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Green Buildings: Principles, practices and techniques, The French "HQE®" Versus The American "LEED®".

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ABSTRACT

Buildings account for a large amount of land use, energy and water consumption, in addition to air and atmosphere alteration. Considering the statistics and the impact of the built environment on human health as well as the natural environment, reducing the amount of natural resources consumed by the buildings industry and the amount of pollution given off is seen as critical to achieve sustainability.

Green Buildings are expected to reduce greenhouse gazes, save the natural resources and meet the users' justifiable demand for more comfort and safety; in addition to their promising projected value within the global economy.

Within the international framework and assessment tools designed to address the buildings environmental issues, this paper aims to outline and compare two of the world's leading standards for Green Buildings, the French "HQE®" and the American "LEED®" assessment systems in order to reveal the differences as well as the common ground and the shared concerns of both systems. A set of environmental issues were selected in such a way to cover the three aspects of the building's sustainability. The findings of the comparison show an advantage for the French system in addition to its innovative extension of the concept to the urban planning operations.

INDRODUCTION

Large areas of open space, wildlife habitat, and wetlands continue to be developed each year worldwide.

In the world biggest economy, the United States, buildings use about 40 percent of the total energy consumed[1], and account for 13.6 percent of water (per day) and approximately 72 percent of electricity consumption[2] (EIA, 2008). Outstripping the sectors of transport and industry, buildings are also responsible of air and atmosphere alteration by 39 percent of the carbon dioxide emission [3](U.S. Geological Survey, 2000). The united nation's statistics show that, unfortunately, the rest of the world, with different proportions, does not break the rule and things are worst elsewhere, especially in the growing economies.

These eloquent statistics introduce a major challenge and lead to the obvious fact that it is definitely crucial to design policies, develop approaches and undertake actions in order to reduce the overall impact of the built environment on human health as well as the natural environment.

Reducing the amount of natural resources consumed by the buildings and the amount of pollution given off is seen as a crucial challenge for and a critical key to achieve sustainability. The international consensus and commitment to a sustainable development and the obligation to find innovative solutions to the rarefaction of the natural resources and control the greenhouse effect, combined to the users' justifiable demand for more comfort and safety is largely considered as the main challenge of the 21st century.

From an environmental point of view, the benefits of a raise in Green Building practices are well worth the efforts to grant. Green Buildings are expected to reduce 24 to 50 percent of the energy use, 40 percent of the water consumption, 33 to 39 percent of the CO_2 emission and up to 70 percent of the total solid waist (Turner, C. and Frankel, M., 2008) (Kats, G., 2003) (GSA Public Buildings Service, 2008).

[1] 54 percent of that percentage is consumed by residential buildings and 46 percent by commercial buildings.
[2] 51 percent for residential use and 49 percent for commercial use (2008 data).
[3] with 21 percent from homes and 18 percent from commercial uses (2000 data).

Moreover, from an economic point of view, the projected Green Buildings value is substantially promising. This value which was of $12 billion for new constructions[4] and $130 billion for renovation in 2006 is expected to reach respectively $30 - $60 billion[5] and $240 by the end of 2010[6] (Mc Graw-Hill Construction, (1), (2), (3), (4), (5)).
Besides, the environmental impact of buildings is often underestimated, while the perceived costs of green buildings are overestimated. A recent survey by the World Business Council for Sustainable Development found that green costs are overestimated by 300 percent, as key players in real estate and construction estimate the additional cost at 17 percent above conventional construction, more than triple the true average cost difference of about 5 percent (World Business Council for Sustainable Development, 2007).

While the concept of sustainable development can be traced to the energy crisis of the 1970s, Green Building, also known as Green Construction or Sustainable Building, is a relatively recent concept. All initiatives are intended to help transform the built environment to sustainability. From the prevailing classical building design concerns of economy, utility, durability and comfort, the new concept came to initiate an operational response to the need to include long term development criteria that integrate the environment concerns in the buildings' projects, and a label to denote an "environmentally friendly" process.

Within the International frameworks, assessment tools, and standards for green buildings or energy efficiency for buildings, this paper aims to outline the leading French experience on Sustainable Buildings, "Haute Qualité Environnementale" (HQE®), in a comparison perspective with the American "Leadership Energy Environment Design" (LEED®).

After a presentation of the assessment methodology and the principles, practices and techniques of the certification of both systems, a comparison - based on the measurement of the degree of consideration of a selected set of buildings' environmental issues – is conducted and analyzed.
Finally, the consideration of the urban sustainable development concept is also discussed to understand how both systems handle this key issue of global sustainability.

[4] $4 billion in the commercial and institutional sector and $8 billion in the residential.
[5] $10 - $20 billion in the commercial and institutional sector and $20 - $40 billion in the residential.
[6] 2007 projection, according to McGraw-Hill Construction.

INTERNATIONAL FRAMEWORKS AND ASSESSMENT TOOLS

The increased interest in Green Building concept is definitely connected to an international context where the consideration of the environmental protection, in a pragmatic way, takes into account the fact that human activity is responsible of air and atmosphere alteration in addition to natural resources rarefaction.

- *Climate Change 2007* is the Fourth Assessment Report (AR4) published by the United Nations Intergovernmental Panel on Climate Change (IPCC),[7] to assess scientific, technical and socio-economic information concerning climate change, its potential effects and options for adaptation and mitigation. Despite the large controversy about its projections among world leaders, businesses and individuals, the report makes clear and more convincingly than ever before, that human actions are responsible of the changes to our climate and strongly emphasizes on the need to reduce our emissions of greenhouse gases.

- The famous *Agenda 21* program run by the United Nations is another important framework which emphasizes on a comprehensive blueprint of action to be taken globally, nationally and locally by organizations of the United Nations, governments, and major local groups to achieve a sustainable development in the 21st century.

In addition to these main global programs, more specific initiatives that encourage Green Building specifications are also undertaken:

- The *Project Sustainability Management Guidelines* (PSM) published by the International Federation of Consulting Engineers (FIDIC)[8] were

[7] Co-established by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP). UNEP works to facilitate the transition to low-carbon societies, support climate proofing efforts, improve understanding of climate change science, and raise public awareness about this global challenge. The UNEP Guidelines for Calculating Greenhouse Gas Emissions for Businesses and Non-Commercial Organizations (GHG Indicator) is one of the "sound science" achievements of this United Nation's body.
[8] FIDIC, the International Federation of Consulting Engineers (the acronym stands for the French version of the name) represents globally the consulting engineering industry. The Federation promotes the business interest of firms supplying technology-based intellectual services for the built and natural environment and recognizes that the work of the consulting engineering industry is critical to the achievement of sustainable development of the society and the environment. FIDIC has issued a number of Policy Statements about issues relevant to the consulting engineering

created in order to assist project engineers and other stakeholders in setting sustainable development goals for their projects. The process is also intended to allow the alignment of project goals with local conditions and priorities and to assist those involved in managing projects to measure and verify their progress.

The PSM Guidelines define themes and sub-themes under the three main sustainability pillars of *Social*, *Environmental* and *Economic*. For each individual sub-theme a core project indicator is defined along with guidance as to the relevance of that issue in the context of an individual project[9].
Protocols underpin each indicator in the Guidelines and include definitions for key terms and intended scope of the indicator, compilation methodologies and other technical references.

- The *IPD Environment Code* launched in February 2008 by the Investment Property Databank (IPD)[10] covers a wide range of building types (from offices to airports) and is intended as a good practice global standard for measuring the environmental performance of corporate buildings. It aims to accurately measure and manage the environmental impacts of corporate buildings and enable property executives to generate high quality comparable performance information about their buildings anywhere in the world.

- The *ISO/TS 21931, 2006* is a framework technical specification for "methods of assessment for environmental performance of construction works" published by the Technical Committee (TC) 59 "Building construction" and its Subcommittee (SC) 17 "Sustainability in building construction" of the International Organization for Standardization (ISO) which has been active in defining standardized requirements for the building assessment methods.
"Part 1: Buildings", is intended to provide a general framework for improving the quality and comparability of methods for assessing the environmental performance of buildings. It identifies and describes issues to be taken into account when using methods for the assessment of the environmental performance for new or existing building properties in the design, construction, operation, renovation and deconstruction stages. The specification details and follows the principles set out in the ISO 14000 series of standards.

- The French *NF label*, owned by the "Association Française de Normalisation" (AFNOR)[11], the French Association for Standardization, is also a recognized label certifying conformity to standards since January 1939.

THE FRENCH "HQE®" INITIATIVE
No doubt that the French experience in this domain tends to be at the leading edge of buildings sustainability: in 1995, a manufacturers' association of construction products[12] registered the trademark (HQE®) which stands for "Haute Qualité Environnementale" (High Environmental Quality), and created the homonymous association ("Association pour la Haute Qualité Environnementale") to promote a global approach that ensures better control of a building's life cycle from the design stage to construction, operation, maintenance, renovation, and deconstruction. Such objective would be achieved, mainly, by monitoring the impacts on the external environment (Eco-construction, Eco-management) and creating a healthy and comfortable indoors environment (Hygrometric, Acoustic and Visual comfort as well as areas, air and water quality).

The association consists of a number of public or collective bodies (associations, labor unions) representing all the actors of the building sector: project owners, consultants, contractors, manufacturers of construction products, experts, etc., organized in five middle colleges within the board of directors[13].
Members are organized in working groups to elaborate reference tables, produce thematic states of the knowledge, organize working sessions and promote the French approach in the international

firms (particularly relevant to clients and financing agencies in developing countries).

[9] The Guidelines contain principles and guidance as well as standard disclosures – including indicators – to outline a framework that organizations can voluntarily and flexibly adopt.
The Sustainability Reporting Framework provides guidance for organizations to use as the basis for disclosure about their sustainability performance, and also provides stakeholders a universally applicable, comparable framework in which to understand disclosed information.

[10] IPD (Investment Property Databank), is a world leader in the performance analysis of real estate which provides performance analysis and benchmarking services in more than 20 countries.

[11] AFNOR was founded on June 1926, decreed a recognized public-benefit utility on March 1943 and played a key role in the foundation of ISO on February 1947.

[12] Association des Industries de Produits de Construction (AIMCC).

[13] On March 2009, the HEQ association account 81 members distributed as follows: College "Maîtrise d'ouvrage "(project owners): 33 members ; college " Maîtrise d'oeuvre" (project management): 5 members ; college "Entreprises et industriels" (Companies and industrialists) : 13 members ; college "Expertise" (expertise) :8 members ; college "Conseil et soutien" (Consulting and support): 14 members and 8 Honorary members.

technical exchange circles, or with the standardization organizations such as AFNOR, CEN (the European Committee for Standardization), and ISO.

Principles of the French HQE® Approach

HQE® approach is a standard for Green Buildings in France designed to improve the environmental quality of the built environment. It leads to a certification that approves the consideration of environmental issues in the construction process of a building.

HQE® helps contracting authorities, architects, manufacturers and entrepreneurs control the building impact on the outdoors environment and create a healthy and comfortable indoors environment for their clients. It can be used as a criterion for investors and property developers to monitor the financial performance of a building or a portfolio. HQE is applicable to all types of new and existing buildings in the residential, tertiary and industrial sectors.

The major assets of the initiative consist of a pragmatic, operational and global approach of the stakes (not limited to processes or products), where the management system of the operations and the requirements to be reached are simultaneous. The idea is to define a common and consistent language so as to be able to fix environmental performance goals and set up a management method for all users. These two pillars are illustrated in two reference documents (drafted in 2001 by 'HQE Association') through the details of the NF HQE® certification scheme:

• The *Environmental Management System* (EMS)[14] constitutes the *Organizational* aspect which defines the tools required to pursue the operation and to structure the interfacing between the various parties involved in the project. The EMS, closely tied to the International System of Environmental Management ISO 14001, includes an examination of the site, the objectives of the operation and the needs of the future users. The building owner elaborates, on the base of the building plans and scheduling, the implementation and the oversight of the construction, in order to manage the quality of the processes. The EMS is periodically internally evaluated in order to make sure the operations are linked with the goals. It aims to provide a framework for builders and provide tools for decision making.

• The "DEQE" (*Explicit Definition of Building Environmental Quality*) [15] is the HQE® reference document for environmental characteristics which constitutes the *Operational aspect*, with the Environmental Quality of Buildings (EQB). It defines 14 targets, bringing together a wide range of environmental concerns about building and construction sites. The client must hierarchically define 14 targets including target performance levels, to create a profile for the building's environmental quality.

The 14 targets are related to both the building's external and internal environments and distributed in 4 groups as shown in table 1, next page.

In addition to the 14 targets and their sub-targets (not included in table 1), the following Environmental Indicators are also assessed:

- P.1. "Consumption of non-renewable energy resources" indicator;
- P.2. "Climate change" indicator;
- P.3. "Water consumption" indicator;
- P.4. "Waste production" indicator.

Assessment is voluntary, but certification will require verification by an independent body (cf. infra). While The HQE is a method owned by HQE association, the certification mark "NF (type of the building) – HQE® approach" is owned by AFNOR.

Over just 10 years, the HQE® approach has become a recognized benchmark for the French construction sectors and continues to evolve, with updates to the reference documents, in addition to the deployment of a certification process covering both the commercial and housing sectors.

[14] "Système de Management Environnemental" (SME). For each building or group of buildings type a "Project Management System's technical scheme" is issued.

[15] "Définition Explicite de la Qualité Environnementale" (DPQE). For each building or group of buildings type a "Technical Scheme for the Environmental Quality of Buildings" is issued.

Table 1. "HQE® Approach": The 14 Targets (Issues) of the Environmental Quality of Buildings.

Domain D1: *Controlling the impacts on the outer environment*	**Domain D2:** *Create a satisfactory internal environment*
Group G1: *ECO-CONSTRUCTION* **Target 1:** Harmonious relationship of the building with its direct environment **Target 2:** Integrated choice of products and construction materials **Target 3:** Low site nuisance/pollution	**Group G3:** *COMFORT* **Target 8:** Hygrometric comfort **Target 9:** Acoustic comfort **Target 10:** Visual comfort **Target 11:** Olfactive comfort (No unpleasant smells)
Group G2: *ECO-MANAGEMENT* **Target 4:** Energy management **Target 5:** Water management **Target 6:** Process waste management **Target 7:** Servicing and Maintenance management	**Group G4:** *HEALTH* **Target 12:** Sanitary quality of areas (Cleanliness of the internal environment) **Target 13:** Sanitary air quality **Target 14:** Sanitary water quality

Certification Procedure and Techniques of the HQE® approach

Since 2004, the HQE association engaged a dynamics of certification to offer to the project owners the possibility of making recognized the environmental quality of their approach and their projects by an independent third party.

As HQE association is having no vocation to be a certification body, the task was assigned to the group AFAQ-AFNOR[16] to set up the HQE® approach certification.

The certification bodies are accredited to deliver a "single source of sustainability truth" through key performance indicators and performance benchmarking reports across multiple building types within one or more activity sectors. The available Reference base documents are[17]:

- For *Tertiary Buildings*, the trade mark "NF Bâtiments Tertiaires - Démarche HQE®" ("NF Tertiary Buildings - HQE® Approach")[18] is conducted by the "Centre Scientifique et Technique du Bâtiment" (CSTB) (the Scientific and Technical Centre for Construction) via its subsidiary certification body "CertiVéA" which has been appointed by AFNOR and the association HQE[19]. Certification documents - Reference base documents for the environmental quality of buildings for this sector - were issued in December 2008 concerning two types of buildings: "Offices/Education" and "Trade and Logistics Platform" (CERTIVIA, 2008).

- For *Homes (Individual Houses)*, the certification "NF Maison Individuelle – Démarche HQE®" ("NF Individual home - HQE® Approach") exists since May 2006. It is delivered to the builders by CEQUAMI, a joint venture that brings together CSTB and QUALITEL[20].

- For *residential (Grouped Housing: Collective or Individual*), the certification "NF Logement – Démarche HQE®" ("NF Housing - HQE® Approach") was launched in December 2007 and delivered by the QUALITEL's subsidiary CERQUAL.

In practice, each target is divided into a number of sub-targets (2 to 5) bringing the number of treated topics up to 52, with as many questions to be asked.

[16] "Association Française d'Assurance Qualité" (AFAQ), the French Association for Quality Assurance, was created in July 1988 as a certification body in response to the emergence of ISO 9000 standards as first-choice toolkits for structuring business-led quality policy. In December 2004, the AFNOR and the AFAQ merged to form the AFNOR Group, with the AFNOR association shouldered by three business subsidiaries.

17 For industrial sector the creation of the NF guidelines "Industrial Buildings - HQE® Approach" is under process.

[18] In early 2005, the group certification body AFAQ-AFNOR agreed to the joint creation of the NF certification "Tertiary Buildings - HQE® approach". Originally, this certification only concerned offices and school buildings but current versions exist for the following building types: Commercial Centers, Hotels, Schools, Houses, Residential, Offices, Healthcare facilities, Sports and Operational.

[19] "CertiVéA" is also accredited by the French Committee of Accreditation (COFRAC) for the certification "NF tertiary Buildings in operation - HQE® Approach).

[20] Created in 1974, the QUALITEL Association is an independent, non for profit body, specialized in the property. QUALITEL, owner of the certification brands, devotes itself to approving reference systems, informing the general public and developing good practices observatories. The certification activity is carried out by three subsidiary companies:
CERQUAL for New dwellings certification; CERQUAL PATRIMOINE for Residential existing buildings certification; and CEQUAMI for Detached houses certification.

The indicators designed to express the requirements of the targets and sub-targets are of various types: quantitative or qualitative, results or means oriented, depending on the case and the phases of the project to which they apply. They are classified as "Operational" indicators in the sense of the standards ISO 14000.

For each operation, the building owner selects the most relevant targets, defines the related quantitative and qualitative objectives and then studies the technical solutions.

An auditor is assigned by the certification body in order to audit the management system and to check the environmental performance of the building. Certification audits must be carried out at three key steps of the project: at the end of the brief phase, at the end of the design phase, and at the end of the construction phase. The first two phases can be validated during the same audit.

Three levels of performance are set for each target: "basic," corresponding to current regulations or normal practice; "good"; and "very good". Certification will be granted upon achievement of a "*Minimum environmental profile*" comprising:

- "very good" rating for at least three issues;
- "good" rating for at least four issues;
- and "basic" rating for no more than seven issues (figure 1).

For the "good" and "very good" rankings, a "principle of equivalence" is allowed. That is, the applicant can suggest an alternative assessment approach to that described in the HQE reference framework in the case of any of the 14 targets.

The environmental profile of the operation is compared to the minimum profile required by counting the number of issues (targets) in each rating level. If at least 3 issues are rated very good, at least 4 issues are rated good, and the rest of the issues (7 at most) are rated basic, the certificate is granted.

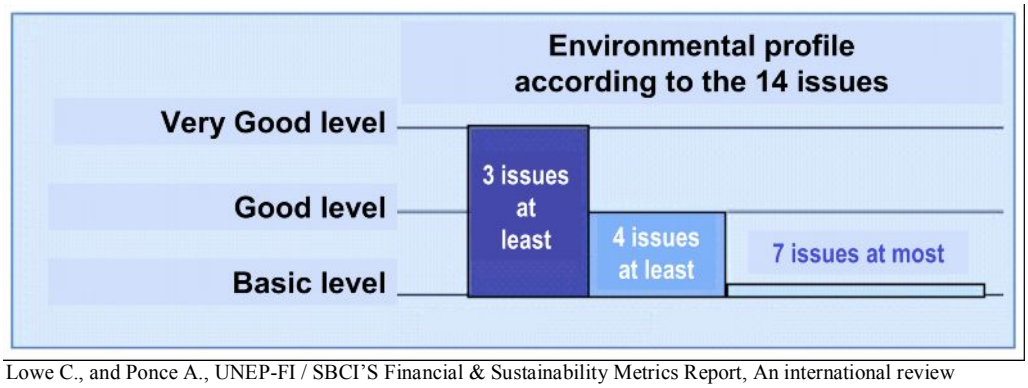

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Figure 1. HQE® Environmental Profile according to the 14 issues.

The HQE Philosophy Adapted to the Urban Planning

Pioneer of the reflection around the quality of the built living environment, the HQE association extended its approach beyond the building to the larger scale of the operations of development. Even though the HEQ® standards were tailored at the beginning for the buildings sector, the approach is definitely transposable in many larger domains such as regional and urban planning operations.

The most recent extension of the HQE concept to urban planning projects, as a major stake of sustainability, was presented through the new certification "HQE™ - Aménagement" ("HQE™ - Development"[21]) which is a comprehensive method for conducting urban operations of sustainable development. The new approach applies to every type of urban operation, for a coherent and globally managed urban planning project.

[21] The concept is a literal translation of the French term "HQE-aménagement" wich is close to urban planning/development or site planning/development. This approach was presented by the French association (HQE) during the colloquium organized in Paris on March 30, 2010: "Colloque officiel de lancement HQE-Aménagement : Réaliser un écoquartier, la réponse HQE-Aménagement" (Official colloquium of launch for HQE-Development : construct an "ecodistrict", the HEQ-Development answer).

"HQE™ - Aménagement", for which reference documents, certification program and assessment tools are under construction, is designed as a real management tool for the governance of an urban planning project. It is:

• *Global*, it covers all the environmental, economic, social and territorial stakes. "HQE™ - Aménagement" is planned through the classic progress of an operation, and aims to become an integral part of the local urban policies taking into account the constraints on the scale of the building.

• *Voluntary approach*, on the initiative of the project owner, "HQE™ - Aménagement" does not define a priori performance levels but obliges the owner to set up objectives of quality and ambitious levels - organized into a standardized and estimated hierarchy - within the framework of, and throughout the project.

• *Transparent and participative*, the exchanges and the participation from the beginning to the end of the project are constant concerns, involving the inhabitants engaged or affected, the professionals and the technical services.

"HQE™ - Aménagement" is a management system of the operation to organize the project steering, and a thematic approach to analyze the site and characterize the project in order to bring an increase in value to each phase of the operation as well as to insure the integration and the coherence of the district with the urban and territorial framework. Other objectives, pillars of the sustainable development, are also pursued: protect natural resources, favor the environmental and sanitary quality of the operation and promote a suitable social life of the district by consolidating the economic dynamics.

THE AMERICAN LEED® SYSTEM

Many international initiatives are underway following different directions according to their genesis or the culture of their country[22] (LOWE C., and PONCE A., 2008). These experiences participate in the maturation of the reflections on the most relevant approach in order to design, construct and manage buildings where quality and environment are taken into account in an optimal way.

Although we are fully convinced that the worthy efforts of these communities should be recognized, advertised and supported by researchers, governments and private sector, this paper will focus on the LEED® American program in a comparison perspective with the French initiative.

The US Green Building Council (US GBC) created in 1994[23] is a non-profit community of leaders managing the label LEED® (Leadership Energy Environment Design) as an environmental certification of the housing and tertiary buildings sector. The LEED® Green Building certification program encourages and accelerates global adoption of sustainable green building and development practices through a suite of rating systems that recognize projects implementing strategies for better environmental and health performance.

Principles of the American LEED® Approach

LEED® is a third-party certification program and the nationally (US) accepted benchmark for the design, construction and operation of high-performance green buildings. The label provides building owners and operators[24] with the tools to have a measurable impact on their buildings' performance.

[22] **Australia** (Nabers / Green Star); **Brazil** (AQUA); **Canada** (LEED Canada / Green Globes); **China** (GBAS); **Finland** (PromisE); **Germany** (DGNB / CEPHEUS); **Hong Kong** (HK BEAM); **India** (GRIHA National Rating System developed by TERI, LEED India); **Italy** (Protocollo Itaca / Green Building Counsil Italia); **Malaysia** (GBI Malaysia]); **Mexico** (CONAVI); **Netherlands** (BREEAM Netherlands); **New Zealand** (Green Star NZ); **Norway** (Ecoprofile); **Philippines** (BERDE / Philippine Green Building Council PHILGBC); **Portugal** (LIDER A); **Singapore** (Green Mark); **South Africa** (SBAT / Green Star SA); **Spain** (VERDE); **Switzerland** (MINERGIE); **Taiwan** (EEWH); **United Kingdom** (BRE Global / BREEAM,); **United States** (LEED / Living Building Challenge / Green Globes / Build it Green / NAHB NGBS).

[23] Generates in 1998 the World GBC (USA, Mexico, Brazil Japan, Italy, Spain, United Arab Emirates, Australia, China and Korea)

[24] Architects, real estate professionals, facility managers, engineers, interior designers, landscape architects, construction managers, lenders and government officials.

The certification program is organized in 9 categories representing the main building groups[25] as shown in figure 2, next page.

LEED® promotes a whole-building approach to sustainability by recognizing performance in nine key areas of human and environmental health (table 2, next page):

- Sustainable site development,
- Water savings,
- Energy efficiency,
- Materials selection,
- Indoor environmental quality,
- Locations & Linkages,
- Awareness & Education,
- Innovation in Design/Operations,
- and Regional Priority.

Certification Procedure and Techniques of the LEED® Approach

LEED® rating system is designed in such a way that each major building type is covered by one certification system: Homes, Neighborhood Development, Commercial Interiors, Core & Shell Development, New Construction and Major Renovations, Schools (New constructions and major innovations), Healthcare facilities, Retail (New construction and Major innovation and Commercial Interiors) and Existing Buildings: Operations & Maintenance[26] (US Green Building Council, 2010, (1), (2), (3), (4), (5)).

During the last fifteen years the ability to be flexible allowed LEED® to evolve, taking advantage of new technologies and advancements in building science while prioritizing energy efficiency and CO_2 emissions reductions.

On April 2009, US GBC launched LEED® v3 under the LEED® 2009 suite where major changes are made to the previous versions making the certification process more effective and the standards and criteria in sync and more compatible with the new orientations, concerns and issues in environmental protection within the international frameworks and assessment tools (cf. supra).

By the end of the certification process, a certification level (certified, silver, gold or platinum), shown in figure 3 next page, is delivered based on the total points achieved by the project over all the possible points (100 base points; 6 possible Innovation in Design/Operations and 4 Regional Priority points).

Table 3, next page, shows the possible points for the credits categories of the LEED® 2009 certification system for each building group (US Green Building Council, 2010, (1), (2), (3), (4), (5)).

[25] Some documents report that a LEED version for Laboratory (LEED Labs) is under development (SAUNDERS, 2008), we could not get any information about this version.

[26] ***LEED for Homes*** promotes the design and construction of high-performance green homes. ***LEED for Neighborhood Development (LEED ND)*** integrates the principles of smart growth, urbanism and green building into the first national program for neighborhood design. ***LEED for Commercial Interiors*** (LEED CI) is a benchmark for the tenant improvement market that gives the power to make sustainable choices to tenants and designers. ***LEED for Core & Shell*** (LEED CS) aids designers, builders, developers and new building owners in implementing sustainable design for new core and shell construction. ***LEED for New Construction and Major Renovations*** (LEED NC) is designed to guide and distinguish high-performance commercial and institutional projects. ***LEED for Schools*** recognizes the unique nature of the design and construction of K-12 schools and addresses the specific needs of school spaces. ***LEED for Healthcare*** *promotes sustainable planning, design and construction for high-performance healthcare facilities.* ***LEED for Retail*** recognizes the unique nature of retail design and construction projects and addresses the specific needs of retail spaces**.** ***LEED for Existing Buildings***: Operations & Maintenance (LEED EB O & M) provides a benchmark for building owners and operators to measure operations, improvements and maintenance.

Figure 2. The LEED® green building certification program.

Table 2. Credit categories in LEED® rating system

Credit category	Logotype	Credit category	Logotype
Sustainable Sites		Locations & Linkages	
Water Efficiency		Awareness & Education	
Energy & Atmosphere		Innovation in Design/Operations	
Materials & Resources		Regional Priority	
Indoor Environmental Quality			

Figure 3. The four levels of US GBC LEED® certification program.

Table 3. LEED® 2009 certification system: credit categories' possible points (*).

Credit category / LEED® (**)	Sust. Sites	Water Efficiency	Energy & Atm.	Materials & Resources	Indoor Env. Quality	Smart Locations & Linkages	Green Infrastr. and Buildings	Neighborhood Pattern and Design	Base points
NC	26	10	35	14	15	NA (***)	NA	NA	100
EB O & M	26	14	35	10	15	NA	NA	NA	100
CI	21	11	37	14	17	NA	NA	NA	100
CS	28	10	37	13	12	NA	NA	NA	100
Schools	24	11	33	13	19	NA	NA	NA	100
ND	NA	NA	NA	NA	NA	27	29	44	100
Retail	Will launch in late 2010. Retail projects continue to register under LEED® 2009 for NC or LEED® 2009 for CI.								
Healthcare	Under the second public comment period (from April 19th to May 18th, 2010) before ballot draft.								
Homes	In process: a list of corrections to the LEED® for Homes Rating System, updated January 2010, is being reviewed.								

(*) : In addition to the 100 possible points of each category, 6 possible Innovation in Design/Operations and 4 Regional Priority points are also taken into account

(**)

NC: LEED® for New Construction and Major Renovations

EB O & M: LEED® for Existing Buildings: Operations & Maintenance
CI: LEED® for Commercial Interiors
CS: LEED® for Core & Shell Development
Schools: LEED® for Schools (New constructions and Major innovations)

Retail: LEED® for Retail (New construction and Major innovation and Commercial Interiors)
Healthcare: LEED® for Healthcare facilities
Homes: LEED® for Homes
The Neighborhood Development rating system is under construction
The "Awareness & Education" credit category is not applicable for all items

(***) : Not Applicable

Regarding the achievements of LEED®, as of 2009, 41 percent of the projects registered for certification were certified. With more than 3 000, Homes count for 39 percent of the certified projects with more than 6 000 units (GBCI, 2010)

About 21 percent of the certified projects has gained the certified level, 41 percent received the silver certification, 30 percent received the gold level while the platinum highest certification was delivered to only 9 percent of the certified projects (figure 4).

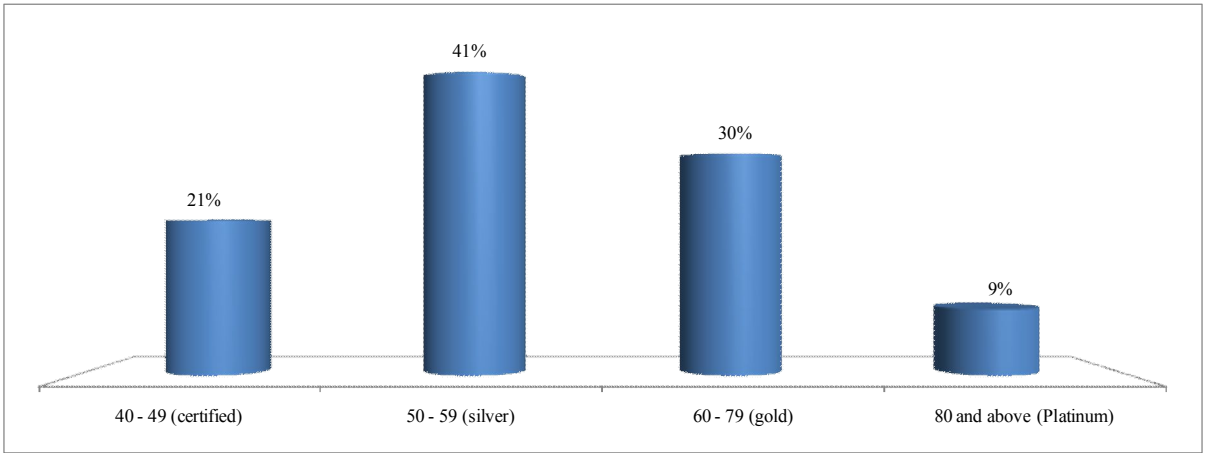

Figure 4. LEED® certified projects as of 2009.

COMPARISON OF HQE® AND LEED® SYSTEMS

Regarding the Assessment of a Selected Set of Environmental Issues

In order to select the framework for comparing the two systems presented above, our main concern was the use of a neutral basis. One of the most famous internationally recognized tools that literature reports was chosen: the European Commission (EC) project "LEnSE": *Methodology Development towards a Label for Environmental, Social and Economic Buildings* (LOWE C., and PONCE A., 2008).

The "LEnSE" project, completed on March 2008[27], developed a list of key issues that were considered relevant when assessing the sustainability of buildings of any types.

The most original aspect of the "LEnSE" framework is its consideration of all aspects of sustainability (Environmental, Social and Economic). We believe in its capability to address most of the issues covered in each system and demonstrate how much a green building certification system is meeting the full range of sustainability requirements of buildings.

It was not possible to take into account all the issues drawn up by "LEnSE"[28]. In order to fit the standard conference paper size, a selected set of issues were chosen in such a way to cover the three aspects of the building's sustainability (Environmental, Social and Economic). However, the social sustainability theme was particularly privileged in accordance to the scientific interests of both authors.

Table 4 shows the 36 sub-issues chosen out of a total of 62 items originally defined by "LEnSE" (LOWE C., and PONCE A., 2008). 10 of them (out of 23) belong to the environment aspect, 20 sub-issues (out of 26) concern the social aspect and 6 economic sub-issues (out of 13).

The comparison method is simply based on the delivery of a green symbol (☻) if the sub-issue is evaluated by the certification system and a red symbol (☻) if not. The score for each system is the total number of green and red symbols collected (Table 4).

What is instantly apparent from this analysis is that HQE® system covers 83 percent of the compared sub-issues, ant that is two times higher than LEED® with only 42 percent. Despite the fact that LEED® could perform better if all the sub-issues recommended by "LEnSE" were compared, the score is, with no ambiguity, in favor of the HQE® system.

But our aim is not just to focus on the differences. It is also interesting to find the common ground and the shared concerns that allow both systems to evolve towards the unification of their methodology. In the context of the global economy, as global stakes appeal global solutions, the principles and the tools of both approaches are definitely useful for adaptation, under all the latitudes to develop an international unified method for the evaluation of the environmental quality of buildings leading to one comprehensive certification system.

Table 4 shows also that HQE® and LEED® have a common base of 15 green symbols (sub-issues covered by both systems) and 6 red symbols (sub-issues not covered by both systems). That gives, only on the basis of the 36 sub-issues compared, 58 percent of common concerns and they may have more then this percentage, once again, if all the sub-issues developed by "LEnSE" were compared.

The common green symbols should lead to a common assessment method and rating system while the red ones have to encourage both parties to find the most adequate way of integrating the missing issues.

These findings should be confronted with the efforts currently undertaken to standardize the description and assessment of the environmental performance of buildings: in Europe under CEN/TC350, and at the international level under ISO TC 59 SC 17 (World Business Council for Sustainable Development, 2007).

[27] The main objective of this project was to review existing assessment methodologies – such as environmental assessment tools, cost calculation tools, calculation of energy performance, building rating systems, incentives, environmental risks etc. – in order to extract the sustainability issues in these methods. The result of this reviewing exercise was a long list of possible issues to be included in the "LEnSE" sustainability assessment methodology (LOWE C., and PONCE A., 2008).

[28] The full list of issues covered by LEnSE can be consulted in the report written by Lowe C., and Ponce A. (LOWE C., and PONCE A., 2008).

Table 4. : HQE® vs LEED® in evaluation of sustainability.

	Category	Issue	Sub-issue	HQE	LEED
ENVIRONMENT SUSTAINABILITY	Resources and waste Management	Waste prevention	Non hazardous waste disposal	☺	☺
			Hazardous waste to disposal	☺	😡
		Water consumption	Use of freshwater resources	☺	☺
			Monitoring of water use	☺	😡
		Land Consumption	Re-use of previously developed sites	☺	☺
			Development footprint	☺	☺
			Contaminated land, bioremediation and soil reuse	☺	😡
	Environmental management and geophysical risk	Environmental management	Environmental policies /certified Environmental Management System	☺	😡
		Climatological and geological risk	Minimizing regional specific climatological risk e.g. flooding	☺	☺
			Minimizing regional specific geophysical risk e.g. seismic	☺	😡
SOCIAL SUSTAINABILITY	Occupant well-being	Building user comfort	Lighting & visual comfort	☺	☺
			Thermal comfort	☺	☺
			Ventilation conditions	☺	☺
			Acoustic comfort	☺	😡
			Occupant satisfaction	☺	☺
		Spatial access	Private space	☺	😡
			Outdoor space	☺	☺
		Health & Safety		☺	😡
			Indoor air quality	☺	☺
			Quality of drinking water	☺	😡
			Building safety	😡	😡
	Accessibility	Public transport	Public transport -frequency and proximity	☺	☺
		Pedestrian networks	Provision of safe and adequate pedestrian route ways	☺	😡
		Bicycling network	Provision of safe and adequate cycle lanes and cyclist facilities	☺	☺
	Social & cultural value	Social & ethical responsibility	Community impact consultation	☺	😡
			Social cost benefit analysis	😡	😡
			Socially responsible and ethical procurement of goods/services	😡	😡
		Sensitivity to the local community	Considerate Constructors	☺	☺
			External 'neighborhood' impacts	☺	☺
		Building aesthetics and context	Design quality	☺	😡
ECONOMIC SUSTAINA-BILITY	Whole life value	Asset Value	Added value	😡	😡
			Building adaptability	☺	😡
		Maintenance	Design for maintainable buildings / Ease of maintenance	☺	😡
	Externalities	Local and regional impacts	Local employment opportunities/use of local services	😡	😡
			Specification/use of locally produced materials	☺	😡
		Image value	Branding and external expression	😡	😡
				☺	**30**	**15**
		SCORE		😡	**06**	**21**
				Total issues	**36**	**36**

COMMON BASE	☺	😡	**58.3 %**
	15	**6**	

On the other hand, we note that 50 percent of the environmental sustainability sub-issues and 50 percent of the social sustainability sub-issues were evaluated by both systems, unlike those related to economic aspect of sustainability where there was no common base.
Is it a simple coincidence due to the choice of the issues within the economic aspect?
Or is it an indicator of a deep discord, between two contrasted visions, in the understanding of the sustainability's economic stakes?
Unfortunately, no answer can be given at this stage. Further analysis is required taking into account all the issues.

Regarding the assessment of the urban planning sustainability
Because the development of our cities and housing environment does not comply any more with the current requirements of sustainability, it is necessary to develop the practices of the town planning. Furthermore, the only juxtaposition of Green Buildings does not make a sustainable city and the environmental performance of a building has no value unless it joins a full urban planning project.
This new vision needs an evolution at the level of the urban environmental performance, which has to be conducted in a global way including the practices' level. The vision and methods of town planning actors have to be modified in depth to achieve this new challenge.

The second part of the comparison method is dedicated to the theme of the urban planning/development sustainability.
Even with the most powerful environmental assessment tool of buildings, the principle of focusing on the building scale is somehow a vision not compatible with the global nature of the environmental issues. Consequently, the assessment methodology underestimates the global stakes by reducing them, to a large extent, to their minimum level.
From this point of view the French HQE® is much further ahead in greening the environment than the American LEED® by extending the environmental quality to the urban development. This is definitely the great innovation of the French assessment methodology.
The new certification "HQE™- Aménagement" ("HQE™ - Development") joins "NF (type of the building) – HQE® approach" certification to finally replace the building in a larger territorial scale of environmental concerns.
The "Neighborhood Development" issue assessed by LEED® is certainly a part of the answer to the crucial concerns of sustainable urban planning and development. Though, the scale of evaluation and action is just narrow to address global issues and face the real environmental stakes. Buildings sustainability should be part of our global environmental concerns and the extension of the HQE concept to development operations is probably the best way to integrate buildings in their environment.

CONCLUSION
The environmental assessment methodologies for buildings covered in this paper included the French HQE® (High Environmental Quality) launched in 2005, and the American LEED® (Leadership in Energy and Environment Design) launched in 1998
The two certification systems for Green Buildings were summarized and presented in a comparison perspective based on two parameters:

- the consideration of a selected set of environmental issues;
- and the extension of the assessment tools to the urban development operations which replaces the building in a global scale making the standards and criteria in sync and more compatible with the global concerns and issues of an effective and comprehensive environmental protection.

During the last decade adaptations have been made to both systems for a variety of reasons, but the main schemes still reflect differences in standard practice and cultures that affect the understanding of environmental issues.
The comparison has shown that a common base exist between the two approaches regarding the evaluation of the compared environmental issues. We have also noted that HQE® has an advantage in the number of environmental sub-issues evaluated compared to "LEED®" and is much further ahead the consideration of the urban development operations is compared.
The results have to be, definitely, replaced in their context especially when the set of environmental issues was chosen as base of comparison.
Future analysis can clear up sure questions.

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