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AN OVERVIEW OF GREEN BUILDING PRACTICE IN TURKEY

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Abstract
The building industry is responsible for a large part of the world's environmental degradation as buildings converge in themselves major indexes of energy and water consumption, raw material employment and usage of land. Thus, green buildings, which are defined as resource-efficient and ecosystem-conscious structures designed with a holistic understanding of social and environmental responsibility, have become the flagship of sustainable development. Today, in several countries, there is a well developed green building practice that is used to improve and assess diverse aspects of a building such as site selection, energy, water, material consumption, waste production and pollution. Ongoing development of the sustainability phenomenon, as well as some pioneer green projects in Turkey, has brought on awareness and discussions regarding the green building practice in the Turkish architectural, engineering and construction (AEC) industry recently. In this paper, current green building practice, legislative framework and policies regarding green buildings have been analyzed and deficiencies in policies and statutory regulation in Turkey are determined to bring forward suggestions towards a more institutionalized development of green building practice. On the other hand, Singapore's Green Building Masterplan and its key aspects have been overviewed as a best practice in terms of a planned and holistic approach in the quest for constituting a model for countries looking for a widespread adoption of green building practice in the near future like Turkey.

Keywords: green buildings, building assessment, sustainable design and construction, Turkey.

INTRODUCTION

The debate about sustainability of buildings is becoming more and more intense with the increasing awareness of the impact that buildings have on the environment both in terms of their construction and use. The building industry, indeed, is responsible for a large part of the world's environmental degradation as buildings converge in themselves major indexes of energy and water consumption, raw material employment and usage of land (Melchert, 2007). Buildings account for nearly 40% of energy consumption, 70% of electricity consumption, 40% of carbon dioxide emissions, 12% of water and 40% of raw material use in the developed countries (Retzlaff, 2008). Thus, also variously designated as "ecological", "environment-friendly" or "sustainable" buildings, the green buildings have become one of the most important elements in the issue of sustainability, an issue inevitably highlighted by climate change and depletion of natural resources. Green buildings are defined by the

Turkish Green Building Association (2009) as resource-efficient and ecosystem-conscious structures designed with a holistic understanding of social and environmental responsibility, harmonious with local conditions, built with proper materials and systems so as to minimize energy consumption, where renewable energy sources are given priority and waste production held under control.

This paradigm shift also generated the need to develop norms and regulations for sustainable building design and construction. Today there is a well developed green building practice and a diverse array of regulations and policies regarding green buildings and sustainability in several countries. However, the results of research by Akbiyikli et al. (2009) show that the current level of sustainability understanding and hence its implementation is still unstructured, piecemeal and insufficient in the Turkish AEC industry.

Since the preparation of relevant legislation and adoption of appropriate and resolute policies constitute an indispensable part of the development of the green building practice, current deficiencies in green building legislation and policies in Turkey are determined and Singapore's Green Building Masterplan is analysed as a best practice in this paper in the quest for constituting a model and putting forward suggestions for countries looking for a widespread adoption of green building practice in the near future like Turkey.

GREEN BUILDING PRACTICE IN TURKEY

Green Building Certification Systems

Green Building Certification is the core and most tangible part of the green building practice for the stakeholders of the AEC industry. Today, in several countries, there is a well developed green building certification practice that is used to assess diverse aspects of a building such as site selection, energy, water, material consumption, waste production and pollution. Despite the debate and efforts, there is a consensus that a global standardization (and certification) of green buildings seems not possible due to the regional differences in climate, supply of energy, water, raw materials and land, availability of "green" materials (EMS certified materials etc), environmental conditions, economic conditions, legal framework, culture and way of conducting business in the AEC industry. On the contrary, recently more and more national certification systems are being developed or global systems are being adapted to local conditions. Leadership in Energy and Environmental Design of the US (LEED), Building Research Establishment Environmental Assessment Method (BREEAM) of the UK, Sustainable Building Tool (SBTool) of Canada, German Sustainable Building Certificate (DGNB), Comprehensive Assessment System for Building Environmental Efficiency (CASBEE) of Japan, GreenStar of Australia and BCA Green Mark of Singapore are some of the green building certification systems that are widely adopted around the world.

The concepts of green buildings and sustainable design have gained recognition in the AEC industry within the past decade in Turkey. However, green building practice is still entirely voluntary and generally limited to foreign investment projects, buildings designed for global corporations, new residential developments and educational buildings. BREEAM and LEED are the two certification systems used and supported institutionally by the Turkish Green Building Association (TGBA). However, TGBA is recently working on an adaptation of BREEAM to develop "BREEAM Turkey". BREEAM was chosen over LEED for adaptation since most of the UK's and Turkey's regulations and standards are common or compatible due to Turkey's adoption of the acquis communitaire within the accession process to the EU.

Despite these recent efforts, green building practice is very limited and piecemeal and the total number of projects certified is still very low. This can be explained with the "context" the green building practice is operating in, namely the *legislation* regarding green building issues and green building *policies* adopted by the central or local administrations. These two are analysed in detail below and suggestions are brought forward for a wider adoption and a more institutionalized development of green building practice in Turkey.

Green Building Legislation

Turkey is one of the few countries which included environmental protection in its Constitution. According to the Constitution, "everyone has the right to live in a healthy, balanced environment and it is the duty of the state and citizens to improve the natural environment and to prevent environmental pollution". Despite this provision, no specific legislation exists in Turkey currently on the green buildings. Therefore, in this section, current legal situation is analyzed under common themes relevant to green buildings such as energy, water, building materials, land use and waste.

Legal regulation has recently been made in Turkey with the purpose of stimulating energy conservation in buildings, rendering some practices compulsory and enabling inspection of obtained results. These legal measures are assembled in Regulation on Energy Performance of Buildings (BEP-Y) dated December 5th. This regulation covers the computational rules for the assessment of all energy uses in a building, and its classification with respect to primary energy use and carbon dioxide emission, the specification of minimum energy performance requirements for new or substantially renovated buildings, guidelines for the evaluation of the practicability of renewable energy sources, inspection of heating and cooling systems, abatement of greenhouse gas emissions, and the performance criteria and the implementation guidelines that apply to the buildings. This regulation is promulgated on the EC Directive on the Energy Performance of Buildings, which lays down requirements as regards the general framework for a methodology of calculation of the integrated energy performance of buildings, the application of minimum requirements on the energy performance of new buildings and large existing buildings that are subject to major renovation as well as the energy certification and regular inspection of buildings and its systems. Regulation on Energy Performance of Buildings requires the evaluation of the energy performance of buildings including determination of energy consumption, CO_2 emission, benchmarking these values to a reference building and classification of the building according to the benchmark results. Building Energy Performance Calculation Methodology (BEP-HY) defines the assumptions and methods used in the calculation of energy consumption of heating, cooling, ventilation, lighting and hot-water systems in a building. BEP-HY can be used for comparing the energy performance of alternatives in the design phase, comparing the cases of using and not using energy efficiency measures, developing foresights for the need of energy in future by calculating typical buildings that can represent the building stock in an area and developing a national database of energy performance of various building elements and materials (Ministry of Public Works and Settlement, 2009).

Although one of the most serious problems that Turkey may face in parallel with global warming is water shortage, currently no legislation exists in Turkey regarding water efficiency in buildings. Use of efficient water equipment, rainwater harvesting systems, surface water harvesting systems, efficient irrigation systems, plant types that consume less water in landscaping, recycling of the treated effluent for appropriate reuse in buildings and water efficiency awareness-building programs for the public could be addressed by such a legislation. Building materials, on the other hand, are regulated by Regulation on Building

Material, which requires the materials used in buildings to be mechanically resistant, non-toxic, safe to use, energy efficient and have a CE or G marking. This regulation could be amended to include limits and/or incentives regarding the environmental impact of the production process of materials in order to render the buildings "greener" in Turkey. Furthermore, additional legislation could be prepared to encourage the use of "green materials" in buildings such as recycled, recyclable, local and renewable material. Such legislation might be supported with training of designers and professionals dealing with material selection in construction projects (Ilter, 2011).

Development plans are the main source of restrictive regulations in land use for buildings. Planning areas are divided into zones such as residential, commercial, industrial etc and some development restrictions such as the maximum number of floors and the usable area to land area ratio are included in these development plans. Ercoskun (2005) argues that current development plans do not consider urban identity and ecological values such as climate, spaces between buildings, direction, natural lighting, and air circulation etc resulting in the Turkish cities to be unsustainable. Furthermore, the reality of illegal settlements and brutal development interests has a damaging effect on both natural and built environment in big cities. However limited to big scale projects, a key piece of legislation regarding environmental concerns in site selection is the Regulation on Environmental Impact Assessment, requiring an independent assessment report evaluating the positive and negative impacts of a project on the environment and appropriateness of the site selected for the project. The scope of this regulation covers energy production and distribution plants, industrial and agricultural buildings, as well as hotels with 100 rooms or more, public and private housing projects with 200 units or more, educational and sports complexes.

As for waste, Regulation on the Control of Excavation, Construction and Demolition Wastes, promulgated on 13 March 2004, sets the rules for the collection, accumulation, recycling and disposal of wastes generated in the excavation, construction and demolition phases. According to the regulation, wastes should be minimized at the source, the persons or organisations who are responsible for the management of the wastes should take the necessary precautions to minimise the harmful impacts of the wastes to the environment, the wastes should be recycled and used as building materials where possible, excavation soil and construction / demolition wastes should be processed separately, wastes should be classified at the source for a healthy recycling process, the producers of the unrecyclable excavation, construction and demolition wastes should pay for the disposal of such wastes. Regarding the recycling of excavation soil, the regulation requires the vegetative soil to be used in parks etc and the rest to be used in filling, as a cover material in solid waste storage areas and as clay in cement industry where the chemical properties of the soil allow. Collection, treatment, disposal and recycling of wastewaters and solid wastes produced during the utilization of buildings, i.e. wastewater and solid waste management are also well established fields covered by separate special legislation and institutional agencies (Ilter, 2011).

Green Building Policies

Apart from the ones supporting the well developed legislation stimulating energy conservation in buildings, holistic policies regarding green buildings or sustainable built environments do not exist and seriously needed in Turkey. There are diverse aspects ranging from macro to micro scales in this approach and thus we need to ensure that we learn from best practise on a global level. Singapore is one of the few countries that introduced a resolute policy regarding green buildings and has tackled the issue of green buildings within a Masterplan prepared with a holistic approach. Therefore, in the next section, "Singapore

Green Building Masterplan" and its key aspects are analyzed in the quest for constituting a model for other countries looking for a widespread adoption of green building practice in the near future, such as Turkey.

A Best Practice: Singapore Green Building Masterplan

According to Building Construction Authority - BCA (2009) and Seng (2011), Singapore Inter-Ministerial Committee on Sustainable Development (IMCSD) has set itself an ambitious target of having "at least 80% of the buildings in Singapore to be greened by 2030", which means 80% of the buildings in Singapore must be certified by Building Construction Authority (BCA)'s Green Mark Scheme by 2030. BCA Green Mark was launched in 2005 as a green building rating system to evaluate buildings in terms of environmental impact and performance in Singapore. The key assessment criteria are energy efficiency, water efficiency, environmental protection, indoor environmental quality and some other green features. There are platinum, gold-plus, and gold certificates available for projects with higher scores and projects that achieve mediocre scores are only "certified" without any further classifications. BCA Green Mark Scheme is only a part of Singapore's Green Building Masterplan which has been designed with a holistic approach and has diverse aspects.

The legislation in Singapore require all new buildings to meet the minimum Green Mark standards, and the public sector demonstrate even stronger commitment by targeting the highest Green Mark certificate (Platinum) award for all new projects and existing buildings undergoing major retrofitting works with an air conditioned floor area larger than 5,000 m2. Other existing government buildings with more than 10,000 m2 air conditioned floor area are required to achieve Green Mark Gold Plus certificate by 2020. On the other hand, higher tier Green Mark standards have been set as land sales condition by the government in new growth areas to ensure that they are truly green. This is expected to result in at least 25% reduction in energy use. This represents an estimated project value of $500 million from the government over the next ten years to upgrade all existing buildings owned by government agencies. When all these are done, Singapore is expected to achieve substantial energy savings of $120 million per year.

As for incentivizing the private sector, 102 projects have been funded with a budget up to S$3 million in cash per project. S$20 million incentive resulted in 26 platinum, 14 gold-plus and 62 gold certified buildings, 56 of which were residential and the rest being commercial projects. On the other hand, to encourage private developers to construct new buildings that attain higher tier Green Mark ratings (i.e. Green Mark Platinum or Green Mark Gold-Plus), BCA and Urban Redevelopment Authority (URA) are introducing the Green Mark Bonus GFA Scheme in the form of additional Gross Floor Area (GFA) for higher-tier Green Mark projects. The Green Mark Bonus GFA incentive is extended to all new private developments, redevelopments and reconstruction developments. The quantum of bonus GFA is up to 1% for Green Mark Gold-Plus and up to 2% for Green Mark Platinum. This is expected to help to accelerate the adoption of environmentally-friendly green building technologies and building design practices to enable the development of green buildings to be even more economically viable in the longer term. To date, 46 applications have been received by BCA and URA, 33 applications were approved and 13 applications were given approval in principle.

As for retrofitting the existing buildings to improve energy efficiency, BCA is introducing a bold S$100 million Green Mark Incentive Scheme for Existing Buildings (GMIS-EB) to jumpstart the 'greening' of existing buildings in the private sector. This will probably be

another successful incentive since financial considerations is one of the key barriers for building owners in upgrading the energy performance of their buildings. This scheme will operate in two parts; first being the cash incentive that co-funds up to 35% of the costs of the energy efficient equipment installed. The second part is the 'health check' scheme; this is an energy audit which determines the efficiency of the air-conditioning plants. BCA will also co-fund 50% of the cost for conducting this Health Check. To date, 13 applications were given approval in principle amounting to S$3 million.

BCA has also raised a S$50 million fund for research in green buildings and supported 48 projects. In this context, a Zero Energy Building (ZEB) has been planned as a show-case to encourage the building industry and show that greening existing buildings to meet the highest Green Mark standards is possible. Apart from being a zero energy retrofitted building, ZEB is also a platform for academicians and researchers to analyse green building technologies and their performances in a real setting so as to bring new knowledge to the technical community and explore areas for further research. It also gives BCA a platform where industry stakeholders, local and foreign government officers, building professionals and students learn about green building technologies by physically seeing them in action.

Beside ZEB, there are many large-scale integrated living labs in Singapore. These offer testing of intelligent energy systems, off-grid energy solutions and applications, sustainable public housing solutions, green business park solutions, trialling of EVs & charging solutions and solar capability building on public housing. There is also innovation and R&D centres, centres of excellence and incubation centres established in Singapore dealing with different aspects of sustainable urbanisation such as urban transport management, connected cars, green ICT, green building and infrastructure, integrated water management systems, smart grid and integrated security management.

BCA also committed to building industry capabilities through training. In this regard, in order to meet the challenging target of greening 80% of all buildings by 2030, BCA has estimated that a total of 18,000 - 20,000 green specialists would be needed over the next 10 years. These specialists include personnel across the entire value chain, covering upstream activities of development and design to the downstream activities of construction and operation & maintenance. With the aim of training these specialists, BCA Academy has been established where a comprehensive suite of green related training courses have been put in place. These include Executive Development Programmes targeting at the senior management of firms, as well as the Academic Programmes, Specialist Certification Programmes and Niche Competency Programme targeting at the professionals. To date, 1563 professionals have been trained as Green Mark Manager, 115 as Green Mark Professional and 133 as Green Mark Facilities Manager. BCA is planning to continue to enable the industry to raise its capability to develop more Green Buildings by providing a comprehensive training and educational framework ranging from Master degree, specialist diploma to certificate courses to ensure adequate supply of green building professionals and sub-professionals to meet the expected strong demand for green buildings.

For international recognition and awareness raising purposes, BCA has established the Singapore Green Building Council with an international panel of experts and BCA was connected to global sustainable building community such as the World Green Building Council through Singapore Green Building Council. After this BCA Green Mark Scheme was adopted by many other countries, such as Malaysia, Vietnam, Thailand, China, India and some Middle Eastern countries.

As a statutory obligation, the Code for Environmental Sustainability of Buildings were incorporated into the building control act as a form of legislation that set out the minimum standard for new buildings to meet the minimum green mark certified level.
Over the years, there has been a steady increase in the number of green buildings. By end of FY2010, it is projected we will have 650 green buildings, occupying 20 million m2 of floor space (Figure 1). This is about 9% of the total GFA in Singapore.

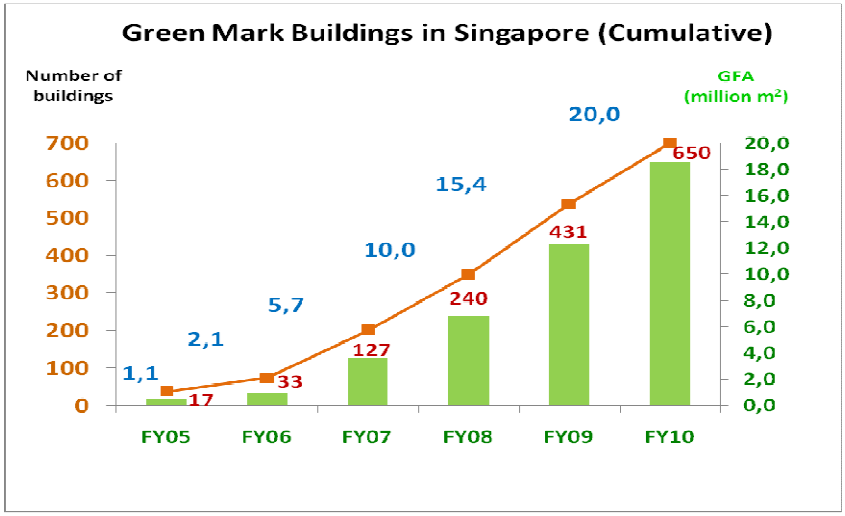

Figure 1: *Green Mark Buildings in Singapore (Seng, 2011).*

BCA Green Mark Scheme was recently revised and Version 4 for new buildings had taken effect from 1st Dec 2010. This new revised rating system placed emphasis on passive design (natural ventilation, day lighting etc), sustainable construction, greenery system as well as enhancement to building energy efficiency standard.

Lessons Learned
Analyzing the best practice of Singapore reveals important lessons for countries aiming a widespread adoption of green building practice in their AEC industry. First of all, as seen in Singapore, government itself has to take the lead and apply green building standards to public buildings (both existing and new) to set a good example for the community. All public sector buildings should meet minimum standards of environmental sustainability. By doing this, government will also be creating a green building industry and business in all levels in terms of production and commerce. On the other hand, government policies for incentivizing the private sector are needed since initial investment is one of the most important barriers to building green in terms of both new developments and retrofits. Resolute policies should be set up ranging from supporting a house owner for retrofitting to tax exemptions for developer companies building green. This can be formulated as direct monetary incentives to developers that achieve a green building rating above a certified level as seen in the Masterplan of Singapore. To further encourage private developers to achieve outstanding design, quality, and sustainability objectives in their projects, policies should set higher standards as land sales conditions for selected new growth areas.

Policies should be formulated to step up developmental and collaborative efforts to build up capabilities and expertise in green building design and technologies. As seen in the Singapore example, this will eventually lead the way to more viable and cost effective applications of

green building designs and technologies. Showcase buildings, laboratories, innovation and excellence centers, incubations hubs are all useful platforms to test bed and showcase new technologies and designs for the built environment. Supporting R&D projects should also be an indispensible part of the policies on furthering the development of green building technologies. Besides supporting the institutions and facilities, human resources should also be created and supported. To meet the increasing demand for green building professionals, it is important to develop the industry's capabilities and ensure an adequate supply of trained professionals. For this purpose, a comprehensive training framework should be prepared to train the specialists in the development, design, construction, operation and maintenance of green buildings. Also, existing personnel will need to be upgraded and new entrants recruited in order to create a highly skilled green collar workforce.

Awareness raising among public and industry stakeholders is an important part of the green building policies. It is important to elevate awareness of green buildings, energy efficiency, and the need for a sustainable built environment within the industry and the community. Green building councils and associations should be supported in this regard for preparing showcase projects, conferences, and workshops etc which are among efficient tools in terms of awareness raising activities.

As for imposing minimum standards on the industry, there certainly is a need for regulations as seen in the Singapore example as well as in Germany, Denmark and the UK. Many countries including Turkey has adopted legislation regulating the energy performance of buildings, however, this should be expanded to include water, raw material efficiency, waste and pollution control etc.

Last but not least, continuous development of the certification systems are needed with different set of measures for new and existing buildings since green building is a relatively new and constantly evolving concept. Serious amount of scientific research and R&D activity is being undertaken and efforts should be made to both support and use the results of these in green building practice in the AEC industry.

CONCLUSIONS

The building industry is responsible for a large part of the world's environmental degradation as buildings converge in themselves major indexes of energy and water consumption, raw material employment and usage of land. Thus, also variously designated as "ecological", "environment-friendly" or "sustainable" buildings, the green buildings have become one of the most important elements in the issue of sustainability, an issue inevitably highlighted by climate change and depletion of natural resources. This paradigm shift also generated the need to develop norms and regulations for sustainable building design and construction. Today there is a well developed green building practice and a diverse array of regulations and policies regarding green buildings and sustainability in several countries. However, the results of research by Akbiyikli et al. (2009) show that the current level of sustainability understanding and hence its implementation is still unstructured, piecemeal and insufficient in the Turkish AEC industry.

Since the preparation of relevant legislation and adoption of appropriate and resolute policies constitute an indispensable part of the development of the green building practice, current deficiencies in green building legislation and policies in Turkey have been determined and Singapore's Green Building Masterplan analysed as a best practice in this paper in the quest

for constituting a model and putting forward suggestions for countries looking for a widespread adoption of green building practice in the near future like Turkey.

Analysis of the current legislation regarding green buildings in Turkey revealed that,

- Energy efficiency is the most advanced theme and there is well established legislation in this area
- Currently no legislation exists in Turkey regarding water efficiency although one of the most serious problems that Turkey may face in parallel with global warming is water shortage
- The Regulation on Building Materials should be amended to include limits and/or incentives regarding the environmental impact of the building materials' production process
- Site selection is the most complex theme requiring regulations and resolute policies on various scales. Besides restoring and implementing development plans with an ecological concern, the problem of illegal settlements in big cities needs to be solved in order to set forth a realistic approach to the issue of sustainable buildings and cities in Turkey
- Regulation on the Control of Excavation, Construction and Demolition Wastes sets the rules for the collection, accumulation, recycling and disposal of wastes generated in the excavation, construction and demolition phases. Collection, treatment, disposal and recycling of wastewaters and solid wastes produced during the utilization of buildings are also well established fields covered by separate special legislation and institutional agencies.

It has been argued in the paper that resolute policies are needed besides the legislative framework for a widespread adoption of green building practice. It has been found that, apart from the ones supporting the well developed legislation stimulating energy conservation in buildings, holistic policies regarding green buildings or sustainable built environments do not exist and seriously needed in Turkey. Analysis of Singapore's Green Building Masterplan as a best practice in this regard constituted a good example for countries looking for a more institutionalized development of green building practice such as Turkey. This analysis revealed that,

- Minimum standards should be imposed in the form of a legislative framework
- Public sector should be taking the lead in terms of greening the public buildings to set up a good example for the community and create a "green building industry"
- Incentive policies should be set up for the private sector in terms of both new developments and retrofitting the existing buildings
- Funds should be raised to support research and technology development projects as well as building up the necessary facilities such as laboratories, innovation and excellence centers, incubations hubs etc.
- Industry capabilities should be improved through training in order to meet the increasing demand for green building professionals
- Awareness raising should be an indispensible part of the policy in order to expand the green building practice to the whole community
- Policies should be set up to provide continuous development of the certification systems to catch up the state of the art in the ever-developing green building technology.

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