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Mini Study 08 – Scope for international cooperation on green building standards

(Pierre Bitard)

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EXECUTIVE SUMMARY

The purpose of this mini study on international cooperation on green building standards is to serve as an input for policy development in the Commission. Based on literature review, on interviews and contacts with key players, this mini study analyses the scope for international co-operation on green building standards. To be more specific, the mini-study focuses on voluntary third-party assessment tools, certification and rating systems (AT-CRS). The approach is empirical and straighforward; we examine how powerful standards may be to promote energy efficiency in buildings. The key question is then to maximise their transformation power, among which answers international co-operation is envisaged.
Hereafter are the main findings.

Section 1 specifies the background against which AT-CRS are developing and are becoming a priority policy issue. It is well established that differentiated climate response options shall be implemented according to industry sectors; the building sector has the largest mitigation potential. Much is thus known and done on the topic, on a worldwide scale. **Section 2** further goes and shows how increased awareness of the need for sustainability has led many organisations to organise and support the advent of AT-CRS as levers for the improvement of energy efficiency in buildings. It should be noted that AT-CRS type of green building standards promote innovative products and practices, with positive environmental impacts. **Section 3** moves on to compare the most prominent green building standards of a selection of thirteen countries. The standards greatly differ according to their scope, application scale, life stages addressed and building types. The comparison leads to identify four priority focuses for an international co-operation policy that would aim at enhancing dissemination of green buildings standards through action on AT-CRS. First, it would have to persuade building stakeholders – especially home owners– to reduce energy consumption in existing housing stock; second, it is important to favour regulations that address energy efficiency in buildings at district, urban and regional levels; third, a large mitigation potential remains unexplored in public and residential buildings; fourth, disseminating state-of-the art life-cycle assessment methods is key. The criteria, scorings and weightings used in five assessment tools, certification and rating systems are then presented. **Section 4** addresses the core innovation policy issue of this mini study by proposing three main complementary routes by which the transformation power of these assessment methodologies, *de facto* standards, can be enhanced. *First and foremost* are measures to promote a systemic approach to building sustainability so that AT-CRS succeed in being used in various sub-sectors, both private and public and at different (geographical) scales. The *second* policy orientation is to increase market benefits for AT-CRS adopters *via* a set of incentive measures (e.g. preferential treatment for energy efficient buildings, according to their performances; subsidies for highly-rated energy efficient buildings; preferential interest rates for highly rated energy efficient buildings). *Thirdly*, the number and competences of those responsible for AT-CRS implementation – i.e. assessors/ auditors and certifiers in selection, accreditation and training processes – shall be ameliorated through education and training on this aspect throughout the building filière. Also, AT-CSR are efficient in sensitising 'front-office' stakeholders, i.e. those in direct contact with the client like architects, on the importance of sustainability. In

Section 5, international cooperation between the EU and other regions of the world is envisaged as a fourth way forward for EC policy to maximise green building standards transformation power. Based on the previous findings of the mini-study, we suggest that exploiting mutual interest zones for co-operation compels to identify territory effect free AT-CRS. In this line of reasoning, the goals are threefold: encouraging clearer and more stretching targets and improving transparency, thereby facilitating the sharing of best practices in the design, construction and operation of the built environment. In terms of the scope of this co-operation, the largest potentials lie in reducing the energy consumption in existing residential building stock and in imposing energy efficiency in buildings at district, urban and regional levels. Disseminating state-of-the art life-cycle assessment methods; and favouring the development of internationally qualified “certification service providers” would also be usefully considered.

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1. Introduction

1.1. Background

The 'Brundtland Report'[1] defines sustainable development as "*development that meets the needs of the present without compromising the needs of future generations to meet their own needs*". Sustainable development is one of the grand challenges facing mankind, while the current crisis occurs at a stage when pragmatism eventually comes to power: not all human activities have the same impacts on climate change and environment; some economic activities have larger mitigation potentials than others. They should be policy priority targets.

In other words, differentiated climate response options shall be implemented, according to the sectors, to realise synergies and avoid conflicts with other dimensions of sustainable development. Improving energy efficiency is a key challenge for the advent of a shared sustainable development model. And there is a positive feedback loop, when development becomes more sustainable, it enhances mitigative and adaptive capacities, reduces emissions, and reduces vulnerability.

In addition to providing decision-makers and others interested in climate change with an objective source of information about climate change, the Nobel Prize Winner "Intergovernmental Panel on Climate Change" (IPCC) analyses and discusses adaptation and mitigation options and their interactions with sustainable development. It helps identify priority actions, for the next few decades.

According to IPCC latest Assessment Report (2007)[2], the largest estimated economic mitigation potential lies in buildings. At a carbon price lower than US$100, through the adoption of *mitigation technologies and practices currently available*, buildings could reduce CO2 equivalent emissions by between 5.3 and 6.7 gigatonnes per year.

The author would like to thank the many people consulted for this mini study (including those met at the IEA/IEC/ISO workshop in Paris). We are particularly grateful to the following persons who devoted some of their busy time to lead us through the green buildings thicket:

- Mrs Sylviane Nibel and Mr Yann Montrelay at CSTB – Division of Sustainable development; Mr Alfonso Ponce at CSTB – Marketing and International Division; Mrs Nibel deserves special thanks for having reviewed parts of the text which was improved thanks to her in-depth knowledge and experience of the matter.

- Mr Pierre Delayen, Head of Environment, Health and Safety, Corporate Saint-Gobain and Mr P. Eveillard, Head of Sustainable Construction, Insulation Division, Saint-Gobain

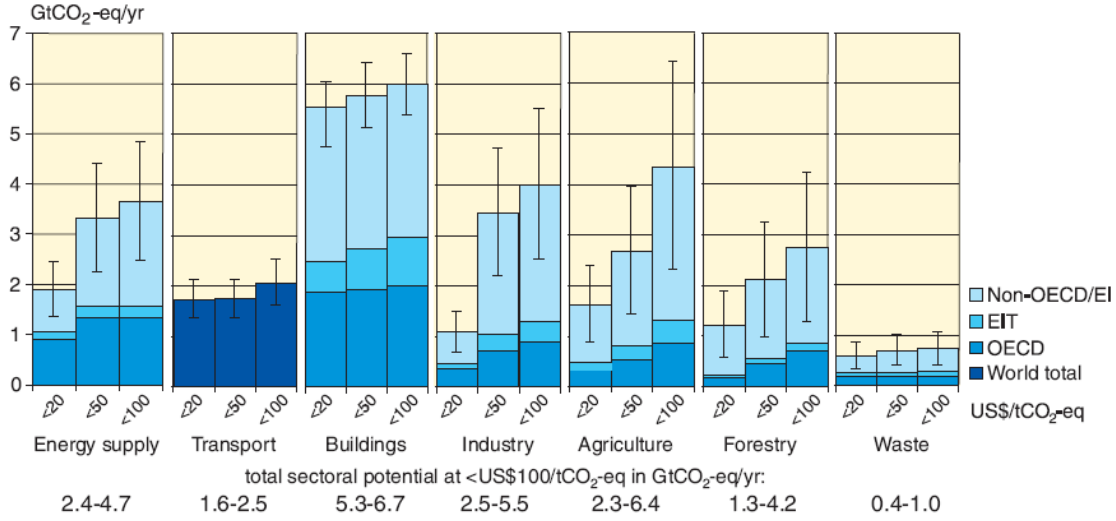
- Mr Constant VanAerschot, Director Construction Trends, Lafarge.

All caveats remain ours, though.

[1] United Nations, 1983. *Process of preparation of the Environmental Perspective to the Year 2000 and Beyond*. General Assembly Resolution 38/161, 19 December 1983. And, UN, 1987, *Our Common Future, Report of the World Commission on Environment and Development, World Commission on Environment and Development*, 1987. Published as Annex to General Assembly document A/42/427, Development and International Co-operation: Environment, August 2.

[2] Formally agreed statement of the IPCC concerning key findings and uncertainties contained in the Working Group contributions to the Fourth Assessment Report. The underlying report was adopted section by section at IPCC Plenary XXVII (Valencia, Spain, 12-17 November 2007).

Exhibit 1 – Economic mitigation potential by sector in 2030 (as a function of carbon price)[3]



Source: Excerpt from IPCC, Fourth Assessment Report, 2007. p. 59.

This analysis allows the IPCC to suggest matching mitigation technologies and policy measures for the building sector. Table 1 below notably stresses the importance of 'building codes and certifications' and updating thereof, as effective ways in coping with global climate alteration, in addition to the use of currently commercially available technologies.

Table 1 –Mitigation technologies and practices identified by the IPCC for the building sector

Key mitigation technologies and practices currently commercially available / *Key mitigation technologies and practices projected to be commercialised before 2030 shown in italics*.	**Policies, measures and instruments shown to be environmentally effective**	**Key constraints or opportunities** (Normal font = constraints; italics = opportunities)
Efficient lighting and daylighting; more efficient electrical appliances and heating and cooling devices; improved cook stoves, improved insulation; passive and active solar design for heating and cooling; alternative refrigeration fluids, recovery and recycling of fluorinated gases; *integrated design of commercial buildings including technologies, such as intelligent meters that provide feedback and control; solar photovoltaics integrated in buildings*	Appliance standards and labelling	Periodic revision of standards needed
	Building codes and certification	*Attractive for new buildings.* Enforcement can be difficult
	Demand-side management programmes	Need for regulations so that utilities may profit
	Public sector leadership programmes, including procurement	*Government purchasing can expand demand for energy-efficient products*
	Incentives for energy service companies (ESCOs)	*Success factor: Access to third party financing*

Source: Excerpt from IPCC, Fourth Assessment Report, 2007. p. 60.

To add on this, in April 2008, Lord Stern has published a set of proposals for a global deal on climate change[4], in which he notably stressed the key role of "globally coordinated standards (e.g. for electrical goods, *buildings*, and transport)" together with "open-market policies to encourage faster deployment of existing low-carbon technologies, in particular making the most of existing opportunities for improved energy efficiency." Lord Stern's stance stresses the need for a globally co-ordinated environment-friendly technology policy that complements, and does not substitute for, other framework conditions policies.

In the building industry, the move towards the promotion of sustainable building has started by the end of the 1980s; since then, a variety of techniques, mainly with a nation-wide scope, has been used to evaluate the environmental performance of buildings.

[3] NB1: The mitigation potential is expressed in Gigatonnes of CO2 equivalent per year, where 1 Giga tonne stands for 1 000 000 000 tonnes. NB2: The economic mitigation potential for a "carbon price" of up to 20 USD, up to 50 USD and up to 100 USD was considered for each sector.NB3: EIT stands for Economies in Transition and refers to countries of the former Soviet bloc which are transitioning to a market economy.

[4] Stern, N, 2008, "Key Elements of a Global Deal on Climate Change", April. The document was prepared with the aim of advancing the current debate on climate change on the road to the UNFCCC's 15th Conference of the Parties in Copenhagen in 2009.

At EU level, the background against which the Energy Performance Buildings (EPBD) recast is to be envisaged consists of a whole set of initiatives; to quote but the most remarkable: the Eco-Design Directive, the Labelling Directive, the Construction Products Directive, the Energy Services Directive, the Energy Efficiency Action Plan, Sustainable Consumption & Production Package, Intelligent Energy Europe Programme, and the newly launched Energy-efficient buildings Public Private Partnership as part of the R&D involvement in the EU Economic Recovery Plan (March 2009).

Exhibit 2 - Energy-efficient Buildings (EeB) -

Energy efficient buildings (EeB) will consist of a financial envelope of € 1 billion to boost the construction sector, and aims at promoting green technologies and the development of energy efficient systems and materials in new and renovated buildings - this, with a view to radically reducing their energy consumption and CO2 emissions. The programme will be financed jointly by industry and the European Commission under the Seventh Framework Programme for Research (FP7). The research programme will begin with coordinated calls for research proposals which should be launched in July this year.

Source: Excerpt form Fact sheet- DG RTD 26 March 2009

The on-going green push given by the EC to the European buildings can be illustrated by the recast of the EPBD. According to converging sources, buildings represent 40% of the EU energy consumption. Savings potential amount to 30% by 2020 and to 70%-80% by 2050. The November 2008 Commission Communication stated that buildings have significant untapped potential for cost effective energy savings "which, if realised, would mean that in 2020 the EU will consume 11% less final energy".

The EPBD is notably related to 31 CEN (Comité Européen de Normalisation, European Committee for Standardisation) standards which are voluntary applied; concrete implementation of the regulation is left to Member States (MS). So far, the variance of performance levels and assessment methods according to MS remains remarkably wide. On the other hand, initiatives such as EPBD, with an EU-wide scope, encourage the growing tendency to extended cooperation between MS. This convergence in terms of methods in the Union is a crucial step towards international cooperation.

1.2. Purpose of the mini-study

This mini study aims to analyse the scope for international co-operation on green building standards. It does so by examining how powerful standards may be to promote energy efficiency in buildings. The mini-study focuses on voluntary third-party assessment tools, certification and rating systems. The key question is then to maximise their transformation power, among which answers international cooperation is envisaged.

In terms of method, this mini study relies on literature review, on interviews and contacts with key players.

The study is structured along the following sections:

2. Promoting energy efficiency in buildings

2.1. Increased awareness of the need for sustainability

The establishment of the Intergovernmental Panel on Climate Change (IPCC) by the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP) dates back to 1988. The very existence of this international body is both the sign of /and partially responsible for a continuous improvement of the understanding of the causes and consequences of global climate change. Awareness of the role played by buildings, and therefore of the construction sector, as a change factor has concurrently been rising. The last ten years have witnessed the growing importance of the sustainability notion in the building sector, exemplified by the founding of the World Green Building Council (WGBC), in November of 1999 in California[5]. This international industry-led organisation[6] is a platform for co-operation which gathers together players of the building industry.

As demonstrated by the IPCC 4th Assessment Report, the building sector has the largest potential for reducing CO2 emissions This potential amounts to about 6 Gigatonnes of CO2-equivalent per year, which is two times as much as 'Energy supply' or 'Industry as a whole' or 'Agriculture', 3 times as much as 'Transport' or 'Forestry', and more than 6 times as much as 'Waste'. This sectoral estimate derives from bottom-up studies and relies upon a comparison with baselines, based on the assumption that the marginal cost of reducing 1 tonne of CO2 emissions is lower than US$50. Specific efforts made to reduce energy consumption that target the building sector will thus have significant positive impacts.

A recent McGraw-Hill Construction Analytics report (2008)[7], based on a survey of early market adopters in 45 countries, tends to show that construction companies, worldwide, are actively engaged in the greening of their practices, services and products. Market transformation is on-going:
- 86% of firms expect rapid or steady growth in sales and profit levels associated with green building;
- by 2013, 53% of responding firms expect to be largely dedicated to green buildings (up from 30% today);

The market study details the drivers of this market transformation. Reasons notably differ according to the world regions: "supporting the domestic economy" is prominent in Sub-Saharan Africa and the Middle East/North Africa, while "environmental regulations" are driving the change in North America, Asia and Europe. Inter-government co-operation through the setting of clear common objectives to environmental regulations appears to be a key change factor.

The increased awareness of the instrumental role that the built system plays in environmental change is carried through by both market players and the civil society at large, on a globalised

[5] The founding countries' councils were the U.S. Green Building Council, Green Building Council of Australia, Spain Green Building Council, United Kingdom Green Building Council, Japan Green Building Council, United Arab Emirates, Russia and Canada. Today, there are fourteen established green building councils: Argentina, Australia, Brazil, Canada, Emirates, Germany, India, Japan, Mexico, New-Zealand, South-Africa, Taiwan, United-Kingdom and U.S.A.

[6] The vision of this not-for-profit organisation reads: "*Through leadership collaboration, the global construction industry will transform traditional building practices and fully adopt sustainability as the means by which our environments thrive, economies prosper and societies grow to ensure the future health of our planet.*"

[7] McGraw-Hill Construction Analytics, 2008, Global Green Building Trends: Market Growth and Perspectives from around the World, SmartMarket Report, September.

scale. International open and mixed – public and private – bodies have developed and are committed to contributing to improve the dissemination of shared methods and metrics. Instead, the most-wanted effective implementation of building energy efficiency policies and measures faces a significant diversity of definition and metrics.

Though explainable, the lack of consistency in measures hampers broader international improvements in energy efficiency delivery. Governments use cross-border comparisons to benchmark the progress of their own environmental performance; trans-national industries need consistency and transparency to assess the return from their estate investments.

Most countries have their own building-performance assessment tools or are currently developing one. The British Building Research Establishment Environmental Assessment Method (BREEAM) issued in 1990 was the first one; the Japanese Comprehensive Assessment System for Environmental Efficiency (CASBEE) created in 2002 is among the latest. Each assessment system reflects the social, economic, cultural and climatic country/region specific backgrounds. Common metrics are to be sought and identified: international co-operation is therefore a pre-requisite for optimal impacts of energy efficient buildings.

2.2. Standards and third-party assessment, certification and rating schemes

Buildings are responsible for a large proportion of the world's energy use and CO2 emissions; their mitigation potential is large. On the other hand, it is an accepted fact that the construction sector is fragmented; everywhere, a large number of small contractors interact to finally install complex building systems. This intrinsic complexity slows/ hampers the diffusion of innovation in buildings, and, at the same time, slows down and limits the adoption of standards. There is however some good in the standardisation system: innovative products and practices, with positive environmental impacts, are also those which are promoted by the international standards!

Despite these well-known difficulties, many policy measures and regulations target efficiency of buildings as a privileged way to promote sustainability. Supporting these policies, at national and regional levels, requires standards for test procedures and calculation methods. And not only do standards need to address each of the various dimensions of energy use, but they have to provide the building system's stakeholders with integrated methods of calculation. The latter are indispensable to design, implement, monitor the compliance and enforce energy efficiency targets by governments. We will come back to this below.

Currently used assessment tools and rating systems - such as BREEAM, LEED, HQE and CASBEE- have demonstrated to be effective in encouraging progress in the management of energy efficiency of buildings. Some of them have been adopted beyond their frontiers of origin (see the Dutch version of Breeam originally British currently under-development or Leed Canada after the North-American original version)[8]. Sharing the lessons learnt in the context of their implementation appears desirable when developing the green building International Standards[9], i.e.:

- ISO TC59 - sub-committee 17, "*sustainability in building construction*"
- CEN TC 350, "*sustainability of construction works*"

8 It should be noted that, on 16th June 2009, BRE Global (cf. BREEAM below), CSTB (cf. HQE below) have signed a Memorandum of Understanding for the development of a pan-European building environmental assessment method.

9 These standards, important parts of which are still under-approuval or under-development, are presented in Annex 1.

Searching complementarities between green buildings international standards and third party assessment and certification schemes is an effective way to achieve sustainability in buildings. This latter statement is one of the main messages of the experts gathered at the ISO/IEC/IEA 'International Standards to Promote Energy Efficiency and Reduce Carbon Emissions' Workshop (2009).

Adopting this approach primarily requires to compare the assessment schemes to find out a shared language and grammar. A synthetic presentation of such a comparison will be proposed in the next chapter, based on available reviews.

The bottom-up, sector-led, formation of the Sustainable Building Alliance (SBA) in April 2008 is a promising though emerging initiative which deserves to be emphasised. Voluntary members aim at establishing "a core set of common metrics for the key issues" while preserving their existing systems. The core metrics will be built so as to provide transparency between rating systems while recognizing regional / national differences. At present, international building promoters and owners happen to have their buildings rated according to two, three or four rating systems, so that the value of their good can be more widely recognised. As the systems in use were not designed to be used across multiple countries, comparing is very difficult. When completed, SBA will allow companies to compare the environmental performance of their buildings in the countries in which they are based with the buildings they occupy overseas; instead of having buildings rated according to several systems (US LEED, French HQE, and UK BREEM, for example).

Expert participants are contributing to the characterisation of a 'core building assessment system', based on the distinction between 'domain indicators' and 'assessment principles'. Indicators will be determined for six domains (energy, CO2 emissions, water, waste, ventilation and indoor air quality, economic performance). The definition of consensual lower and upper range values will be considered in the 'assessment principles' task group. A first consensual result is to be reached by autumn 2009.

SBA was created on the initiative of the Building Scientific and Technical Centre (CSTB), France, a subsidiary of which runs and delivers the HQE certification – BRE – Building Research Establishment Ltd, Britain, which delivers the BREEAM certificate through its subsidiary BRE-Global – and DGNB – German Sustainable Building Council, which runs and delivers the German certificate (launched in January 2009), the Finnish VTT, the Italian ITC-CNR, the Brazilian FCAV, and the American National Institute for Standards and Technology (NIST). Other certification and standardisation organisations and companies have joined in since then, such as AFNOR, Lafarge, Saint-Gobain, EDF or BNP-Paribas.

SB Alliance is not a certification body, and it does not deliver a new label or certification. The operation objectives are the coordination and sharing of R&D efforts, the establishment of a common core for promoting shared use of building assessment tools and worldwide promotion of building assessment systems. As CSTB representative Bruno Mesureur[10] puts it: "It is no longer the time to compare schemes. We need to show that we can work together harmoniously towards common goals, as a heterogeneous but yet global community. It is not about managing diversity, it is about respecting differences and recognizing that drivers and needs vary considerably between climates, regulatory frameworks and indeed, social and cultural priorities."

10 Head of Marketing and International division at CSTB.

3. Assessment tools and rating systems for buildings - comparables

This section provides a brief review of assessment tools, certification and rating systems (AT-CRS). There is a rich body of literature on the topic –cf. Annex 2 for the selected reference list used for this section.

If AT-CRS seem to be mushrooming these days, it was not so until BREEAM was developed, in 1990. Today, variety is the rule and most countries/regions have their own, some of which have the same bases. As the appetite for assessment tools grows, the communities involved, as international as they are, need to be able to compare the assessment tools' respective merits.

3.1. Assessment tools, certification and rating systems: diversity in scope

As abovementioned, diversity is explained by the fact that policy sustainability targets are translated from regulations and measures into manageable systems by the stakeholders concerned: assessment tools, rating and certification systems embed the building communities' 'standardised' practices. It is worth pointing out that these voluntary standards usually go beyond baselines of sustainability regulations. As the practices are context-specific and intertwined with the built characteristics (history, culture, social, economy, etc.), so are the assessment tools. In addition, these tools are designed by, and for, a specific users' community, with the aim of favouring particular changes. A certification or assessment system of environmental performance is meant to convey a designed transformation potential. The tool design has therefore to be as scientific and objective as possible while supporting a readable and appealing change target. The combined choice of indicators and associated methodologies shall be incentives that consistently convey the policy priority choices. Since the latter evolve in time, so do the tools' metrics (cf. **3.2.** Criteria, scorings and weightings).

Assessment tools and rating systems differ according to their scope, i.e.:

- **application scale**: from components and system parts to complete buildings, districts or cities;
- **life stages**: from design to renovation;
- **building types**: from housing (collective and individual), to commercial interiors or schools or healthcare;

Table 2 below presents some of the environmental assessment tools for buildings according to their scope. This presentation calls for two preliminary remarks:

1. The assessment tool's ability to measure and rate energy efficiency for **existing buildings** is a key discriminating factor. Irrespective of the location, existing buildings represent the main source of environmental inefficiency and are nearly the entire built stock (new constructions add only about 1% to the built environment a year). Assessment tools shall therefore be differentiated according to their capacity to address also renovation of **existing buildings**.
2. The assessment tool's capacity to measure and rate energy efficiency for both **residential** and non-residential building matters too. Indeed, despite marked differences between Eastern and Western Europe, residential and non-residential building account for about 50% each (Germany and Ireland show specific patterns since housing construction represents above 66% of total construction). In addition, as the UK example illustrates, above one-fourth of carbon emissions come from

domestic buildings – twice the emissions of commercial and public buildings and five times that of industrial buildings.

Table 2 – Environmental assessment tools, name and scope – by country of origin

COUNTRY	MAIN RATING SYSTEMS	SCOPE
Australia	- NABERS - Green Star Rating Tool	- NABERS (National Australian Building Environmental Rating System Project) specialises in **existing buildings**, "in operation", for residential and office building. - Green Star rates the potential environmental performance of new office buildings.
Canada	- LEED Canada - Go Green (Green Globes)	- LEED Canada covers new construction, commercial interior, core & shell (for **existing building** the Canadian version is under-development, available in June 2009), homes and neighbourhood development (under-development in the US/adaptation in Canada; market-ready v1, in 2009); - 'Green Globes', originally Breeam Canada, applied to **existing buildings** then named 'Green Globes for Existing buildings and finally 'Go Green' ('visez vert'); version for new constructions (design).
Denmark	- BEAT	Computer-based tool for environmental assessment for building and construction materials, building parts and buildings (BEAT); based on Environmental Development of Industrial Products (EDIP), which is a Danish life-cycle assessment tool (assess the impact on the environment during its entire life cycle)
Finland	- PromisE	Residential, office and retail buildings; Assessment and classification systems for **existing buildings** and for new buildings.
France	- HQE (High Environmental Quality)	Assessment and certification system for non-residential new construction and heavily refurbished **existing buildings** (offices, schools, hotels, shopping centres, healthcare buildings, logistics). HQE is also an assessment and certification system for new residential buildings , targeted at private promoters and single-family house builders. Regarding LCA of construction products, PriceWaterhouseCoopers' TEAM™ Building and CSTB's Elodie (the latter is based on INIES EPD database) are the two 'software partners', which support the implementation.
Germany	- DGNB (German Sustainable Building Certificate)	New office and administration buildings ('2008 version', launched in January 2009).
Japan	- CASBEE	For Pre-design, new construction, **existing buildings**, renovation, temporary construction, major urban area (heat island effect), regional scale (and vernacular housing), detached houses.
Netherlands	- GREENCALC - GPR BUILDING - ECO-QUANTUM - BREEAM NL	- GreenCalc (software, v2.2 in 2009) assesses and compares the "environmental sustainability" of buildings, four modules (materials, energy, water, mobility); life-cycle assessment, and hidden costs taken into account. - GPR Building (software), for residential, office and schools; design phase (for architects) based on life cycle assessment. - ECO-QUANTUM (software), design phase, life cycle assessment. - BREEAM NL is still under-development by the Dutch Green Building Council.in April 2009.
Norway	- ECOPROFILE	Initially developed for assessing existing commercial buildings, **existing houses** and as a planning tool for houses.
Sweden	- Miljöstatus (environmental status)	- Miljöstatus is an inspection and assessment tool for buildings.
Switzerland	- MINERGIE	- Assessment, certification and labelling tool for components, new and **existing residential buildings**; it is also a standard (fixed energy consumption targets; new buildings: E≤42kWh/m²; renovation: ≤80kWh/m² (building constructed before 1990).
United Kingdom	- BREEAM	Initially developed to assess performance of offices, now for retail, industrial, schools, housing, courts, prisons, hospital (Hospital NEAT; "Breeam Healthcare" is under-development), eco-homes, bespoke and international. Can be used at different stages in the building's life: design & procurement, post-construction review, 'fit-out' for major refit, management and operation. In line with its logics of life cycle assessment, "Breeam in Use" is now proposed (as of **March 2009): existing buildings**. And Breeam development (regional level).
United States	- LEED - Green Globes	Initially developed for new constructions, and exists now for **existing buildings**, commercial interiors, core and shell, homes, neighbourhood development, schools, retail and health care.

Sources: Own compilation, based upon documents available on the organisations' websites (as of April 2009).

Four key lessons can be drawn from summary **Table 2** above:

1. Not all of the AT-CRS (9 out of 19 in the 13 countries) can be applied to **existing buildings**, most of them are essentially meant to help design more energy efficient new constructions. Since new constructions represent a marginal proportion of the market, this is a serious limitation on their market transformation power, hence a serious limitation on their potency to support the objective of sustainable development.
2. CASBEE is the most advanced in providing tools to address the issue at a larger scale than individual building and tackle issues regarding district level (including the 'heat island effect'). Urban development at district level is touched upon is in the US Leed family, and in the French HQE (under development) while Breeam is currently developing one (April 2009). Stakeholders met in the framework of this mini-study all stressed the necessity to **change scale**, district level being just one step up on the ladder to adopting a true systemic perspective.
3. Most AT-CRS have specific features designed to take into account **various building types**. As illustrated by the international consortium Sustainable Building Alliance (cf. infra), a privileged target remains office buildings. The driver of this move is the existence of a globalised market for such buildings. Besides, public and importantly residential buildings shall remain priority targets.
4. If most of these tools, in their philosophy, acknowledge a **life-cycle assessment** foundation, a few of them only are indeed consistently developed on this basis. This is the third largest limitation so far.

An international co-operation policy that would aim at enhancing dissemination of green buildings standards through action on AT-CRS, may therefore preferably concentrate on:
- persuading building stakeholders – especially home owners– to reduce energy consumption in existing housing stock;
- favoring regulations that address energy efficiency in buildings at district, urban and regional levels;
- the large mitigation potential that remains unexplored in public and residential buildings;
- disseminating state-of-the art life-cycle assessment methods.

3.2. Criteria, scorings and weightings

In this section, we will focus attention on the criteria, scorings and weightings used; we will not deal with issues related to the assessment process (duration, auditors, check-list and facts needed, costs, etc.). The section aims to emphasise their key differences.

The most advanced comparison of AT-CRS is 2008 BREEAM's '*Discussion document comparing international environmental assessment methods for buildings*'. In which document, an attempt was made to translate the scores established by a series of assessment systems (namely CASBEE, LEED and GREENSTAR) into BREEAM's language.

One of the many difficulties met in the making was that each AT-CRS is specifically designed to push adopters beyond the simple application of the local (including nation-wide or larger-region wide) regulation/ standards, which are far from similar. A method was therefore designed to allow comparison, by answering the question: "*how well would a UK building score against BREEAM, if it was designed to meet the requirement of an alternative assessment scheme*?" A series of method choices were subsequently made to complete the comparison. Amongst which choices, the comparison applies to 'new office buildings' only. More than any active institution in the field, Breeam certainly is aware of this important

limitation. Noteworthingly, they have carried the study through on these bases. This can be considered as an indicator of the complexity of the exercise, would they be pursued by way of inter-governmental co-operation.

Table 3 – Environmental assessment systems: Breeam, Leed, Casbee, HQE and Minergie- Assessment items, weighting and scoring

Name	**BREEAM**	**LEED**	**CASBEE**	**HQE**	**Minergie**
Country	*UK*	*US*	*JAPAN*	*FRANCE*	*SWITZERLAND*
Development (creation, latest evolution)	1990, 2008	1996, 2006	2002, 2008	1996, 2009	1994, 2004
Assessment items	1. Management 2. Health & well-being 3. Energy 4. Transport 5. Water consumption 6. Materials 7. Land use 8. Ecology 9. Pollution	1. Sustainable sites 2. Water efficiency 3. Energy & atmosphere 4. Materials & resources 5. Quality of indoor environment 6. Innovation &design process	**Environmental quality (Q)** Q_1. Indoor quality Q_2. Quality of Service Q_3.Outdoor environment **Environmental Load (L)** L_1. Energy L_2. Resources& materials L_3. Off-site environment	**Impacts on outdoor environment** 1. Harmonious relations with the close environment 2. Product-process integrated choice 3. Low impact sites 4. Energy management 5. Water management 6. Waste management 7. Maintenance management **Indoor environment** 8. Hygrothermal comfort 9. Acoustic comfort 10. Visual comfort 11. Olfactory comfort 12. Indoor space quality 13. Air quality 14. Water quality	1. Comfort 2. Safety 3. Absence of environmental injury **4. Energy consumption** (5. Cost efficiency: costs shall not exceed 10% of those incurred for non-Minergie standard houses) **For:** Architecture Shell (insulation) Technical appliances The limiting Values are all given in terms of energy consumption, as compared with the "regular house"
Scoring and weighting	Issues are weighted according to their perceived importance; the weightings are applied to the percentage score for each issue category. The environmental score is given by total sum of credits.	Awards credits for each category without weightings; since it has more subcategories, the materials section is advantaged (more credits). The environmental score is given by total sum of credits	S_Q is the score for environmental quality (Q), calculated as a weighted sum of its three components, where Q_1 (indoor quality) is weighted more; respectively for S_L, L_1 (Energy). **BEE=Q/L**, which an eco efficiency, i.e.systemic- rating.	Each of the 14 issues is subdivided in elementary issues, where each of them is scored in terms of Basic, Good or Very Good. Partial aggregation is then done, so as to get a 14-component profile. Not all the 14 issues can be simultaneously reached, so it is advised to prioritise the family criteria.	To obtain Minergie standard, the weighted energy consumption limits for New residential buildings shall be lower than 38 kWh/m², 70 kWh/m² for renovation; to obtain Minergie-P, weighted energy consumption shall be below 30 kWh/m².
Certification levels	**Pass** (25% of points);**, good** (40%)**, very good** (55%), **excellent** (70%)	**Certified** (26-32 points)**, silver** (33-38 points)**, gold** (39-51)**, platinium** (52-69)	**C** (BEE: 0 to 0.49)**, B-** (0.5 to 0.99), **B+** (1 to 1.49), **A** (1.5 to 2.99), **S** (BEE over 3)	No total aggregation of assessment results. Profile of 14 environmental issues, each of them adopting a 3-level performance scale : **Basic**, **Good**, **Very Good**. Minimum profile : 3 VG, 4 G and 7 B.	**Minergie Standard, and Minergie-P** (P stands for Passive, as in the German Passiv' Haus system, more stringent)

Sources: Own compilation, based upon documents available on the organisations' websites (as of April 2009).

4. Maximising the assessment tools' transformation power

At national level, environmental assessment methods are now unanimously considered to play a pivotal role in the promotion of better energy efficiency of buildings. Each nationally dominant tool is being asked to widen its scope to address issues related to new building types, new phases of their life cycles, and expanded geographical scale of use.

Given the pressing influence of the environmental regulations and policies, the framework that assessment and rating systems provide the users with is much appreciated: they act like *de facto* standards for voluntary stakeholders from the –much dispersed- construction industry and support standard based sustainability policies. So, promoter organisations, professional users (e.g. product manufacturers, promoters, designers, developers, architects, urban planners, etc.), home-owners and policy-makers have converging interests in augmenting the dissemination and use of assessment tools, certification and rating systems (AT-CRS).

The interviews carried out and the literature reviewed for this mini-study point to three main complementary routes by which the transformation power of these assessment methodologies can be enhanced. Moreover, anecdotal evidence from the interviews suggests that international co-operation[11] – i.e. beteween Europe and other regions of the world- is not a priority topic in the building sector stakeholders' agendas; so, whether a renewed activity in establishing international co-operation with regard to green building standards is a desirable fourth way can be disputed (see Section **5.**).

4.1. A consistent (systemic) approach to building sustainability

To efficiently promote the changes they convey, AT-CRS must succeed in being used in various sub-sectors, both private and public at different scales. No building functions in isolation from the built system in which it finds place. The systemic logic is, from the start, one of the key features of CASBEE, and is illustrated by 'L', the 'environmental load reduction', which unambiguously sets virtual boundaries around the assessed building site, as an area of influence. This explains why CASBEE is the most advanced AT-CRS in providing tools that account for district specificities.

At public, community level, many countries (e.g. Sweden, Japan, UK, and USA) have initiated eco-cities schemes which aim just at this: moving up from building to district and city levels. Such initiatives support the adoption of AT-CRS for cities / urban planning because they make the environmental performance of cities visible. At EU level, the "smart energy cities" amendment was considered by the European Parliament as a promising option in the framework of the discussion of the European Economic Plan for Recovery (EEPR) by end of March 2009, before being rejected. In the US, the Mayors Climate Protection Agreement has been launched in 2005, with the explicit aim of reducing emissions in the signatory cities to seven percent below 1990 levels by 2012. The 850 mayors who have signed the U.S. Mayors Climate Protection Agreement are committed to meet or exceed Kyoto Protocol targets for reducing global warming pollution; they are to do so by taking actions in their own communities. Among which commitments, we find the promotion of sustainable building practices "using the U.S. Green Building Council's LEED program or a similar system".

[11] Not to be confused with the much desired and on-going European Member States collaboration.

In the private sector, building owners, construction companies and architectural design firms use AT-CRS. For building owners, AT-CRS are tools for setting performance requirements to be met by buildings they order and in design competition of their own buildings. Construction companies use them as a self-checking tool for internal management of the buildings they construct. Architectural design companies use AT-CRS as reference tools for Design for Environment (DfE) at each stage of the design process[12]; this resulted in a positive contribution to the improvement of the status of DfE within the design process. Architects also use AT-CRS as communication tools with clients and designers.

From a technical viewpoint, synergies between assessment criteria would be usefully promoted. Most assessment systems are constructed on a Cartesian logic and therefore rely on a clear separation of each possible criterion from one another, so as to avoid overlapping. As a consequence of that choice, a building's overall environmental performance can be derived from the aggregation of the points obtained for each criterion. As convenient as it may be, a building's (or a whole district's) energy efficiency stems from the many inter-relationships and feedback loops that constitutes its systems. Obtaining comparable sums of points cannot be the ultimate assessment method for systemic complex structures as buildings are.

According to our review, the CASBEE, in combining (by way of an 'eco-efficiency' ratio) the building's environmental load with its environmental (indoor) quality goes slightly further. Nonetheless, the experts auditioned for this mini-study indicated that calculating a single (summative) indicator to assess a building energy efficiency performance, if instructive, is insufficient[13]. They supported a multicriteria multi-indicators approach and recommended to be particularly cautious about the choices of those indicators. The International Energy Agency's leading role on this latter aspect must be emphasised (cf. P. Taylor, 2009)[14], while they underlined that various policy processes are required to reach a better harmonisation level, including industry voluntary initiatives.

4.2. Increasing market benefits for adopters

As demonstrated (e.g. UNEP, 2007[15]), succeeding in imposing the objectives of sustainable buildings implies ensuring that energy efficient buildings' AT-CRS support market transformation. It requires quantifying energy performance through assessment and sharing of the results among stakeholders.

Developing an incentive system which favours buildings with high energy efficiency ratings is an indispensable step. A number of government administrations implement policy initiatives to support preferential treatments, subsidies and access to preferential interest rates. A careful monitoring system is necessary to make sure that energy efficient properties are properly valued while avoiding triggering a vicious circle.

Ensuring that the most effective and shared AT-CRS serve as judging tools for providing incentives shall be done through:

[12] AT-CRS allow an early detection of a project's strengths and weaknesses, and thus improve it. It is deemed useful to all designers.
[13] An aggregate indicator might be calcutaed but it must be considered as an additional information that complements detailed mutlticriteria data
[14] Cf. Energy Efficiency Indicators, 2009, representation at the International Workshop on International Standards to Promote Energy Efficiency and reduce carbon emissions, IEA, Paris 16- 17 March. (Based upon OECD/IEA's "Worldwide Trends in Energy Use and Efficiency", 2008)
[15] UNEP, 2007, Assessment of policy instruments for reducing green house gas emission from building, September.

1. Preferential treatment for energy efficient buildings, according to their performances. In Japan, high CASBEE ratings[16] are required for permission to apply for comprehensive design (which allows the relation of legal constraints) and permission to increase the maximum floor area ratio.
2. Subsidies, given for highly-rated energy efficient buildings. This is so in France, with HQE, subsidies allocated to projects of modelling for reducing CO2 emissions from buildings, to projects of environmentally-friendly housing.
3. Preferential interest rates made available for highly rated energy efficient buildings, such as lower interest rates for home loans. In the US for instance, San Francisco-based New Resource Bank offers qualifying LEED projects better interest rates and fees. The State Bank of India, in the context of newly launched 'Green Homes', offers such advantages when the home project has been rated by the Indian Green Building Council (IGBC).

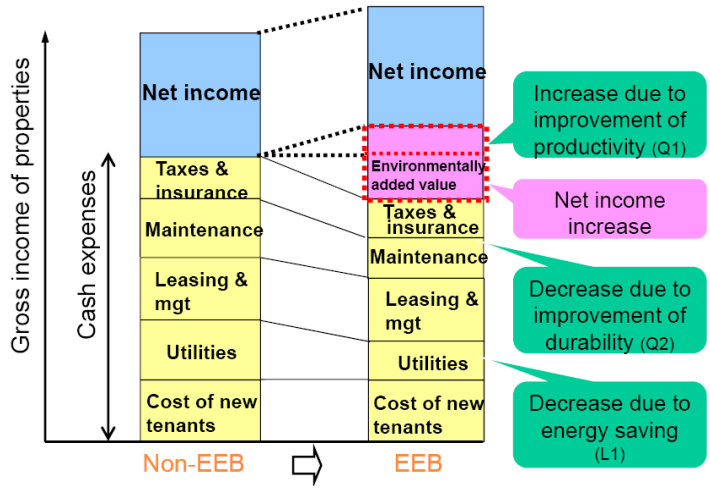
Moreover, in the coming years, the growing pressure to cope with building sustainability will result in uncertainty as regards property values. Both policymakers and economic players anticipate increased environmental risks which may result in lower property values. Stricter regulations such as 'green taxes' can be considered as emerging environmental risks: non energy-efficient buildings value are likely to decrease while energy-efficient would increase on the real estate market. Since there are more non-efficient buildings, the tendency may be price decrease. On the other hand, other environmental factors may lead to increased property values, such as investments in reduction of energy costs, or, investment in the improvement of houses service performance (comfort, noise, appearance)

Against this background, AT-CRS become more and more valuable tools; a wide adoption of AT-CRS can be recommended for property appraisal, in limiting environmental risks. An appraisal of the relationship between the AT-CRS items and property value items shall make the overall effects of their adoption clearer. One may even argue that AT-CRS and property appraisals are very much alike, cf. **Exhibit 3**.

Exhibit 3 – Linkages between AT-CRS and property appraisals – the case of CASBEE

The BEE ratio (building energy efficiency) is a sustainable ranking, where Q relates to improvement of durability and of productivity, and L relates to energy savings. In the case of direct capitalisation, the property value is expressed by the ratio of the net income generated by property (which depends upon the decrease in utility costs, the increase in tenant income, the decrease in the required repairs) on the capitalisation rate (including factors that reduce the risk premium such as: decrease in depreciation ratio, reduction of environmental risks, image improvements).

[16] The same holds in France for HQE ratings.



So, implementing CASBEE allows an increase of the gross income of EEBs, due to energy savings (L_1), improvement of durability (Q_2), newly created "environment added value" and improvement of productivity. These reasons provide a rationale for a widespread sharing and use of an EEB assessment tool.

Source: Murakami, S., Presentation at the International Workshop on International Standards to Promote Energy Efficiency and reduce carbon emissions, IEA, Paris 16- 17 March.

4.3. Improving training and education

A third complementary route to accelerate dissemination of buildings' energy performance assessments, certificates and ratings is by improving the number and competences of those responsible for their implementation: supporting AT-CRS' assessors/ auditors and certifiers selection, accreditation and training processes. Moreover, education and training on this aspect also are to be enhanced throughout the whole building filière. In line with that, AT-CSR are good ways to sensitise 'front-office' stakeholders, i.e. those in direct contact with the client like architects, on the importance of sustainability.

In Europe, this may entail sharing the best practices on energy certification and building energy auditing between Member States, for instance through the creation of regional information and competence centres. This can favour the transfer of results to interested key actors in other regions of Europe by increasing the competence and knowledge level of qualified certification "service providers".

Increasing the number of such certification and assessment bodies is also at stake in the case of the Energy Performance of Buildings Directive (EPBD) recast[17]. Indeed, an effective enforcement system is critical. Infringements of legislations which transpose the EPBD at national levels are to be credibly punished. For the enforcement system to be accurate, a minimum amount of the assessed, certified and rated green buildings must be tested. Given that independent experts shall be controlled too, this would result in an important development of such experts and expertise in Europe.

The AT-CRS supporting organisations are also to develop guidelines and accreditation schemes to assure the quality level of 'their' certificates and experts, and to develop training for independent experts. They should be encouraged more strongly to do so.

Eventually, efforts analogous to those implemented in Japan may be carried out so that national academia also uses AT-CRS as common support for design training & courses at

[17] The position of which was adopted at first reading on 23rd April 2009

university and college levels. The same example illustrates how important it is to deal with AT-CRS as a research matter (a growing number of publications are submitted, the subject matter of which is CASBEE).

5. International cooperation: a way forward?

The experts consulted for this mini-study did not point to a growing need for international cooperation between Europe and other regions of the world at governmental level on the issue of green building standards. Instead, they have come up with a wealth of existing initiatives in this direction (to which they happen to participate).

Alongside CEN and ISO, the international bodies officially entitled to develop standards, other international specialised cooperation bodies (such as the UN Environment programme, the International Energy Agency, the International Panel on Climate Change) and international industry-led initiatives have developed specific actions to participate in the development of green building harmonised principles and methods, assessment tools, certification and rating systems (such as the Sustainable Building Alliance, the World Green Building Council - WGBC - and the World Business Council for Sustainable Development's - WBCSD - Energy Performance in Buildings project). The latter stakeholders who, including European Commission representatives, were present at the IEA/IEC/OECD 'International Workshop on International Standards to Promote Energy Efficiency and reduce carbon emissions' (March 2009). They have collectively insisted on the good complementarity between the two types of standards, i.e. *de facto* standards -third-party industry led assessment schemes- and *international standards*.

According to UNEP (2007), international co-operation is an efficient policy to reduce green-house gas emissions from buildings when the barriers identified pertain to structural characteristics of the political, economic and energy system. This category of obstacle would result from a mix of problematic enforcement of standards, inadequate detailed guidelines, tools and experts, a lack of incentives for energy efficient investments, a lack of governance leadership/ interest, and a lack of equipment testing / certification. In the case of AT-CRS, which was not dealt with within the UNEP report[18], things are evolving quickly and, on a global scale, in spite of a variety of motivations, the underlying communities are today very much organised and structured.

Enhancing the implementation of shared standards, creating incentive policies encouraging energy efficient buildings are recommended. This primarily requires a clear vision and leadership. This stance is illustrated by the Japanese government who clearly promotes the use of CASBEE as a method to increase energy performance of buildings in the framework of the Kyoto Protocol Target Achievement Plan. Similarly, the choice of LEED was also made explicit by the American mayors who are striving to meet and even go beyond Kyoto Protocol Targets.

Going beyond these power considerations where one would try to impose its regional standard, searching a mutual interest zone for co-operation compels to identify territory effect

18 This point is actually emphasised in the last sentence of the report (p. 68).

free AT-CRS[19] so that multiple AT-CRS could develop side by side, without each international player being obliged to duplicate or triplicate its investments in AT-CRS. In this line of reasoning, international co-operation shall intend to:

- Encourage clearer and more stretching targets;
- Improve transparency, thereby facilitating the sharing of best practices;
- Share best practice in the design, construction and operation of the built environment.

In terms of the scope of this co-operation, the review of the AT-CRS considered for this mini-study pointed to limitations of the current AT-CRS developments, which in turn indicate where the largest potentials lie:

1. Reducing the energy consumption in existing residential building stock;
2. Imposing energy efficiency in buildings at district, urban and regional levels;
3. Disseminating state-of-the art life-cycle assessment methods;
4. Favouring the development of internationally qualified "certification service providers".

As a complement to the empirical approach of this MS, we will recall a few elements of economic theory in relation with a rationale for policy initiatives in the field[20].

Exhibit 4 – Convergence of green building standards: basics

AT-CRS for sustainable buildings are a specific form of standards, which makes the economic evaluation of their impacts on trade and global welfare very difficult. In addition, irrespective of their types, the relationships between standards and innovation are not straightforward: they can either hinder or enable innovation, notably depending on the timing -too early, standards may prevent superior solutions to advent; too late, standards may block dissemination, because of the high level of switching costs.

From an economic theory standpoint, combining environmental economics and innovation economics generates highly complex arguments. The basics are that harmful consequences of economic activities on the environment (e.g. those in relation with the construction sector) are often 'externalities' i.e. the producer (of a building) or the consumer (of an appartment, of a school) does not pay for all costs incurred due to the effects of their activities; they are external in the sense that market prices do not convey all information related to costs and benefits.Environmental policies seek to favour the 'internalisation' of those 'external' costs, so that stakeholders take into account the effects of their actions on the environment. There are two main routes for that: pricing so that rational individual decisions (from those responsible for the damages) lead (them) to behavioural changes, and mandatory (quantity-based) standards. Against this background, innovation is likely to reduce the costs of the negative impacts *via* a reduction of the externalities themselves.

1. Green building AT-CRS are process-focused, private and voluntary
Standards may be public or private, mandatory or voluntary, and they can focus on products or processes. Those which are the subject of the present mini-study are process-focused (they pertain to the characteristics of the construction process), they originate in private initiatives and their application, though in accordance with public intervention, is voluntary. Their dissemination is therefore based on the network and market nature of the relationships between the users of the standards; convergence establishes without policy intervention.

[19] This is the very purpose of the SB Alliance, even though primarily for international office buildings which are marginal in terms of their effective impacts on the environment, but less so in terms of their exemplariness. SB Alliance has planned to develop tools for district evaluation and certification soon, in the EU and beyond.
[20] A good departure point for relevant literature on this is ISO/IEC Inventory of studies on the economic and social benefits of standardisation (http://www.standardsinfo.net).

2. Green building AT-CRS are reducing negative environmental externalities
By adopting shared and ambitious rules to measure the global eco-performance of the buildings, the construction sector communities are improving environmental quality through innovation. Multi-criteria life-cycle based comparisons are embedded in the production/ renovation processes. Here, regulation and policy initiatives (such as EPBD) find their justification and are effective in raising awareness and settting assessment tools' fundamental principles and targets.

3. Green building AT-CRS cannot internalise externalities alone
In the case of global environmental externalities such has those associated with buildings, and notably with existing buildings, no standard can be fully optimal: they depend on individual countries / regions / territories specificities which in turn make it inadequate to take into account the effects of their actions on other countries International cooperation may therefore accompany the convergence process.

To conclude, would a transatlantic cooperation (or between Europe and other regions of the world) be found relevant by the EC as a way for progressing towards a sustainable future, green building standards, mainly in the form of assessment tools, certification and rating systems are potentially powerful. As above-developed, there are three major reasons for this large leverage effect: they are tools actually and effectively used by communities who are progressively structuring themselves at global level; they are timely in proposing their market transformation power; they are mature enough to become part of the strategy and policy discussions in the framework of the discussion of the Kyoto Protocol. The next meeting of which will take place in Denmark, between December 7 and December 18, this year; according to its roadmap, a framework for climate change mitigation beyond 2012 shall be agreed.

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ANNEX 1- INTERNATIONAL GREEN BUILDING STANDARDS – DEFINITION AND ON-GOING ACTIVITY OF ISO AND CEN

1. According to International Standardization Organization (ISO)/ International Electrotechnical Commission (IEC) Guide 2:2004 'Standardization and related activities -- General vocabulary', a **standard** is a "document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context. An **international standard** is a "standard that is adopted by an international standardizing/standards organization and made available to the public."

2. In line with this definition, two sets of standards are properly labelled "international green –with a view to become really sustainable - building standards", the ISO TC59/SC17 and the European Committee for Standardisation (CEN, after the French acronym) CEN 350.

3. At ISO level, standards are being prepared by TC59 (building construction), subcommittee 17 (sustainability in building construction), which has 5 working groups:

TC 59/SC 17/WG 1 General principles and terminology
TC 59/SC 17/WG 2 Sustainability indicators
TC 59/SC 17/WG 3 Environmental declaration of products
TC 59/SC 17/WG 4 Environmental performance of buildings
TC 59/SC 17/WG 5 Civil engineering works

The following four standards have been published by TC 59/SC 17

ISO 15392:2008, ***Sustainability in building construction -- General principles (22/04/08)***

ISO 15392:2008 identifies and establishes general principles for sustainability in building construction. It is based on the concept of sustainable development as it applies to the life cycle of buildings and other construction works, from their inception to the end of life.

ISO 15392:2008 is applicable to buildings and other construction works individually and collectively, as well as to the materials, products, services and processes related to the life cycle of buildings and other construction works.

ISO 15392:2008 does not provide levels (benchmarks) that can serve as the basis for sustainability claims. It is not intended to provide the basis for assessment of organizations or other stakeholders.

A guidelines document is under preparation in order to make more explicit the sustainability principles developed in ISO 15392:2008.

ISO/TS 21929-1:2006,

ISO/TS 21929-1:2006 provides a framework, makes recommendations, and gives guidelines for the development and selection of appropriate sustainability indicators for buildings.

The aim of this part of ISO/TS 21929-1:2006 is to define the process that shall be followed when addressing the economic, environmental and social impacts of a building using a common framework and a set of indicators. This part of ISO/TS 21929-1:2006:

adapts general sustainability principles for buildings;
includes a framework for the assessment of economic, environmental and social impacts of buildings;
shows indicators as examples;
shows how to use sustainability indicators with regard to buildings and shows the process of using sustainability indicators;
supports the process of choosing indicators;
supports the development of assessment tools;

defines the conformity with this specification.
This TS will soon be an ISO Standard.

ISO 21930:2007, Sustainability in building construction -- Environmental declaration of building products (01/10/07)

ISO 21930:2007 provides the principles and requirements for type III environmental declarations (EPD) of building products.

ISO 21930:2007 contains specifications and requirements for the EPD of building products. Where this International Standard contains more specific requirements, it complements ISO 14025 for the EPD of building products.

ISO 21930:2007 provides a framework for and the basic requirements for product category rules as defined in ISO 14025 for type III environmental declarations of building products. Type III environmental declarations for building products, as described in ISO 21930:2007, are primarily intended for use in business-to-business communication, but their use in business-to-consumer communication under certain conditions is not precluded.

ISO 21930:2007 does not define requirements for developing type III environmental declaration programmes. Requirements for type III environmental declaration programmes are found in ISO 14025.

The working environment is not included in ISO 21930:2007 because it is normally a subject for national legislation.

ISO/TS 21931-1:2006, Sustainability in building construction -- Framework for methods of assessment for environmental performance of construction works -- Part 1: Buildings

ISO/TS 21931:2006 provides 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 environmental performance for new or existing building properties in the design, construction, operation, refurbishment and deconstruction stages. It is intended be used in conjunction with, and following the principles set out in, the ISO 14000 series of International Standards.
(under revision: stage: 40.60 (2008-11-22)). This TS will soon be an ISO Standard.

4. **At EU level**, CEN is developing TC350 - Sustainability of construction works, the scope of which is similar to that of ISO/SC17.

"The TC 350 shall be responsible for the development of voluntary horizontal standardised methods for the assessment of the sustainability aspects of new and existing construction works and for standards for the environmental product declaration of construction products. The standards will be generally applicable (horizontal) and relevant for the assessment of integrated performance of buildings over its life cycle. The standards will describe a harmonized methodology for assessment of environmental performance of buildings and life cycle cost performance of buildings as well as the quantifiable performance aspects of health and comfort of buildings."

In terms of standard development process, the method part relative to product declaration will be issued this year (November), followed by the general framework for the assessment of buildings (October 2010)

PROJECT REFERENCE		TITLE	CURRENT STATUS	DAV
350004	prEN 15804	Environmental product declarations - Product category rules	Under Approval	2010-02
350006	FprCEN/TR 15941	Environmental product declarations - Methodology and data for generic data	Under Approval	2009-11
350008	prEN 15643-3	Sustainability assessment of buildings - Part 3: Framework for the assessment of social performance	Under Development	2011-04
350009	prEN 15643-4	Sustainability assessment of buildings - Part 4: Framework for the assessment of economic performance	Under Development	2011-04
350010	prEN 15643-2	Assessment of Buildings Part 2: Framework for the Assessment of Environmental Performance	Under Approval	2011-01
350011		Assessment of environmental performance of buildings - Calculation methods	Under Development	2011-05

350012	prEN 15643-1	Assessment of Buildings Part 1: General Framework	Under Approval	2010-10
350013	prEN 15942	Environmental product declarations - Communication format - Business to Business	Under Approval	2011-02

ANNEX 2- COMPARING ASSESSMENT TOOLS, CERTIFICATION AND RATING SYSTEMS - SELECTED REFERENCES

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ANNEX 3 - EU DIRECTIVE ON THE ENERGY PERFORMANCE BUILDINGS (EPBD) – MINIMUM ENERGY REQUIREMENTS

In the proposal the objectives and main principles of the current EPBD are retained and the role of Member States in setting up the concrete requirements is also the same as in the current EPBD. The administrative burdens are kept to a minimum, but developed in order to achieve maximum effect. It is crucial that the current EPBD be properly implemented and on time. This proposal should not be an excuse to delay implementation of the current Directive.

The proposal clarifies, strengthens and extends the scope of the current EPBD's provisions by:

- introducing clarification of the wording of certain provisions;
- extending the scope of the provision requiring Member States to set up minimum energy performance requirements when a major renovation is to be carried out;
- reinforcing the provisions on energy performance certificates, inspections of heating and air-conditioning systems, energy performance requirements, information, and independent experts;
- providing Member States and interested parties with a benchmarking calculation instrument, which allows the nationally/regionally determined minimum energy performance requirements ambition to cost-optimal levels to be compared;
- stimulating Member States to develop frameworks for higher market uptake of low or zero energy and carbon buildings;
- encouraging a more active involvement of the public sector to provide a leading example.

The Commission will continue to help Member States implementing this Directive, like with the information service "Buildings Platform". In 2009, the Commission will launch a major “Build-up” initiative to increase the awareness of the whole chain from authorities, to construction industry and citizens on the saving opportunities. New financing schemes are introduced to overcome investment barriers. According to the Commission, the macroeconomic estimated impacts are also significant: 5-6% less energy will be used in EU in 2020 (which equals the total current consumption of Belgium and Romania) and about 5% less CO2 emissions will be emitted in the whole EU in 2020.

Source: Commission/Council: initial legislative document, 13/11/2008.

Comments

In line with the present study’s object, a crucial dimension of the directive lies with the **Annex I**, which **specifies the methodology** to be used for the calculation of the energy performance (KWh/m2) of the building system (and/or its components). It shall be set at national or regional level and energy performance shall be expressed in a transparent manner and may include a CO2 emission indicator.

The methodology of calculation of energy performances of buildings is to take into consideration (a) the **actual** thermal characteristics of the building (including its thermal capacity, insulation; passive heating, cooling elements; and thermal bridges); (b) to (d) heating, hot water supply and air conditioning including their insulation; (e) to (i) built-in lighting installation, design and orientation of the buildings, passive solar systems and solar protection, natural ventilation, indoor climatic conditions, including the designed indoor climate and internal loads. In addition, the **positive influence** of the following aspects must be taken into account, if relevant : local solar exposure conditions, active solar systems and other heating and electricity systems based on renewable energy sources, electricity produced by CHP cogeneration, district or block heating and cooling systems, natural lighting.

The appropriate European standards must serve as bases for the calculation of energy performance of buildings, cf. CEN TR15615. Their use implies calculation steps, from the calculation of the building energy needs for H/AC to the calculation of the overall energy performance. Importantly, these CEN/ISO standards are developed and applied on voluntary basis, details of which are further specified in the EPBD recast articles: **Energy performance requirement**: as regards 'new buildings', art.4 and 5, 'major renovations', art. 4, 5 and 6; **Energy performance certificate and recommendations**, art. 7, **System inspections**: art. 8 & 9.

The EPBD 'recast' adds to the previous version in specifying the cost-optimal calculation method, and making its use compulsory. Also, MS bear penalties would they not comply. On the other hand, Art. 12 (Information and communication programmes) states that Member States are invited to take the necessary measures to inform the users of buildings as to the different methods and practices that serve to enhance energy performance. Upon Member States' request, the Commission shall assist Member States in staging the information campaigns concerned, which may be dealt with in Community programmes.

In terms of the cost-optimal calculation method's implementation agenda, the EC committee will establish the method by end 2010, the MS give incentives only if cost-optimality is respected by end of June 2014, eventually, all MS codes shall be based on cost-optimality by end of June 2017.

A key practical question raised by the EPB directive is related to Art. 1 which sets its overall objective, based on a notion of cost-effectiveness. Cost-effectiveness can but be derived from a *specific mix of measures*. The directive does not provide an answer to what the mix should be. Should investments be made in energy demand reduction (such as in the building envelope, or in solar gains? Should investments be made in energy supply technology, such as boiler, heat pump, solar boiler, photovoltaics? Put differently: should they more demand or supply oriented

ANNEX 4- GREEN BUILDINGS ASSESSMENT TOOLS, CERTIFICATION AND RATING SYSTEMS – MAIN ORGANISATIONS

This annex does not intend to be comprehensive; it provides a list of the main organisations that are developing, supporting and implementing assessment tools, certification and rating systems on sustainable buildings. They were identified as such while carrying out the mini study.

1. The three main worldwide organisations that develop and promote green buildings assessment tools, certification and rating systems

Sustainable Building Alliance
Private-led the Sustainable Building Alliance (SBA) was created in April 2008. Voluntary members aim at establishing "a core set of common metrics" while preserving their existing systems. The SBA was created on the initiative of the Building Scientific and Technical Centre (CSTB), France, a subsidiary of which delivers the HQE certificate–, BRE – Building Research Establishment Ltd, Britain, which delivers the BREEAM certificate- and DGNB – German Sustainable Building Council, which delivers the German certificate (launched in January 2009). Other certification and standardisation organisations and companies have joined in since then, such as the Italian ITC and Finnish VTT, EDF or BNP-Paribas.

World Green Building Council
The WGBC is a business-led coalition of Green Building Councils; they are consensus-based not-for profit organisations with no private ownership, from all sectors of the construction industry. The WGBC is partner with the Clinton Climate Initiative and with the United Nation's Environmental Programme and support the World Business Council on Sustainable Development's "Zero Net Energy Challenge". Members types: Agents, Facility & Asset Managers, Building Owners, Building Product Manufacturers/Suppliers/Distributors, Building Controllers and Service Contractors, Building Tenants, Construction Companies & Sub Contractors, Environmental Organisations, NGOs, Financial Institutions, Government (Local, State & Federal), Professional Services, Property Developers, Universities and Technical Research Institutes and Utilities & Energy Service Providers.

World Business Council for Sustainable Development
The WBCSD is a CEO-led, global association of some 200 companies dealing exclusively with business and sustainable development. Members come from more than 35 countries and 20 major industrial sectors. The Council also benefits from a global network of about 58 national and regional business councils and regional partners.

2. Organisations that support green buildings assessment tools, certification and rating systems at national level (cf. Table below)

COUNTRY	MAIN RATING SYSTEMS	SUPPORTING ORGANISATIONS
Australia	- NABERS - Green Star Rating Tool	- National Australian Built Environment Rating System, national initiative managed by the **New South Wales Government Department of Environment and Climate Change**. - Green Star – Developed and managed by the **Green Building Council of Australia**; for the sake of the example, there are more than 450 members, the largest category of which is the professional services'.
Canada	- LEED Canada - Go Green (brand name of Green Globes)	- **The Canada Green Building Council (CaGBC)** - Go Green (for Existing Buildings), is derived from Building Research Establishment's Environmental Assessment Method (BREEAM); it is owned and operated by **Building Owners and Managers Association (BOMA) Canada** (2 500 members); the other Green Globes products in Canada are owned and operated by ECD Energy and Environment Canada
Denmark	- BEAT	Current version BEAT 2002, PC tool for performing environmental assessment of products, building elements and buildings developed and owned by **Sbi Danish Building Research Institute (Aalborg University)**.
Finland	- PromisE	**VTT -** Technical Research Centre of Finland VTT has developed the national method for the environmental assessment and environmental declarations of building products and the environmental classification system for buildings (PromisE), together with actors in the Finnish building and real estate sector.
France	- HQE (High Environmental Quality)	**Association pour la Haute Qualité Environnementale** (Association HQE), 81 members, structured around 5 technical committees: "project owner" "project manager", "Industries", "Expertise", "Support and advice". Association HQE is mainly supported by AFNOR Certification, CSTB, Qualitel, ADEME, professional federations.
Germany	- DGNB (German Sustainable Building Certificate)	German Sustainable Building Council, 540 members
Japan	- CASBEE	**Japan GreenBuild Council (JaGBC)** / Japan Sustainable Building Consortium (JSBC), with its secretariat administered by the Institute for Building Environment and Energy Conservation (IBEC).
Netherlands	- GREENCALC - GPR BUILDING - ECO-QUANTUM - BREEAM NL	- Greencalc is managed by **SUREAC TRUST,** the members of which are **DGMR** Raadgevende Ingenieurs BV [Consulting Engineers], the **NIBE** (the Dutch Institute for Building Biology and Ecology) [multidisciplinary research and engineering bureau], **NUON** [Energy company, 10,000 employees, more than three million consumers and organisations in the Netherlands, Belgium and Germany], the **Dutch Government Buildings Agency (Rgd)** - GPR® has been developed by the **municipality of Tilburg** and **W/E consultants**. - ECO QUANTUM has been developed by **W/E consultants** sustainable building Gouda and **IVAM Environmental Research Amsterdam** - Breeam NL of the the **Dutch Green Building Council** (June 2008), 90 organisations have joined the council.
Norway	- ECOPROFILE	**Norwegian Building Research Institute**
Sweden	- Miljöstatus (environmental status)	Managed by the (Swedish) **Association for the Environmental Status of Buildings**, 40 member organisations (mostly building owners)
Switzerland	- MINERGIE	**AMI** (the MINERGIE® Association), is organised as an association and is registered in the Swiss Trade Register.
United Kingdom	- BREEAM	**Building Research Establishment Ltd**
United States	- LEED - Green Globes	- **US Green Building Council**, 501(c)(3) non-profit community, composed of more than 19,500 member organisations - Green Globes is owned and operated by the **Green Building Initiative** (**GBI**).

ANNEX 5 – IEA/IEC/ISO INTERNATIONAL STANDARDS TO PROMOTE ENERGY EFFICIENCY AND REDUCE CARBON EMISSIONS - CONCLUSIONS ON BUILDINGS

The IEA/IEC/ISO Workshop on International Standards to Promote Energy Efficiency and reduce carbon emissions (16- 17 March 2009) gathered about 290 experts representing the major players from standardisation, the private sector and public policy makers. Among the "Results and directions for future action", the following were focused on Green Buildings standards:

1. Buildings are responsible for a large proportion of the world's energy use and CO 2 emissions

2. Policy targets for low or even zero carbon emissions new buildings are important, but it is even more important and challenging to tackle the efficiency of the existing building stock

3. There are many existing standards for test procedures and calculation methods covering a variety of aspects of energy use in buildings. However, it is critical to extend the scope of the standards to cover methods of calculation and verification of the integrated performance of buildings. These extended standards will have an important role in supporting the definition of targets and implementation measures by national governments

4. Existing assessment tools adopted at national level (such as CASBEE, BREEAM and LEED) have proven to be effective in encouraging improvements in the energy efficiency of buildings. These experiences need to be shared in the development of International Standards.