruplar da var tabi. Yeşil binadan anladığım orasını burasını yeşillendirip üç beş ağaç koymaktır diyen Türkiye'nin ilk onunda olan proje grupları da var.
Ama gittiğiniz zaman sizi dinleyen gruplar da var.

3C) Sürdürülebilir tasarımı oluştururken danışmanlık firması ile mimarın koordinasyon ve iletişim nasıl sağlandı?
4A) Sürdürülebilir proje yönetiminde oluşturulması gereken ek birimler neler olmuştur?
4B) Projenin tasarım aşamasından inşaat aşamasına geçiş sürecinde sertifikaya uygunluk için sağlanan koşullar sertifika almayacak proje ile karşılaştırıldığında nasıl farklılıklar içerir?
4C) Projenin inşaat aşamasında sertifikaya uygunluğu sağlamak için oluşturulan sistem şantiye yönetim şemasında nasıl değişiklikler meydana getirmiştir?

Bir yeşil bina danışmanlığı yapan firmalar. Proje yönetim firması olaydan bihaberse… Bizim gibi firmaların da bünyesinde açıkçası sürdürülebilirlik anlamında birisini bulundurması lazım. Onun idaresinde farklı iş kollarının ayrılıp proje gelişirken onların da bütün projeye hâkim olup destek olup yorumlarını yapmaları lazım. Mesela ben burada yeşil bina uzmanıyım ama Fahri Bey daha çok comissioning ve enerji verimliliği konularında uzmanlaştırmaya çalışıyoruz.

Mesela elektrik ile ilgili bir şey geliyor elektrik koordinatörümüz var, o bakıyor. Sürdürülebilir proje içinde hem bir ekip işi hem proje yönetiminde bir background u olan bu konulara hakim bir proje yönetiminin işi. Ayrıca tasarımcılarla ve inşaatı yapan firmalarla çok koordineli ve çok hızlı çalışmayı gerektiriyor çünkü Türkiye'de şöyle bir şey var proje yönetimi dahi olsa bazı şeyler o kadar babadan kalma yöntemlerle gider ki. Hâlbuki sürdürülebilir proje yönetiminde öyle bir şey yok. Yıkım aşamasında bile senin dikkat etmen gereken bir disiplin. Yaparken de dikkat etmen gereken bir sürü nokta var. Mesela BREEAM der ki bütün şantiyeye giren çıkan kamyonların kaç km uzaktan geldiğini bul bunu o kamyon tipinin saldığı karbondioksit miktarıyla çarpıp bir hedef belirle. O hedefi standartlarla karşılaştır. Aynı şekilde şantiyedeki su tüketimini ya da iç hava kalitesi planı diye bir şey var. Şantiyede bütün elektro mekanik ekipmanları tozdan koruman lazım. Diyelim ki bir kanal yaptın o kanalın ucunu akşam kapatman lazım. Fan-coil i özel bir şekilde kapatman lazım. Şantiyeyi de etkileyen bir dize aktivite var. Mesela comissioning konusu çok daha komplike bir şey. Bunu yüklenici ile beraber tasarımcı ile beraber. Tasarımcının tasarladığının doğru bir şekilde uygulandığının test edilmesi lazım. Sistem çalışıyor mu çalışmıyor mu değil. Comissioning in asıl amaçlarından biri o. O yüzden bütün gruplar orada da bir araya gelecekler. Bütün bu kontrol koordinasyon ve desteği sağlamak da bir anlamda sürdürülebilir proje yönetiminin işi.
Mesela bir projemizde yükleniciye yazdık. BREEAM den anlayan bir BREEAM sorumlusu koyacaksın, bu sorumlu bütün bu işleri takip ettiği gibi haftalı aylık rapor verecek, olayın gidişatını takip edecek aynı şekilde Unilever projesinde de aynı şeyi yaptık orada da günlük raporları doldurup ay sonunda da aylık bir rapor yazacak.

5A) LEED ve BREEAM süreci, projenin sertifika kurumlarına kaydının yapılmasıyla başlıyor. Bu süreç içerisinde Türkiye açısından herhangi bir zorlukla karşılaşılıyor mu?

Bu süreç içerisinde hiçbir zorlukla karşılaşılmıyor.

6A) Başvuruların yapıldığına ve projenin bu süreçte işleyeceğine dair Türkiye'de herhangi bir kuruma bilgilendirme yapılması gerekli midir?
Gerekli ise bu kurum için yapılması gerekenler nelerdir?

Herhangi bir kuruma bir bilgilendirme yapılması gerekmiyor.

7) LEED/ BREEAM sertifikasında altı adet yerine getirilmesi gereken ana başlıklar bulunuyor. Bunların Türkiye koşullarını yerine getirilmesinde en çok hangi konuda zorluk yaşanıyor.
a) Sürdürülebilir Arazi
b) Su Tasarrufu
c) Enerji ve Atmosfer
Örneğin LEED'de saha dışındaki yenilenebilir enerji puanının alınabilmesi için ülkedeki yenilenebilir enerji santrallerinin karbon emisyonlarından tasarruf ettikleri miktarları ülke içinde satabilmesi gerekmektedir. Henüz ülkemizde bu yaygınlaşmış bir uygulama değildir.

Bir diğer örnek ASHRAE 90.1'in bina kabuğu standardına uygunluğun sağlanması ne tip zorluklar doğuruyor? (ayrı projelerde ne gibi farklılıklar)
d) Malzeme ve Kaynaklar
Örneğin de her iki sistemde (LEED BREEAM) de aranan FSC (Forest Stewardship Council) sertifikalı kereste temini. Bu özelliğe sahip keresteyi bulmak Türkiye'de oldukça zordur.
—Malzemeleri temini için tedarik yönetim birimi oluşturuldu mu?
e) İç Mekan Yaşam Kalitesi
f) İnovasyon

Bazı malzemeleri bulmakta gerçekten zorlanılabiliyor. Malzeme kredilerini, özellikle çok malzemenin kullanılacağı projelerde hedeflemek doğru değil. Mesela bir otel projesinde malzeme puanlarının hiçbirini hedeflemedik zaten çok fazla malzeme var. Otel belki 40-50 çeşit malzemenin kullanıldığı proje. Bir ofis binası olsa iki boya var bir sıva var belki ahşap panel var ama otel projesinde öyle değil. Her ne kadar bu uluslar arası bir zincir de olsa. Diyelim ki bu zincirin Türkiye'de beş tane oteli var. Ve bu beş oteli de aynı kişi işletiyor diyelim. Şu önyargıyı da kıramıyorsunuz ; ''biz şu otelimizde bilmem ne firmasının halısını kullandık. O halı çok güzel, çok iyi, dayanıklı.'' Ama o halı yeşil bir halı değil, mesela muadili yeşil bir halı kullanın. Yok kullanamayız! Otel olunca işin içine dayanıklılık sağlamlık da girdiği için öyle şeyler olabiliyor.

Enerji konusunda da çok zorlanılıyor. Şöyle bir şey var. Mesela bu çevrede gördüğün bütün plazaları ele al diyelim ki bunun değil LEED/BREEAM kriterlerini bizim TSE 825 e bile uyması neredeyse mucize gibi bir şey. Türkiye'deki neredeyse yapıların %90 ı LEED enerji kriterleriyle uzaktan yakından alakalı değil. Yeni binalarda da bir bina her ne kadar Ashrea standardına uyuyorum dese de mesela cephesi tamamen cam ve gölgeleme katsayısı standartların çok üstünde kalan bir ürün ve bu tüm avantajları dezavantaja çeviriyor. Bu gibi çelişkili durumlar söz konusu olduğu için uymak çok zor. Şöyle bir bina gelirse mesela cephedeki doluluk boşluk oranının %40-60 olması lazım.%40 ın altında cam oranı olan binalar avantajlı. İyi bir cam seçilmesi lazım, yerli üreticiyle çalışılmaması lazım. Onun haricinde muhakkak yalıtım olması lazım. Fibrobeton gibi bir malzeme kullanılması lazım. Bütün bu cephe bileşenlerine bakılıyor. Cephe iyi tasarlanmış bir cephe ise ve elektro-mekanik sistemleri de klasik sistemler seçildiğini düşün ama verim değerleri yüksek sistemler seçilirse zaten 90.1 in istediği standartları karşılayabilecek şeyler ortaya çıkıyor.

8)Bu standartları sağlamak, bu ve benzer kıyaslamaların yapılması için "Ülke Referans Tabloları" yayınlamaktadır.
—Türkiye için bu referans tabloları oluşturuldu mu?
—Yoksa uluslararası standartlar mı sağlanmaya çalışılıyor?

BREEAM de var LEED de böyle bir şey yok. LEED in standart kitapçığı var ve kitapçıkta yazan değerler değişmez. Bu kitapçık ta Amerikan orijinli standartlara referans verir. Bu standartlara uymaz isen herhangi bir puanı alman mümkün değildir. Herhangi bir esnekliği yok diyebiliriz.
BREEAM de şöyle bir şey var. Diyelim ki BREEAM in önerdiği bir İngiliz standardı muadili bir Türk standardı var ise onu İngilizceye çevirip adamlara

gönderiyorsun. Adamlar inceliyor ve tamam diyorlar ben standardınızı kabul ediyorum. Standardı kabul ettikten sonra o krediyle ilgili artık İngiliz standardını kullanmıyorsunuz. Country Reference Sheet dedikleri bir sheet oluşuyor ve böyle bir süreç ilerleyebiliyor fakat mesela Redevco projelerinde hiç böyle bir şey yapılmadı. Mesela sadece asansör yönetmeliği çevrildi. O da EN standartlardan alıntı olduğu için İngilizler de çok benzerini kullanıyorlar çünkü bu kolay bir süreç değil. Bunların çevrilmesi gönderilmesi, adamların bunları okuyup değerlendirip soru sorması falan çok vakit kaybettirici şeyler. Türkiye'deki hiçbir yatırımcının bu kadar uzun soluklu bir vakti yok. Adam bir an önce projeyi bitirip satıp kaçmak istiyor.
BREEAM eğer Türkiye'ye adapte edilirse zaten o adaptasyon sırasında bunların da bir şekilde muadillerinin bulunup o kredilerin karşılığına konması söz konusu olur.

9A) Sürdürülebilir yapıların getireceği ekonomik faydalar sadece uzun vadede gözlemlenebiliyor. Bu faydaların etkisi (bina bazlı) görülmeye başlandı mı?
9B) Sürdürülebilir bina sertifikası almış binalarda geçen zaman içerisinde kullanıcılardan nasıl tepkiler geliyor?
9C) Binanın sertifika almış olması ya da sertifikasız olması kullanıcı için ne gibi farklar yaratmış?

Redevco projelerinden henüz bir feedback almadık. Mesela Unilever projesinden bunu çok rahat örnekleyebiliriz. Mekânsal tasarımın iç hava kalitesinin artmasının insanların yaşantısına ve verimliliğine çok olumlu etkileri olduğunu herkes söylüyor. İnsanlar çok daha insani koşullarda çalışıyorlar, iyi havalandırmaları var. Bütün oturma alanları dışarıyı görüyor aydınlatma seviyeleri çok düzgün. Bina içinde bir sürü farklı sosyal aktivite var falan bunlar tabi gözle görülür biçimde çalışanların verimliliğine yansıyor. Ofis binalarında bu çok daha hissedilebilecek bir şey. İşletmesel anlamda da çok daha faydalarının olacağı kesin. Mesela Unileverde yağmur suyu sistemi var. Bu sistemi efektif bir şekilde kullanıyorlar artık ve öyle olunca da su faturaları azalmış oluyor.
İyi bir sistem kurulduğunda ve test ve devre analizleri düzenli bir şekilde yapıldığı için sistemdeki enerji kayıpları, kaçaklar da daha minimalize edilmiş oluyor.

10) Sürdürülebilir binalar için oluşturulmuş bir tedarik zincirinden faydalanıldı mı?
—Bu süreç sırasında nasıl bir yönetim şekli uygulanmıştır?
—Bu süreç içinde gerekli olan görevli sayısında ve konumunda nasıl değişiklikler olmuştur?

Faydalanılan herhangi bir tedarik zinciri yok.

11A)Türkiye şartlarında mevcut sertifika sistemlerinde tarafınızca görülen eksiklikler nelerdir?
11B)Türkiye kendi standartlarına uygun bir sertifikasyon sistemi oluştursa mevcut sisteme eklenmesi ya da çıkartılması gereken maddeler nelerdir?

Standartların Türkiye koşullarına uymaması ile ilgili durumlar sorun yaratabiliyor. Ya da şantiyede yapılması gerekenler Türkiye şartlarında zorlayıcı olabiliyor. Şantiyede uyulması gereken maddelerin yumuşatılması gerekiyor.

Mesela engelli tuvaleti isteniyor ve bunu şantiyeciye uygulatmak mümkün olmuyor. Bunun gibi birçok unsur var. Tabi bunlar İngiltere'de çok başarılı bir şekilde uygulanıyor.

15)Türkiye koşullarında sertifika sistemlerindeki yerine koşulların yerine getirilmiş olsa bile etkin olarak kullanılamadığı maddeler hangileridir?(bisiklet alanları vb..)

Her projede yapıyoruz koyuyoruz bisiklet alanını mesela Unilever yakınında carrefour var oraya bisiklet ile gidilebiliyor yine yakınlarında bir koru var orayı belediye izin verirse rehabilite edip bisiklet parkurları uygulamayı düşünüyorlar. Ama çoğu projede mesela kent merkezlerinde bisiklet park yeri yapıp yapmamak çok bir şey değiştirmiyor. Bunun dışında göstermelik olarak diyebileceğimiz bir madde yok.

LEED in su ile ilgili kriterleri de bu son versiyonunda çok sıkı olmaya başladı. Böyle olunca da armatürlerde çok ciddi önlemler alınması lazım. Ya o su standartlarını sağlayan armatürler giriyor projeye ve onlar da genelde çok tasarım işi olmadığı için mimarlar çok da sıcak bakmıyorlar.
Tam koşulların yerine getirilemeyeceği maddelerden bir tanesi de su tüketimi.
Mimarların olaylara da ılımlı bakmaları gerekiyor. Bir iç mimari grup mesela ısrarla susuz pisuar kullanmayacaklarını söyledi. Unilever projesinde susuz pisuar kullanıldı ikna ettik. %30 su tasarrufu yapıyorsunuz. Onlar da tamam dediler takalım olmadı normal pisuara çevririz ama çevirmediler çünkü memnunlar. Düzgün bir işletme ve düzgün bir temizlik yapıldığı takdirde bir problem olmuyor bunu %100 söyleyebilirim.

APPENDIX C

Siemens Sanayi ve Ticaret A. Ş. Gayrimenkul Yönetimi ve İnşaat Proje Yönetimi Müdürü Sn. Cemil YAMAN ile LEED sertifikası almış Siemens Fabrika Binası ve genel olarak LEED ve BREEAM hakkında soru cevap niteliğinde yapılan görüşme.

SORULAR / CEVAPLAR

1A) Yapılan tasarım Türkiye koşullarında ele alındığında sürdürülebilirliği teşvik edici bir unsur ile karşılaşılıyor mu?
1B) Binanın sürdürülebilir olmasına rekabet / pazarlanabilirlik vb durumlar sebep oluyor mu yoksa başka nedenler var mı?
Siemens olarak biz ürettiğimiz ürünlerin tamamında enerji tasarrufuna dikkat ediyoruz dolayısıyla binayı tasarlarken de özellikle enerji tasarruflu bir bina olmasına özen gösterdik. Yeşil bina sertifikası gündemde yokken bile biz yeşil alanlar olsun su tasarrufu olsun güneş tasarrufu olsun enerji tasarrufu olsun bu kapsamda doğal kaynakların korunması adına baya bir çalışmamız vardı. Sonra da sertifikaları incelediğimizde birçok özelliği yerine getirdiğimizi gördük. Siemens olarak da biz her zaman yaptığımız işten sorumluyuz diyoruz, ürettiğimiz üründen sorumluyuz diyoruz. Bu anlamda da ürün üretirken satış ve pazarlama için veya Türkiye için dünya için ürün üretirken nasıl ki enerji tasarruflu ürün olmasına dikkat ediyorsak oturduğumuz binanın da aynı şekilde enerji tasarruflu su tasarruflu ve çevreye saygılı bir bina olmasını doğru bulduk, olması noktasında çalışmalarımızı yaptık. Açıkçası ilk etapta bu kadar çalışmayı yaptıktan sonra ortada LEED sertifikası yokken Alman meslektaşlarımız tarafından bize önerildi. Biz de konuyu inceledikten sonra biz de bu sürece dâhil olmaya karar verdik. Süreç boyunca hiçbir sıkıntıyla karşılaşmadık diyebilirim. Türkiye şartlarında LEED çok uygun bir sertifika sistemi. LEED ashrae standartlarını ele alıyor. Makine mühendisleri diğer mühendisler ashrae standartlarını iyi biliyorlar. Uygulamada herhangi bir sıkıntı çekmiyorlar. BREEAM Avrupa standartlarında olduğu için sıkıntılı olabiliyor. Yine aynı şekilde bir online sayfası var. İnternet üzerinden bütün işlemlerinizi yapabiliyorsunuz. Büyük bir kolaylık sağlıyor. BREEAM de ise exelde bir rapor hazırlamanız gerekiyor. BREEAM assesor un hazırlamış olduğu bir rapor doğrultusunda sertifika veriliyor. Şu an Türkiye'de 20 tane sertifika almaya hazırlanan proje var bunların 17- 18 i LEED alacak

2A) Sürdürülebilir yapı tasarımının alacağı yeşil bina sertifikasının hangisi olacağına karar aşamasında kimlerin (İşveren / Müteahhit / İnşaat Firması) ya da neyin etkisi oluyor?
2B) Bu kararı verirken ilk aşamada hangi faktörler etkili oluyor?

Biz binaya sertifika alırken BREEAM yoktu ama bugün sorulsa ben yine LEED derim. Şu anda hem BREEAM assesor hem LEED AP olduğum için biliyorum ikisini de yine LEED derdim. Çünkü LEED daha hızlı daha Türk inşaat sektörüne uygun mühendisler, işveren ve tasarımcılar, uygulamacılar tarafından daha kolay yerine getirilebilir.
BREEAM in Türkiye'ye adaptasyonu şeklinde bir çalışma var. Tek bir sertifika sistemine gidiliyor; fakat bunu piyasa ortaya koyacaktır. Kabul edilip

edilemeyeceğini piyasa ortaya koyacaktır. Sonuçta oyuncular var piyasada, uluslar arası yatırımcılar var ortada. Bazıları diyecektir ki yine ben LEED istiyorum. Bazıları diyecektir ki ben BREEAM istiyorum. Onun için tamamen bu konu piyasa tarafından kabul edilecektir. Olumlu ya da olumsuz bir şey söylemek doğru değil.

3A) Geleneksel proje yönetimi ve sürdürülebilir yapım proje yönetimi arasında ne gibi farklar bulunmaktadır?
a) Yapı ömrünün fizibilite aşamasından başlayan ve yapının ömrünün tamamlanması ile son bulan döngünün tüm aşamalarındaki performansının farklı olması gibi…
b) Değişik meslek gruplarından oluşan bir takımı oluşturma gereği…
c) Yapının tesliminden sonra da kullanım ve yıkım safhaları için uygulanacak yönetim…
d) Kullanıcı memnuniyetinin ölçülmesi ile ilgili çalışmalar…
3B) Mimari tasarım grupları, sürdürülebilir sertifikalı bina tasarlamak için ek desteğe ihtiyaç duyuyor mu?
3C) Sürdürülebilir tasarımı oluştururken danışmanlık firması ile mimarın koordinasyon ve iletişim nasıl sağlandı?

Sürdürülebilir proje yönetiminde veya bu sertifika prosesinde entegre olmuş bir proje yönetimi düşünülüyor. Bütün partnerlerin bir arada olduğu bir yerde bir değişiklik yapıldığı zaman bu değişikliğin diğer partnerler tarafından da görülebilir olması gerektiği ve birlikte tümleşik bir çalışma sistemi ortaya koyuyor LEED. Onun için dış cephede bir cam özelliğinin değişmesiyle içerideki klima sistemlerini de etkileyeceğinden dolayı organize olunması gerekir ve bu bilgilerden gerekli olan partnerlerin haberdar olması gerekir. Makine mühendisi elektrik mühendisi mimar veya uygulamacı; tamamının bir arada çalışması gerekir. Klasik bir proje sisteminde bunlar ayrı ayrı ve bağımsız çalışabiliyor. Bunda da büyük kayıplar olabiliyor. Zaten kararların %80 i proje aşamasında veriliyor. Hatta neredeyse tamamı proje aşamasında veriliyor. Dolayısıyla binayı ciddi anlamda etkiler klasik proje yönetiminde.

4A) Sürdürülebilir proje yönetiminde oluşturulması gereken ek birimler neler olmuştur?
4B) Projenin tasarım aşamasından inşaat aşamasına geçiş sürecinde sertifikaya uygunluk için sağlanan koşullar sertifika almayacak proje ile karşılaştırıldığında nasıl farklılıklar içerir?

5A) LEED ve BREEAM süreci, projenin sertifika kurumlarına kaydının yapılmasıyla başlıyor. Bu süreç içerisinde Türkiye açısından herhangi bir zorlukla karşılaşılıyor mu?
6A) Başvuruların yapıldığına ve projenin bu süreçte işleyeceğine dair Türkiye'de herhangi bir kuruma bilgilendirme yapılması gerekli midir?
Gerekli ise bu kurum için yapılması gerekenler nelerdir?

Karşılaşılmıyor. Gerekli hiçbir şey yok.

7) LEED/ BREEAM sertifikasında altı adet yerine getirilmesi gereken ana başlıklar bulunuyor. Bunların Türkiye koşullarını yerine getirilmesinde en çok hangi konuda zorluk yaşanıyor.
a) Sürdürülebilir Arazi
b) Su Tasarrufu
c) Enerji ve Atmosfer
Örneğin LEED'de saha dışındaki yenilenebilir enerji puanının alınabilmesi için ülkedeki yenilenebilir enerji santrallerinin karbon emisyonlarından tasarruf ettikleri miktarları ülke içinde satabilmesi gerekmektedir. Henüz ülkemizde bu yaygınlaşmış bir uygulama değildir.

Bir diğer örnek ASHRAE 90.1'in bina kabuğu standardına uygunluğun sağlanması ne tip zorluklar doğuruyor? (ayrı projelerde ne gibi farklılıklar)
d) Malzeme ve Kaynaklar
Örneğin de her iki sistemde (LEED BREEAM) de aranan FSC (Forest Stewardship Council) sertifikalı kereste temini. Bu özelliğe sahip keresteyi bulmak Türkiye'de oldukça zordur.
—Malzemeleri temini için tedarik yönetim birimi oluşturuldu mu?
e) İç Mekan Yaşam Kalitesi
f) İnovasyon

Doğrusunu söylemek gerekirse Siemens olarak hiçbirinde zorlanmadık. Tabi biliyorsunuz yaptığınız çalışmalar sertifika seviyenizi ortaya koyuyor. Zorluk demeyelim ama işverenin isteğine, talebine projenin özelliğine göre yapılması gereken çalışmalar vardır bir de yapılamayacak çalışmalar vardır. Bu her projede değişiklik göstermektedir. Bu nedenledir ki bir proje LEED sertifikası alırken diğer proje LEED altın sertifikası alıyor. Onun için zorlanacak hiçbir nokta yok ama projeye özgü değişiklikler olabiliyor.

Spesifik bazı şeyler vardır hiçbir projede uygulanamayan Türkiye'de mevcut olan mesela urea formaldehyde ahşabı kompozit malzemeyi bulamıyoruz ama LEED in tanımlamış olduğu voc limitleri içerisinde yapıştırıcılar boyalar ve diğer malzemeleri bulabiliyoruz.

8)Bu standartları sağlamak, bu ve benzer kıyaslamaların yapılması için "Ülke Referans Tabloları" yayınlamaktadır.
—Türkiye için bu referans tabloları oluşturuldu mu?
—Yoksa uluslararası standartlar mı sağlanmaya çalışılıyor?

Ülkede yerel standartlar varsa bu yerel standartların BREEAM standartlarına uygun olup olmadığını tespit etmek için tablolar vardır. Daha doğrusu appendix dediğimiz check listler var.Bu kapsamda Türkiye'de bazı standartlar var. Bunların ne kadarı uygun BREEAM in check listinden görebiliyoruz. Türkiye diye girdiğinizde hangi standartlar uygun hangileri değil görebiliyoruz.
BREEAM projelerinde Avrupa standartlarına uyulmaya çalışılıyor, LEED projelerinde ASHREA standartlarına uyulmaya çalışılıyor.

9) Sürdürülebilir yapıların getireceği ekonomik faydalar sadece uzun vadede gözlemlenebiliyor. Bu faydaların etkisi (bina bazlı) görülmeye başlandı mı?

Başlandı. Sürdürülebilir faydalar çoktur. Bu anlamda Siemens projesinde biz peyzaj alanlarında ve bina içlerinde %20 su tasarrufu sağlandı. %30 enerji tasarrufu sağlandı. Tabi ASHRAE standartlarına göre. Kullanılan yerel malzemeler olsun ekonomiye sağlamış olduğu katkı açısından. Recycle geri dönüştürülmüş malzemelerin kullanımı doğal kaynakların korunması adına yapılan çalışmalar. Atık yönetimi uygulamalarıyla her yönüyle baktığınızda ciddi anlamda sürdürülebilir faydaları vardır. Özellikle su ve enerjide bunu açık ve ölçülebilir bir biçimde görebiliyorz.

10) Sürdürülebilir binalar için oluşturulmuş bir tedarik zincirinden faydalanıldı mı?
—Bu süreç sırasında nasıl bir yönetim şekli uygulanmıştır?
—Bu süreç içinde gerekli olan görevli sayısında ve konumunda nasıl değişiklikler olmuştur?

Yurt içinden de yurt dışından da tedarik ettiğimiz malzemeler oldu. Dediğim gibi bunda zorlanılan nokta birkaç tane şey vardır. O da sertifikalı ahşap. Onun dışında yurt içi yurt dışı malzemeler bulunabiliyor. Bir iki malzeme dışında yurt dışından getirilen hiçbir malzeme yok. Yine normal inşaat koşulları standartları geçerlidir. Türkiye'deki inşaat sektörünü farklı bir yere yönlendirmiyoruz. Tamamen yerel malzemelerle yerel piyasadaki imkânlarla LEED BREEAM sertifikası alınabiliyor.

11) Projenin inşaat aşamasında sertifikaya uygunluğu sağlamak için oluşturulan sistem şantiye yönetim şemasında nasıl değişiklikler meydana getirmiştir?

Yine sonuçta çok ciddi bir yük getirmiyor şantiyeye LEED ya da BREEAM. Daha çok tasarım ağırlıklı bir sistemdir; ama şantiyede de takip edilmesi gereken bazı çalışmalar vardır. Böyle bir organizasyonu değiştirecek ya da büyük bir organizasyon gerektirecek bir nokta değil. İlgili bir kişinin haftada bir iki saatini ayırmasıyla elde edeceği çalışma yapacağı bir noktadır.

12A) Sürdürülebilir bina sertifikası almış binalarda geçen zaman içerisinde kullanıcılardan nasıl tepkiler geliyor?
12B) Binanın sertifika almış olması ya da sertifikasız olması kullanıcı için ne gibi farklar yaratmış?

Yeşil binalar sağlıklı binalardır diyoruz. Onu da şöyle açıklıyoruz; içeriye verilen taze hava miktarı, miktar ve kalite anlamında daha iyidir diğer binalara nazaran. Binada gün ışığı ağırlıklıdır. Bu tür binalarda yine görüş manzara daha algılanır. Kullandığınız malzemeler insan sağlığını olumsuz etkilemeyen malzemelerdir. Özellikle boyalar yapıştırıcılar halılar içindeki voc değeriyle uçucu organik bileşikler içeriğiyle insan sağlığını en az etkileyecek şekilde seçildiği için diyoruz ki diğer binalara nazaran sağlıklı binalardır.

13)Türkiye şartlarında mevcut sertifika sistemlerinde tarafınızca görülen eksiklikler nelerdir?
14)Türkiye kendi standartlarına uygun bir sertifikasyon sistemi oluştursa mevcut sisteme eklenmesi ya da çıkartılması gereken maddeler nelerdir?

15)Türkiye koşullarında sertifika sistemlerindeki yerine koşulların yerine getirilmiş olsa bile etkin olarak kullanılamadığı maddeler hangileridir?(bisiklet alanları vb..)

Bir iki noktada sadece vardır. Mesela bisiklet parkları elverişli olmayabiliyor. Bazı projelerde olmasa da olur diyebileceğimiz bir nokta. Ama LEED BREEAM sertifikası alınacaksa bu iki noktaya bakılmaz diyorum çünkü sonuçta bu sistemler kendi ülkeleri için yapılmıştır. LEED Amerika'da yaygındır. Amerika'da LEED kullanılır ya da İngiltere'de BREEAM kullanılır. Yani kendi ülkeleri şartlarını dikkate alarak geliştirdikleri için zamanla tabi uluslar arası düzeyde de ülkeleri de dikkate alarak bazı revizyonlar yapıyorlar.