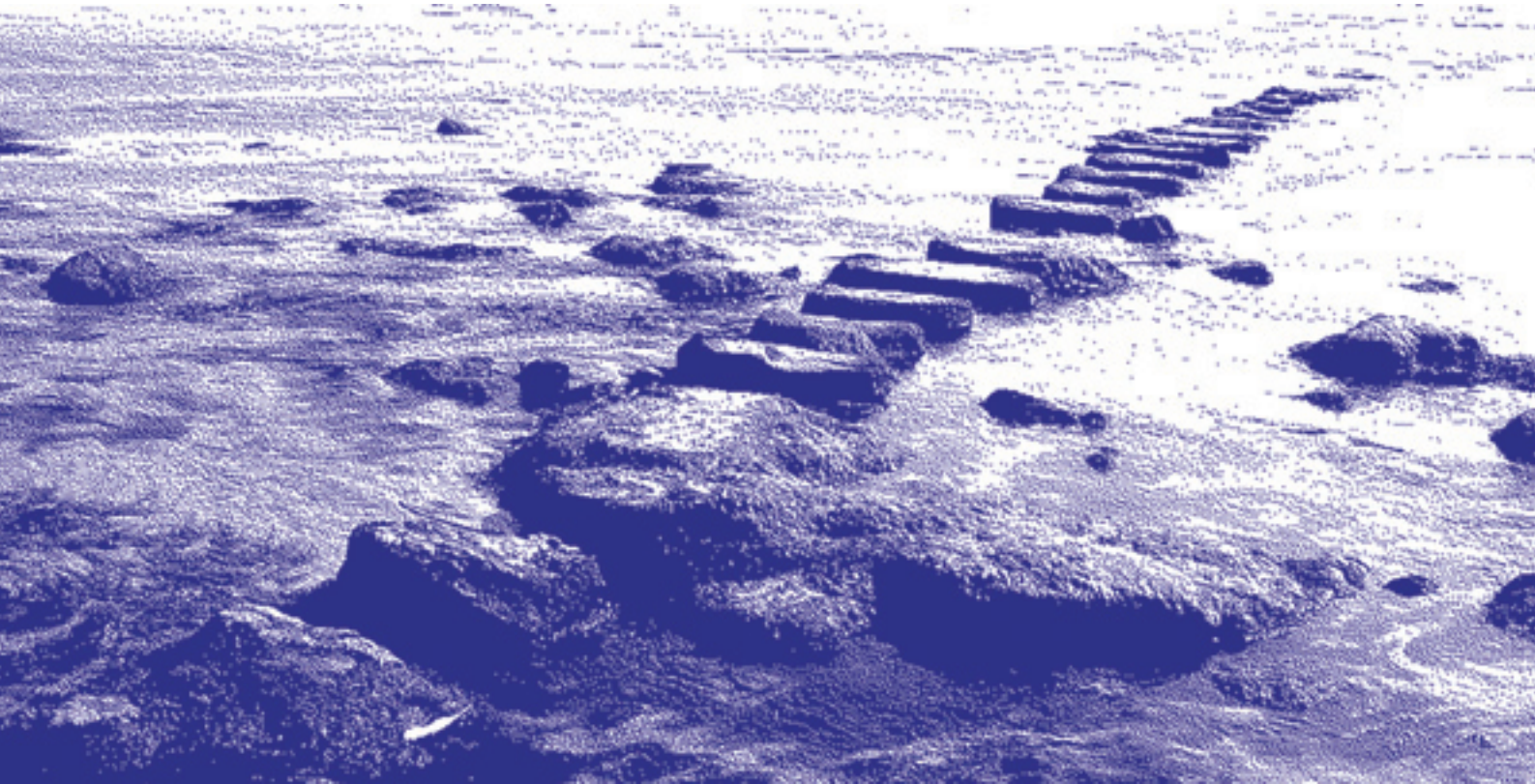
Methodology Development
towards a Label for Environmental,
Social and Economic Buildings

LEnSE

## Stepping Stone 1

# Sustainability assessment of buildings

## Issues, scope and structure



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## Content

# General information about LEnSE

LEnSE is a European research project that responds to the growing need in Europe for assessing a building's sustainability performance. The project draws on the existing knowledge available in Europe on building assessment methodologies.

The main objective is to develop a methodology for the assessment of the sustainability performance of existing, new and renovated buildings, which is broadly accepted by the European stakeholders involved in sustainable construction.

This methodology will allow for future labeling of buildings, in analogy with the Energy Performance Directive. The work should result in increased awareness of the European stakeholders and will allow adequate policy implementation on sustainable construction.

## The importance of LEnSE approach

The importance of the LEnSE project lies in its approach to develop a truly holistic methodology that addresses the overall, integrating concept of sustainability. Furthermore, LEnSE aims to develop a Europe-wide accepted assessment methodology, which also allows for regional or national variances and priorities to be incorporated.
The key stakeholders on the European and national level will be highly involved in the development of the methodology, to guarantee a wide acceptance and implementation of the project results.
The results of the LEnSE project will be important for all stakeholders involved in sustainable construction:

- Governments can use the methodology for the implementation of subsidiary schemes in order to promote sustainability;
- Architects can use it to communicate about sustainability issues with their clients;
- Project developers have an instrument to determine the sales values of buildings in the context of sustainability. The methodology could also be translated into a sustainability certification for buildings;
- Clients can get reliable information about the sustainability performance of the planned building before purchase or construction.

## Objectives of LEnSE

The three main objectives of LEnSE are:

To develop a list of issues which need to be included in the assessment methodology. The list must be wide enough to be meaningful for all European members, but it must be limited enough to be practical. A broad consensus on these issues will be reached through strategic consultation of the relevant stakeholders.

To develop a methodology for assessment of the overall sustainability of existing buildings, major renovations and plans for new buildings. The methodology must take into account the existing methodologies and initiatives and ongoing standardisation activities. Guidelines on how to address local variations will be provided.
This work will be validated by the development of a prototype tool and tested on case study buildings.

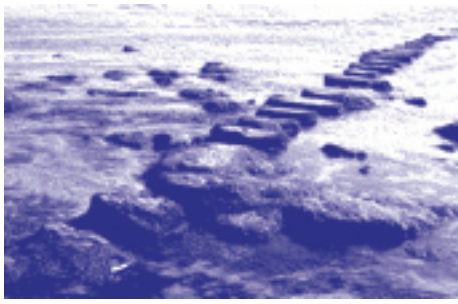
To set up a strategic consultation of the stakeholders, in order to ensure a methodology accepted and used by the stakeholders, These consultations will include national meetings with stakeholders and trans-national expert workshops. The consultation and communication activities should also raise the stakeholders' awareness about sustainability assessment and the advantages of the LEnSE approach. The LEnSE project will also interact with standardisation activities at CEN and ISO level to make sure the methodology is in line with the standards in development.

## Work plan

The objectives of the LEnSE project have been translated into 4 work packages:

- WP1 - The identification of issues and scope definition
- WP2 - Development of a sustainability assessment methodology
- WP3 - Consultation and communication with stakeholders
- WP4 - Project management, meetings and quality assurance

The project started in 2006 and will run until December 2007.



# Stepping Stones?

*Katrien Putzeys*
*Johan Van Dessel*
*BBRI - Belgian Building Research Institute*

The involvement of the key stakeholders on the European and national level, such as architects, building owners and buyers, governments, project developers, user groups, etc. is essential in the development of a Europe-wide methodology for the assessment of the sustainability performance of buildings.
This involvement is necessary to guarantee a wide acceptance of the developed methodology, and to facilitate its uptake into construction practice.

Within the LEnSE project, a number of crucial decisions have to be taken with regard to the methodology development. It is exactly at those crucial decision points that the project wants to get a clear view on the opinion of the concerned stakeholders, so that in the end, the best possible options are carefully selected for the methodology.

The 'Stepping Stone' publications – of which this is the first – are a tool to support this important decision-making process. Indeed, they are the basis for the discussions with the stakeholders, summarizing the findings of the project to date and formulating some key questions for the future work. Hence, they are an instrument through which the project is taken to the next level; they are really our Stepping Stones.

The LEnSE project will publish three of these thematic 'Stepping Stone' publications. This first publication deals with the issues which should be included in a sustainability assessment methodology and the structure and format of such a methodology.
The second one, scheduled for early 2007, will focus on the actual content of the assessment method. The third and final publication will be published in autumn 2007 and will review the practical testing of the methodology. It will also raise some questions on how we could use these results in the optimisation of the methodology.

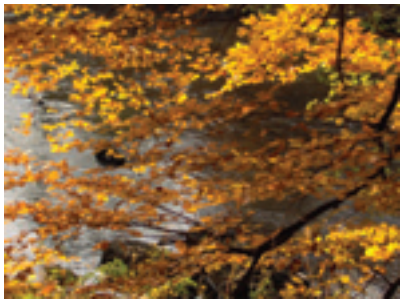
Simply preparing and distributing these 'Stepping Stone' publications is however not enough. Therefore, each of the publications is followed by a Trans-National Expert Workshop, to which a limited number of European recognized experts on (sub-areas of) sustainable construction are invited. Discussions on the outstanding questions for the methodology development, in which

the views of the LEnSE partners are confronted with the views of the experts, should enable the project to move forward in the right direction.

The trans-national workshops are also an opportunity to involve experts on sustainable construction from other countries than the LEnSE partner countries. The organisation of the workshops in different regions of Europe will underline this ambition. The workshops will also allow involving experts which are in particular working on the overall European level, for example standardisation. This will ensure a true European approach of the methodology development.

Of course, the 'Stepping Stone' publications will be spread around also beyond the invited experts of the expert workshops. In each of the partner countries, local networks of sustainable construction experts have been established through the organisation of national stakeholder meetings. These national experts can provide valuable feedback on the national particularities and sensitivities, so that LEnSE can also take these into account.

In conclusion, the combination of the 'Stepping Stone' publications and the Trans-National Expert Workshops, together with the distribution of information to national networks, clearly demonstrate the importance to the LEnSE partners of the consultation of stakeholders. Their active involvement is a key factor in the success of the project and is guaranteed to bring substantial value to the LEnSE project.


# Identification of sustainability issues for the LEnSE methodology

*Bruno Peuportier*
*Armines - ENSMP*

The main objective of this task 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. At the same time, information was collected on the success factors of these existing assessment methods in Europe.
The result of this reviewing exercise was a long list of possible issues to be included in the LEnSE sustainability assessment methodology. This list needed further refinement to become a sufficiently wide, but practically feasible set of sustainability issues. This work is described further in this Stepping Stone publication.

## Identification of sustainability issues

Sustainability includes environmental, social and economic issues. Due to this very broad scope of our study, many different fields had to be covered.
The partners involved in this work have used a large number of documents, and particularly:

- **Environmental assessment tools:** LCA tools (e.g. LEGEP, ECO-QUANTUM, EQUER, ENVEST), studies regarding external cost, …
- **Building rating systems and existing labels:** GB Tool, BREEAM, LEED, GPR GEBOUW, ECO-BAU, ESCALE, …
- **Cost calculation tools:** LCC calculation, elements method, …
- **Calculation of energy performance:** EN13790, national tools used in building regulation, thermal simulation tools, …
- **Infrastructure tools**
- **Sustainability incentives:** tax credits, subsidies, green certificates, energy certificates, …
- **Existing review reports** (e.g. International Energy Agency)
- **Previous European projects:** PRESCO, CRISP, BEQUEST, ECO-HOUSING, …
- **Existing standards and draft standards:** ISO, CEN, AFNOR, …

This review resulted in the following list of issues (see table below).

| Environmental | Social | Economic |
|---|---|---|
| Environmental risks, e.g.<br>■ climate<br>■ earthquakes<br>■ floods | Safety and security, e.g.<br>■ indoor risks<br>■ burglary | Building life cycle cost, e.g.<br>■ construction<br>■ operation<br>■ maintenance<br>■ dismantling<br>■ land cost |
| Environmental toxicity<br>■ through outdoor air<br>■ through water<br>■ through soil | Health, e.g.<br>■ indoor air quality<br>■ water quality<br>■ electro-magnetic fields | Financing |
| Effects on fauna and flora, e.g.<br>■ acid rain<br>■ eco-toxicity<br>■ eutrophication<br>■ biodiversity and local habitat | Comfort, e.g.<br>■ thermal<br>■ visual<br>■ acoustic<br>■ odour<br>■ micro-climate | External costs, e.g.<br>■ health<br>■ risks<br>■ damages |
| Resources<br>■ energy<br>■ water<br>■ materials<br>■ land use | Well being, e.g.<br>■ amenities<br>■ transport | Local economy, e.g.<br>■ local employment |
| Waste | Functionality, e.g.<br>■ services<br>■ maintenance<br>■ flexibility<br>■ mixing living/working | Adding value, e.g.<br>■ Improving productivity - related to comfort conditions<br>■ increasing site value |
| Environmental management, e.g.<br>■ planning<br>■ data | Social value, e.g.<br>■ equity<br>■ accessibility<br>■ privacy<br>■ working conditions<br>■ affordable housing<br>■ neighbouring properties | |
| | Cultural heritage, e.g.<br>■ architecture<br>■ image<br>■ history | |
| | Ethical issues, e.g.<br>■ ethical purchasing<br>■ probity<br>■ prompt payment | |

**Table 1:** *"long list" of sustainability issues*

The comprehensive list of issues includes information about the geographic scale and possible assessment methods. As an example, this information is given hereunder for some issues.

| Issue | scale | Assessment method(s) |
|---|---|---|
| Preserve raw material resources | G, E, N, L | ■ Exhaust of abiotic resources, CML 2001<br>■ % recycled, renewable, reused materials, ECO-BAU (6.2)<br>■ Eco-devis, SIA 112/1(3.1.1) |
| Save drink water resources | G, E, N, L | ■ Life cycle inventory data bases<br>■ drink water use<br>■ % rain water and water reuse |
| Improve visual comfort | I | ■ daylight factor, SIA 112/1 (1.4.2), software DIAL-Europe ver. 3 (ESTIA), ECO-Bau |
| Improve acoustics comfort | S, I | ■ SIA 112/1 (1.4.6) (reduce noise and vibration indoor and outdoor) |
| Reduce life cycle cost of a new building | S,I | ■ Construction (Swiss elements cost calculation standard)<br>■ land cost<br>■ operation (CEN TC 228)<br>■ maintenance (CEN TC228, preventing maintenance, Management and maintenance plans and schedules to minimise cost and optimise endurance)<br>■ renovation (Ready flexibility and adaptability for reuse)<br>■ end of life (dismantling, recycling, disposal)<br>■ Balance of capital (construction) to revenue (running and refurbishment) costs. |

**Table 2:** *Different scales of sustainability issues and examples of assessment methods*

*G = global*
*E = European*
*R = regional*
*N = national*
*L = local*
*S = site*
*I = indoor*

## Methodology review

Because of the complexity of the concept of sustainable construction, different approaches have been developed for assessing sustainability (or parts of sustainability). In the LEnSE project; two main types of assessment methods regarding sustainable building have been surveyed: life cycle assessment tools (LCA), and global rating systems. LCA tools are more detailed, but they only concern some environmental issues.
Global rating systems may include LCA, which is then complemented with other issues, or simpler assessment methods can be derived from LCA studies on samples. These two methods cover the larger part of the existing assessment tools.

The identification of issues – described above – clearly shows that a multi-criteria assessment is needed to evaluate the sustainability performance of a building. Priorities had to be defined also in the existing tools and schemes to ensure a realistic and practical assessment. Balancing simplicity and completeness has therefore led to various approaches according to local and national contexts.

In the Green Building Tool developed by an international group, weighting different criteria is proposed, considering weighting factors that are fixed at a national level. Each "score" results from a comparison between the studied building and a national reference. For instance, if the greenhouse emissions of the building are reduced by 80% compared to the reference, the score is 5. This scheme allows an international comparison of buildings from different countries.

In the weighted summation approach, the score is calculated by first multiplying each value by its appropriate weight followed by summing of the scores for all criteria. If the scores are measured on different measurement scales, they must be standardized to a common dimensionless unit before weighted summation can be applied.

There are different possibilities in standardization. A first standardization method scales the scores for each criterion according to the relative distance between the origin and the maximum score (distance to target). A second method scales these scores according to their relative position on the interval between the lowest and highest scores. For the GPR Gebouw tool the second procedure is applied to achieve a score between 5.0 and 10.0 for each module.

Most LCA-tools use the normalization step for standardisation. Normalisation consists in transforming indicator values into equivalent person-years.
For instance, if the greenhouse gases emissions related to a building's life cycle are 800 tons of $CO_2$ and the average $CO_2$ emission per person and year is 8 tons (such a reference value may correspond to a regional, national or European level), the normalised value for this building is 100 person-years. Normalisation allows several indicators to be expressed using the same unit.

Other tools are based upon credits. The credits are added and weighting factors may be used to derive the final score of a building, that is expressed by a rating (e.g. from Pass to Excellent in BREEAM).

In the Japanese tool CASBEE, a quality / load ratio is used to assess the performance of a building.
The numerator quality indicator integrates indoor environment quality, quality of service and neighbouring outdoor environment quality. The denominator load indicator accounts for energy, resources, materials and environmental impacts issues.

Aggregating quantitative and qualitative information requires also some attention. Both types of assessment can be expressed by scores or credits, allowing for their combination in a final score. Some methods do not aggregate all issues and keep a multi-criteria "profile", leaving the final rating open according to the user's priorities. This type of questions will be discussed further in the second work package of LEnSE.

## Success factors of assessment methods in Europe

In LEnSE, the aim is to develop a methodology which is accepted by the stakeholders. In order to increase our chances of success, the partners first wanted to understand better why some of the existing tools were successful, and why others have failed. To do this, information has been collected someone a number of the reviewed LCA and rating tools:

- the purpose of the tools (design, policy making, research…),
- the users (designers, constructors, end users…),
- the focus (building, site, neighbourhood…),
- the building types (residential, tertiary…),
- the life cycle phases (design, construction, operation, refurbishment, demolition),
- the number of issues covered,
- the number of users,
- the time / cost needed to perform an assessment, including collection of input data (but excluding regulatory assessments),
- the incentives to use the tool (e.g. subsidies according to the result of the assessment),
- the source of funding (public, private) for the development and maintenance of the tool,
- the scientific credibility of the assessment and certification process.

From this information and from the review presented above, some trends can be derived regarding the strengths, weaknesses, opportunities and threats of the different approaches. These elements are summarized in the SWOT matrices below.

## LCA methods

| Strengths | Weaknesses |
|---|---|
| ■ LCA tools are based upon a standardised methodology (ISO 14 040)<br>■ The results can be checked as far as the assumptions are published<br>■ Validation work exist, e.g. 8 tools have been compared in the PRESCO thematic network, showing a +/- 10% discrepancy on CO2 emissions of the studied cases<br>■ Some tools are user friendly, making the assessment as easy as using simplified methods<br>■ Some tools have a large number of users (e.g. ENVEST : 233 registered users)<br>■ Some tools are linked with economic or social issues (LEGEP with life cycle cost, EQUER with thermal comfort) | ■ LCA concerns only some environmental issues, that can be evaluated in a quantitative way<br>■ Some harmonisation work is still needed among the different tools in Europe<br>■ LCA tools require data that may not be available (e.g. life cycle inventories of locally produced materials, or technical innovation)<br>■ The number of users of LCA tools is generally limited (still more researchers than professionals) |
| **Opportunities** | **Threats** |
| ■ A European project aims to develop a data base including life cycle inventories of building materials (JRC, Ispra)<br>■ LCA is considered in the CEN technical committee in charge of sustainable building (TC 350)<br>■ Incentives could be provided according to environmental performances evaluated using LCA<br>■ Continuing education could allow building professionals to be trained | ■ LCA could be rejected as being too complicated by building professionals<br>■ The cost of an assessment must remain low to ensure the acceptance of a labelling process |

**Table 3:** *SWOT matrix of LCA methods*

## Rating tools

| Strengths | Weaknesses |
|---|---|
| ■ Rating tools include more easily all kind of issues (social, economic, environmental), including qualitative issues<br>■ Rating tools are generally user friendly, the input and output being adapted to both building professionals and clients<br>■ Some rating tools are partly based upon LCA, which may increase their reliability<br>■ Some tools are widely used (e.g. 25,000 accredited LEED professionals in the U.S., over 1,000 BREEAM assessors) | ■ Qualitative evaluation is very difficult to validate: the confidence in the result of a rating tool is sometimes limited<br>■ Many tools exist, which can be very different in their structure and content |
| **Opportunities** | **Threats** |
| ■ An increasing number of owners apply for "green labelled" buildings<br>■ A harmonised methodology can emerge from European research and standardization activities | ■ Labelling low performance buildings reduces the credibility of labelling<br>■ Agreeing on a common qualitative assessment method may be difficult, and the result may depend a lot on the assessor |

**Table 4:** *SWOT matrix of rating tools*

Already in the past, there have been attempts to combine the strengths of both approaches in one method. For example, GPR Gebouw has derived a simplified assessment method from LCA and complemented this with other issues. GB Tool on the other hand has integrated the LCA approach into a more global rating tool. Another approach is to define two levels of detail for an assessment (e.g. application of the Energy performance of Buildings Directive in France). In this method LCA is only used when the simple assessment is not acceptable, for example for special or innovative buildings.
defining.
In any case, developing a user friendly interface is an essential success factor for a software assessment method: data collection and input is much more time consuming than the calculation itself (even using detailed methods). Simplifying data input using default values, building typologies, ratios per $m^2$ etc. is certainly a relevant approach. This requires some validation to check that a sufficient accuracy level is preserved throughout the simplification process.

The work in this subtask was mainly oriented at a review what is already available on the market: which issues are covered, what kind of assessment methods are used, etc. At the same time, a review was made of the factors for success and failure of the existing approaches. The conclusions of the work will be taken forward in the further development of the LEnSE sustainability assessment methodology.



# National stakeholders meeting 2006

*Oliver Kornadt*
*Bauphysikburö Kornadt & Partner*

Communication and Consultation is a mayor part in LEnSE to achieve both integration of knowledge from external experts as well as a broad acceptance for the methodology for a label for environmental, social and economic buildings. Therefore, various channels for communication and consultation are foreseen: the LEnSE web site, the Stepping Stone publications, national stakeholder meetings, transnational expert workshops and an international symposium.

From June to July 2006 the first series of national stakeholder meetings took place. In all eight partner countries national meetings were organized with key stakeholders, including architects, property developers, construction industry and building owners as well as representatives from governments, local authorities, research institutes and universities.

Main purposes of the national stakeholder meetings were to raise the stakeholders' awareness about the LEnSE project, to discuss on relevant issues for a label for environmental, social and economic buildings, and to identify national and regional priority issues taking into account the national situation in each country. This close involvement of key stakeholders should contribute to gaining a wide acceptance for the LEnSE methodology.

A total of 106 participants representing different organisations met during the eight national stakeholder meetings, *Figure 1*. This diverse audience ensured that the different perspectives on sustainable construction were all represented in the discussions.

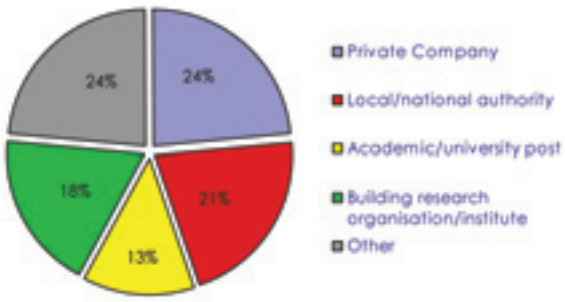



**Figure 1:** *Types of organisations*

Explicit feedback on sustainable construction in general, and the LEnSE objectives in particular, was obtained by means of a questionnaire. The results learned that a very large majority (79%) of the participants feel that the development of a Europe-wide methodology for a sustainability label for buildings is important or even very important for their country, *Figure 2*. They also think that all types of stakeholders should be involved in the development of such a methodology.

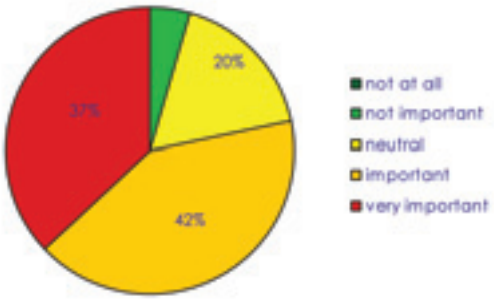



**Figure 2:** *Importance of the methodology of a label in the partner countries*

Surprisingly, although the importance of the development of a sustainability assessment for buildings was deemed to be very high, the willingness to implement it in practice was considered much lower, *Figure 3*. This means that there still exist important barriers between theory and practice. Through the identification of factors for success or failure of existing tools (in WP1), LEnSE hopes to be able to remove some of these barriers and to increase the chances of a successful implementation of the methodology.

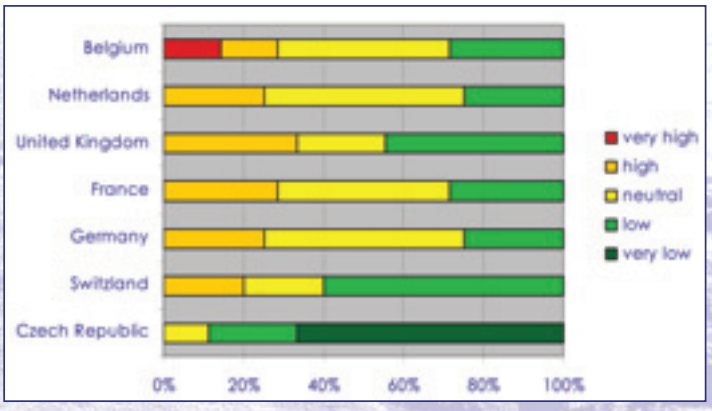



**Figure 3:** *Willingness to implement sustainable construction in practice*

The respondents have identified several benefits of a methodology for a sustainability assessment of buildings. The most important benefit was considered to be the increased sustainability of the buildings (24%), followed by a standardised information for users (21%) and public awareness of the topic (16%), *Figure 4*. This shows that the stakeholders are well aware of the importance of increasing sustainability in buildings, and that it is essential to communicate this in a correct, but comprehensible way to the users of the buildings.

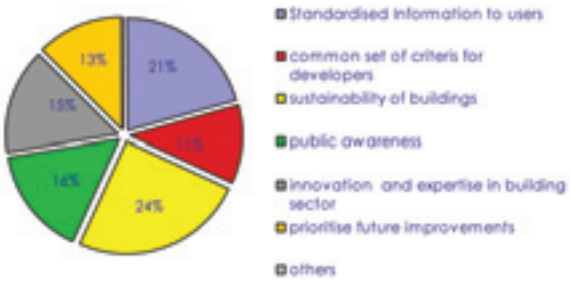



**Figure 4:** *Most important benefits of a sustainability assessment methodology*

In the past, it were mostly the environmental aspects of sustainability which have been considered in building assessment methods. By now, stakeholders have realised however that sustainability should be approached in an integrated way, taking into account also the social and economic dimensions. The respondents of the questionnaire even felt that these themes are even more important at the moment than the environmental topic. This can probably be explained by the fact that most of the participants are already involved in sustainable construction in some way, and they have experienced that a lot of work has already been done on environmental impact of buildings. Therefore, they may feel that the focus should now be more on the social and economic aspects of sustainability.

In general, the national stakeholder meetings have been very successful. Local networks of sustainability stakeholders have been created, thus ensuring a wider spread of the LEnSE activities. The comments and remarks from the stakeholders are very useful and without doubt very helpful for the further development of the methodology. Last but not least the LEnSE partners are convinced that the acceptance for the methodology for the sustainability assessment of buildings is improved by the meetings.



# Scope and boundary setting.

*Richard James Murphy*
*Bill Hillier*
*David O'rorke*
*Imperial College*

## Overview and methodology

The work of Task 1.2 has been carried out partly based on the work of Task 1.1, and partly derived from new analysis and the consultation activities.
The meanings of the words scope and boundary have been interpreted quite separately as follows: scope refers to the scope for development within the current LEnSE project, as constituted and time-tabled; boundary refers to the theoretical technical coverage and limitations of the ultimate methodology itself.
This distinction arises from the very broad potential and requirements for an EU sustainability labelling methodology, and the strictly limited time and resources available within this research project.

The decision was made, however, that the project team would explore and discuss the fullest possible range of issues for a comprehensive methodology, whilst limiting the development work within the project to a key sub-set of issues in order to prove the methodology. This is in accordance with the commitment of the project to be 'representative' and 'practicable'.

The decisions and conclusions reached so far on the appropriate boundaries for a comprehensive, EU-wide sustainability labelling methodology have been elaborated based on a range of work including:

- analysis of 48 existing sustainable construction tools and sustainability assessment tools such as LCA tools,
- guided discussions with experts at a series of national expert meetings,
- analysis of a suite of questionnaires completed at those meetings by 106 specialists from around Europe,
- discussion and individual review work by the experts within the project group.

A further contribution in the continuing work of this task has been to conduct visits and interviews at existing 'model' developments claiming sustainable development credentials. So far two developments in the UK have been analysed, and it is proposed to expand this to all of the project member countries in the following months, and to produce an analytical comparison of the scope and extent of such schemes in due course.

The main work of Task 1.2 involves identifying and defining the boundaries in a number of key 'dimensions'

of a comprehensive assessment methodology for buildings. A further crucial issue to be addressed in developing a successful system is the cost and time required, and acceptable to the user, in order to achieve a full assessment.
Below are summarised the current state of boundary definitions and the project decisions on scoping as they directly affect the methodology development work now underway under LEnSE work package 2.

## Building type

What was made clear in the discussions with experts is that simplicity would be a key characteristic in any successful system; both for those taking part and for those seeking to interpret the results. This suggests that wherever possible the minimum number of classes and other sub-divisions possible should be aimed for.

Three classes have been adopted for the parameter of building type: Residential, Office & Commercial, and Industrial. It will be immediately apparent that sub-divisions of these classes exist, for example social and sheltered accommodation within housing, public and private within commercial premises or storage and production within industrial premises, etc. However, the advantage of a simpler approach is felt to be so significant that it is worth seeking a methodology that can be made to work within these broad classes.
Clearly, where either the best methodology or the clear interpretation of results depends crucially on specificity, then this decision may be re-visited and modified.
At present, however, we have assumed a working hypothesis that no more than three building classes will be applied.

## Life-cycle stage

There are five clearly distinct phases in the life-cycle of a building: Planning/Design, Construction, Occupation/ Maintenance, Renovation/Refurbishment and End of life. Each of these stages involves a different set of actors and, to some extent, a different set of sustainability issues. However, the basis for the growth of holistic assessment methods, exemplified by LCA, is that improvement in one type of impact or in one part of the life-cycle may be at the cost of a more significant increase in impacts elsewhere. This is combated by including the widest possible range of impacts over the life-cycle from 'cradle to grave' (from the extraction of raw materials to their final fate as wastes or as reused materials).
The growth in the application of Life Cycle Costing (LCC) is directed at minimising the life-cycle economic cost of buildings, which is analogous to the life-cycle approach to environmental impacts in LCA. It is directed at striking the optimum balance between capital costs (design and construction) and revenue costs (use and maintenance) with more or less weight given to eventual disposal costs.
This approach has become popular with governmental and other bodies which are responsible for a building over its whole life-cycle. For speculative and other private constructions, the problem is one of how to encourage and reward apparently altruistic activity earlier in the life-cycle, for example to design and build for cheaper running and ease of modification / maintenance / disposal / recycling.
To a very large extent, the market is capable of doing this, through preferential sales/leasing and a price premium on new buildings with the lowest whole-life

cost. However, this depends on the availability of a clear and reliable means of identifying such buildings. This will therefore be a key role of any effective sustainability labelling scheme.
The decision has therefore been made that the LEnSE methodology must be able to encompass the whole life-cycle of a building, from design to disposal. It must also address environmental and economic issues in a coordinated way over the whole life-cycle.
This boundary has the consequence of requiring that a comprehensive methodology must be applicable to both new constructions and to existing buildings. Given the much wider availability of tools and research for issues in new-build rather than existing structures and given the spread of experience within the project, the initial development of the LEnSE methodology will be based on new constructions, but recognising the future requirement for expansion to cover existing structures.

## Scale of application

This refers to the scale at which a methodology and label is applied (unit or flat, building, building plus its immediate surroundings, whole development, planning area, etc.) and this parameter is distinct from the area of relevance for any label itself (this is discussed further below).
In terms of the scale of application of the methodology, it was clear that the single building or structure was always likely to be the basic unit at which any label would be applied, although there is a wide range of issues that are only relevant and controllable at a wider scale.
A comprehensive assessment scheme will, therefore, have to address broader-scale issues, such as access to transport links, even though the final assessment is likely always to be applied at the building scale.
The building and its associated site is therefore the boundary chosen for development and testing of the methodology within LEnSE, but where broader scale issues arise, these may be taken into account if they are deemed to be relevant - for example, choosing a building site close to public transport provisions.

## Area of relevance of the methodology

It is clear that some issues, such as climate change, are globally relevant. Others, particularly environmental hazards (such as earthquake, landslip, flood, wildfire, etc.) may be of great but purely local importance. Furthermore, the level of importance of some ubiquitous issues varies greatly between countries within the EU, based on factors such as the degree to which those issues have already been addressed.
An example might be the generation, disposal and recycling of waste, where performance varies considerably between and even within countries.
A successful methodology will therefore be applicable EU-wide, but flexible enough to allow for crucial local/regional issues to be included, and to allow for national and regional best practice to be recognised as well as EU best practice encouraged.

## Actors addressed by a sustainability assessment

If an assessment is intended purely to classify and identify the sustainability characteristics of buildings, then the type of person or body requesting the assessment may be irrelevant. If, however, one of the aims of the assessment scheme is to inform and to guide towards best practice, then different actors may be influenced in very different ways. For example, architects, designers and specifiers will not want to produce buildings that subsequently achieve a poor assessment result, so that they will inevitably seek some means of predicting a final score, and effectively use the assessment criteria as a

'design guide'. Equally, users and refurbishers will not want to carry out alterations that possibly lower the result and therefore resale value of their property.

It is clear that tailoring the exact content, context (in terms of supporting information and guidance) and presentation of an assessment result will determine how useful its information is and how it is used for each of these groups. At the stage of development being addressed by LEnSE however, that of developing a comprehensive methodology towards an eventual label, it is not possible or necessary to identify and target specific actors in the building life-cycle.
We will therefore identify and discuss points in the methodology development where these issues are relevant, but will proceed at this stage without addressing specific actors.

## Costs of performing an assessment

In designing a practicable methodology that is likely to be widely used, it is crucial to understand and recognise the level of work and cost that will be acceptable to the user community. Two aspects of cost need to be considered; firstly the cost of the assessment process, and secondly any additional construction or refurbishment costs associated with sustainable construction. The administrative costs were found to have been minimised for the specialist developers of sustainable buildings, since they had incorporated recording systems and employed assessors as part of their everyday activities. This suggests that as sustainable construction enters the mainstream, the extent and level of sophistication in assessments will be able to increase as costs are reduced in this way.

For the general run of current constructions, the survey of experts suggested that at least 10% of the budget for a new building should be spent on sustainability considerations. The other half stated that this proportion should be under 7%, with responses ranging from less than 1% to 6%. The opinions of the stakeholders were similar for buildings under renovation, though more of them - 65% - stated that the proportion of the budget should be 10% or higher. Again, the other responses varied from less than 1% to 8%.
These opinions match reasonably closely with the actual spends of the developers at the case study sites, but it was made clear by the specialist developers that the effectiveness of the spend on sustainability measures is dependant on the size of the building or the development. There is a danger, therefore, of pricing small developments out of the scheme, and unfairly (and perhaps inappropriately) favouring large-scale developments.

The conclusion therefore is that the total costs of administering and of complying with an assessment scheme must be limited to 10% as a maximum of the building costs. In terms of the staff time involved in completing an assessment, the consensus appeared to be that no more than 2 man-days could be demanded, and that for highly paid and time-pressured actors, such as architects, that no more than half a day could be demanded. The time for completion rather than the costs of complying are therefore likely to be the most critical factor in determining the scope of the methodology developed.
Achieving this level of rapidity in assessment depends greatly on the level of supporting information that is generally available (such as through eco-profiles, green guides, etc.) and on the ingenuity and succinctness of the methodology itself.

## Range of sustainability issues to be included

The work of task 1.1 resulted in a 'long list' of 120 sustainability issues that could potentially be addressed in a sustainability assessment for buildings. Based on the survey of experts, the maximum number of criteria that it was believed should be included was 10. The frequency analysis of existing sustainability assessment methods found that 52% have ten or less criteria. However, several well established methods cover more specific criteria than this (BREEAM covers 51, LEED covers 32 criteria and HK BEAM covers 43). The process of reducing the long list will be finalised following some basic considerations:

- Some issues can be omitted as they are largely duplicated in more than one category
- Other issues are outside the boundary determined for a building assessment scheme
- A number of issues are important for a comprehensive sustainability assessment scheme but cannot be properly addressed within the limited LEnSE project.

This work should result in the LEnSE list of sustainability issues, which will be taken forward to work package 2 for the actual development of the methodology. A further distinction can be made between these issues:

- Issues that are taken into account within LEnSE but have been adequately developed in existing schemes
- Issues for detailed development work within WP 2

It was decided that particular weight should be given to issues that are under represented or under developed within existing schemes.

Also, to ensure an even balance between economic, social and environmental aspects of sustainability, approximately 3 of the 10 themes should be taken for each. Of the 48 tools in the frequency analysis, almost all (85%) measure at least one environmental aspect of sustainability and 75% measure some aspect of social sustainability. Far fewer (35%) include economic issues in their assessment, so this is an under-developed area. Using the frequency analysis of existing schemes and the results of the questionnaire which asked the 106 pan-European specialists to prioritise the long list of sustainability issues the general list below was obtained:

## Environmental issues

**Resource use:** Some measure of this is included in almost 80% of existing sustainability assessments methods and 55% of the pan-European specialists ranked it as either the most or second most important environmental sustainability issue. Resource use includes some measure of raw materials, primary energy, water or land use.

**Climate change:** This was cited by 45% of the specialists as the most important aspect of environmental sustainability and is included in over 70% of the existing methods from the frequency analysis. It includes aspects of greenhouse gas emissions, energy use and stratospheric ozone depletion.

**Biodiversity:** This was ranked as the first, second or third most important aspect of environmental sustainability by the specialists and is also measured by 58% of the existing tools.

**Air quality:** Ranked as the most, or second most, important aspect of environmental sustainability by over 40% of the key stakeholders, air quality is also included in 65% of the existing tools.

## Social issues

**Well being:** This was ranked as most or second most important of the social topics by 36% of national

stakeholders meeting attendees, and is also measured by 65% of the existing schemes. This includes access to amenities, public transport and pedestrian and cycling routes, as well as the provision of a sense of place.

**User comfort:** This was ranked first by a third of the stakeholders and is included in almost 60% of the schemes in the frequency analysis. It involves various issues of indoor air quality and indoor thermal, visual and acoustic comfort.

**Occupants' health:** This was ranked in the top three aspects of social sustainability by 84% of questionnaire respondents and includes water quality, noise, vibrations, the use of hazardous materials and indoor air quality.

In addition, security and safety of a development – including provision against crime and reduction of hazardous features – is included in over a quarter of the existing schemes analysed and was ranked as the first, second or third most important issue of social sustainability in over half the questionnaire responses.

Similarly, the social value of the development – which includes the provision of social housing, reducing negative impacts for neighbouring properties and encouraging integration and participation – was ranked first, second or third by over a third of the key stakeholders.

## Economic issues

Because only 16 of the existing schemes measure any aspect of economic sustainability, the two statistical approaches could not be applied for this aspect of sustainability. Yet several themes can still be highlighted as priorities:

**Life cycle costing:** This was considered most or second most important of the economic themes by about 80% of the specialists. It was included in only 13% of the existing schemes that were analysed, though this is a third of the issues that assess any aspect of economic sustainability.

**Support for the local economy:** The most frequent issue in the analysis of existing schemes – particularly local employment opportunities and the use of locally produced materials – support for the local economy is analysed by 23% of the 48 tools. About a third of specialists ranked it as their first, second or third priority, and only about 8% as their top priority.

**Externalities:** This covers issues such as minimising health costs for the local community and reducing any detrimental effects on surrounding historical buildings., yet it This was ranked first, second or third by over three-quarters of the questionnaire respondents, though is addressed by only one of the existing tools.

Of the other themes considered part of economic sustainability, construction financing was ranked first, second or third by 43% of specialists and is included in three of the existing tools.

There are possible means by which certain measures can act as surrogates or indicators for a wider range of associated issues. For example, the total consumption of fossil fuels has often been found in LCAs to be a reasonable indicator of (to be associated with) total global warming score, acidification impacts and resource depletion. If a limit of 10 indicators is to be achieved, then it is likely that finding key reliable indicators that can each stand for or indicate a wider range of associated issues will be a crucial part of the future work in LEnSE.

# Proposed framework for the LEnSE methodology

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## Introduction

The first phase of the LEnSE project focused on the identification of issues to be included in the proposed methodology, definition of the scope of the identified issues and the boundary of the method. The next phase of the project(WP2) concerns the actual development of the LEnSE sustainability assessment methodology.

There are four tasks in work package 2, these are;

1. Developing a framework and format for LEnSE
2. Defining the assessment content of the method
3. Development of a prototype assessment tool
4. Testing of the methodology

As this publication serves as a Stepping Stone between the first and second work packages, this section of the publication concentrates predominantly on the first of the above tasks, the structure and format of the method. The remaining work under this package follows on from this and is described in more detail in the last article 'Outlook'.

## Objectives

The ultimate objective of LEnSE is the development of an EU wide methodology that can assess the overall

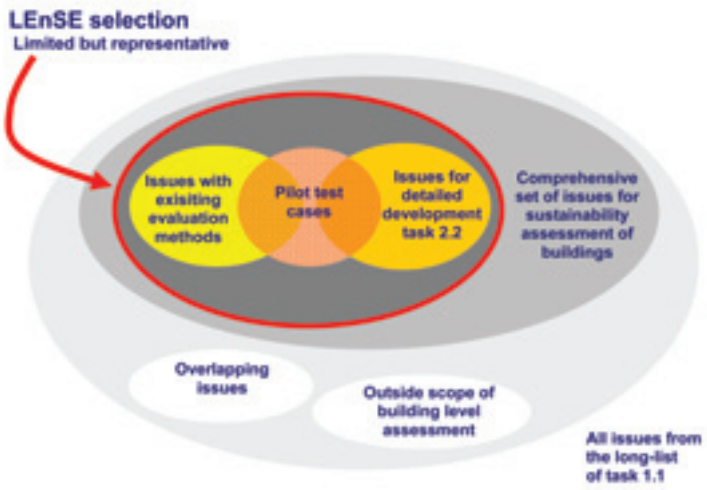


**Figure 1:** *Illustration of the concept of narrowing down from the long-list of issues to a workable set of assessment criteria*

sustainability performance of existing buildings, major renovation schemes and plans for new buildings. Such a method should allow for future labelling or certification of buildings.

Based on the findings from work package 1, summarised earlier in this publication, this second phase of the work will develop a method that meets this objective. Development of this framework will enable the project team to test the viability and functionality of the proposed structure and to finally pilot a sample of the limited but representative range of key issues, referred to as 'assessment criteria'. Figure 1 illustrates the process of reducing from all identified sustainability issues in WP1 towards a limited but workable set of issues within LEnSE.

## Proposed structure & framework

Research from work package 1 has highlighted that there are few, if any, building assessment methodologies that combine and address environmental, social and economic sustainability issues. It is felt that this is partly due to the current prioritisation of environmental issues and the relatively large body of existing research that focuses on the building impacts related to them.
In addition, marrying these three pillars of sustainability in a way that ensures successful application and meaningful progress, whilst encouraging the necessary support from the various actors involved in the process, is not an easy goal to achieve.

In particular, defining social impacts in respect to buildings, and setting measurables and benchmarks that

are meaningful and achievable for such issues represents a difficult task. Doing so on an EU wide basis, considering the diversity of cultures, politics, geography and climate, presents any proposed methodology with its most important challenge.

With this in mind, and in parallel with maintaining the necessary fundamentals that define a credible and workable assessment methodology that compares on a like for like basis, the structure of LEnSE will be based on the principles outlined below. These initial principles are currently being utilised to develop the structure of LEnSE, the results of which will be detailed in a report to be finalised by the end of November 2006.

## Synchronisation with existing methods

The research and findings from work package 1 have highlighted that there already exist a large number of methodologies. Each of these is relevant to the country and sector it was developed for and covers a different number and type of sustainability issues. In addition, there are a number of initiatives at the European level on development of standards relevant to LEnSE's area of work in particular, ISO TC59 SC17 'Sustainability in building construction' and CEN TC350 'Sustainability of Construction Works'.

It is the project team's aim to avoid LEnSE being perceived as "just another Eco-label" or as a label that undermines the progress achieved by existing national and international methods and ongoing development of standards in this field. LEnSE will seek to avoid replicating research and performance benchmarks where adequate and suitable indices already exist. This principle serves the dual purpose of ensuring that the label recognises the degree to which the issues it covers vary between European nations in terms of applicability, and the level to which they have already been developed.

To achieve this aim and future proof the method against this perception a core principle of LEnSE will be;

1. To facilitate the adoption of the methodology, by an organisation, to develop – from new – a LEnSE affiliated tool for their country.
2. To enable an organisation to align and affiliate their existing method(s) to the content and principles of the LEnSE methodology.

In addition, the structure and content of the methodology will define scale of application, as outlined in the article on 'Scope and boundary setting', including the issues assessed and performance benchmarks adopted. The methodology will not necessarily define in detail how performance against each benchmark is demonstrated as the information available and required for this variable is likely to vary from country to country. This will depend on the approach adopted by any existing methods, the context of the building sector and stage at which each county is at in terms of addressing each issue.

## The pan-European relevance of assessment issues

There are two possible routes that the structure of the method could adopt in the development of European wide assessment indices. The first is to cover only those issues which have a pan European relevance.
This would involve placing to one side country and regional specific priorities that maybe of particular importance within one country, but, are of less relevance in another. The second option is to consider the regional differences and account for them in the methodology.

In this respect the onus of the work carried out in work package 2 will be on the development of the issues which have a pan European relevance. Despite this, it is felt that any practical methodology will need to recognise at some level the priorities, limitations and opportunities within a particular country or region.

Whilst the scale of application and scope of issues should adopt a simple approach to guarantee a successful system, the aim is to avoid a label that is standardised to the point that it ignores country specific issues. Being forced to default to the lowest common denominator, in this respect, will miss an opportunity to recognise and encourage sustainable buildings.
This principle serves to reinforce the point outlined previously in this document; that the methodology should focus on encouraging continuous improvement as well as, or rather than, solely enforcing, or measuring, international standards.

The label will therefore categorise and develop assessment issues as follows:

1. Mandatory pan European issues and assessment requirements.
2. Mandatory pan European issues with country specific assessment requirements.

For example, climate change expressed in terms of $CO_2$ emissions is a globalised issue which can be

predicted and benchmarked in terms of a building's $CO_2/m^2$. In this case, the LEnSE methodology could set a standard pan European means of benchmarking this issue. The same rationale applies for many of the common environmental issues found in most traditional environmental assessment methodologies. If one takes the concept of social value of buildings this is a key issue, which is of relevance on a pan European basis, but which may have differing expectations and understanding across Europe. The assessment requirements for such issues will require greater consideration in terms of developing pan European requirements and may require tailoring to individual country circumstances.

In addition to this, the structure and content of the methodology will need to explore the relevance of certain issues to particular countries e.g. earthquakes, flooding and wildfire. A further principle of the method may therefore be an element of selection or de-selection of specific issues by individual member states in accordance with their priorities. The adoption of this principle should not undermine the basic idea of a label that seeks to compare buildings on a level playing field across the EU. As a result inclusion of optional issues needs to be governed by the requirement to assess the same number of issues in each country, as well as limiting the potential number of 'opt out' issues.

## Categorisation and weighting of the assessment issues

The purpose of categorising issues, other than for presentational or functional purposes, is to facilitate the weighting of each category or issue to reflect their relative importance in the overall method.

Prior to deciding how to categorise and weight the issues it is important to consider whether the methodology and its assessment issues need to be weighted. The general project team consensus in this respect is that some form of weighting and categorisation is required and should be adopted in LEnSE.

This is felt necessary in order to recognise the importance of the issues relative to one another and to ensure clear and robust presentation of the results. In addition, the ability for each country or region to adjust the weightings, albeit to a limited degree, could prove to be a necessary requirement of the methodology. This will be explored further in work package 2.

## Potential categorisation

There are a number of ways that weightings can be applied and issues categorised. Briefly these include:

1. By sustainability impact; i.e. environment, social and economic groupings and weightings;
2. By common issues and impacts, i.e. security and safety, social value, climate change, resource use and life cycle costing;
3. By individual assessment issue;
4. By a combination of the above.

Feedback from work package 1 identified that separating the sustainability issues strictly according to the three categories is useful when developing the methodology, but may be limiting and confusing to interpret when presenting results. In addition, there is extensive overlap between the three categories, for example access to public transport has both social and environmental benefits; use of locally sourced materials brings both environmental and economic benefits.

Striking an even balance between economic, social and environmental aspects, while minimising the number of issues we address to ensure an efficient and practical methodology, could prove constraining and detrimental to the methodology's objective. It is therefore not felt appropriate to weight and categorise issues in this way.

The preferred approach at this stage is to categorise and weight according to the groups of impacts, as identified and recommended in work package 1. The exact means of achieving this will be decided during work package 2 and will be reviewed following the piloting phase.

## Determining relevant weightings

In addition to deciding on the format of categories and weightings an appropriate means of determining the weightings will need to be defined, if not necessarily implemented at this stage.

It is envisaged that the weightings in LEnSE will be EU wide consensus based, particularly for pan European and global issues such as energy consumption. It is also felt that there may need to be an element of 'fine tuning' of weightings according to member state priorities and opportunities. This would be particularly appropriate if the method offers the opportunity for member states to select or de-select a limited number of assessment issues.

## Assessment output

It is understood that the majority of stakeholders would like to see a single, graded scale measure representing overall building performance. Such a score is easy for building users to interpret and understand but is also one which clients, designers and specifiers can work with. In addition to a single overall score there may be a need for some actors or stakeholders to measure and interpret building performance against particular issue categories.

With this in mind, the current proposal is that performance against the LEnSE methodology will be represented by a single score on a graded scale. This is similar to the approach adopted by existing labelling schemes such as the EU Energy labelling scheme for white goods *(figure 2)* and the European DisplayTM Campaign posters. In addition to presenting a single score the method will highlight, using the same scale, the building's individual issue category performance.

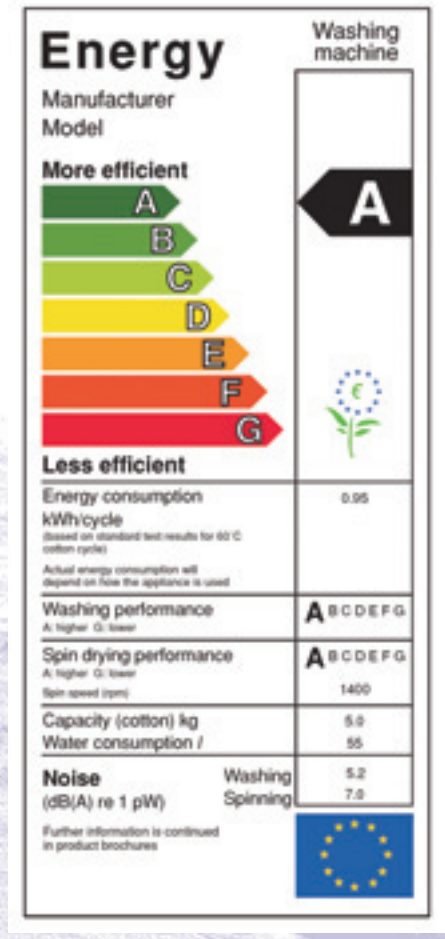


**Figure 2:** *Example of the EU Energy label*

## LEnSE Assessors

The scope of this project is to develop the framework and define the content of the methodology but not to fully develop the label itself and in some respects, decisions as to who will apply such a label and how they will do so are not critical at this time. Nonetheless, it is important to understand and define in principle the proposed type and competency of the users of such a label at an early stage. Doing this will help define how the methodology will be applied and may influence the structure and content of the assessment issues developed.

Whilst the ultimate aim of the methdology is to assess buildings there is also a didactic role for such a labelling scheme. That is a role where those applying the methodology and assessing performance also have the opportunity to inform and improve the design and operations of buildings.

To fulfil both roles an individual must be able to apply and interpret the requirements correctly and produce an assessment that is consistent with the methodological requirements and other LEnSE assessed buildings. This calls for technically minded individuals competent in the application of the methodology and assessment of the issues. Ensuring this is the case requires that potential LEnSE assessors receive formal training, and potentially evaluation, in the application of the method and understanding of its technical content. This could be demonstrated via individuals with qualifications in an existing method that has since become LEnSE affiliated and compliant or, where the 'owner' of a LEnSE affiliated assessment methodology offers such training to potential future assessors.

## Length of assessment

The length of time and effort required to complete any voluntary building assessment method has a large influence over the successful uptake of such methods. Length of assessment also dictates to a large degree the final scope and content of the method. A lengthy, costly and bureaucratic label will not be favoured by its target audience and, if there is not adequate buy-in from the key stakeholders, it will fail to fulfil its aim.

The need to balance this requirement next to the need to ensure that LEnSE is robust and meaningful is the determining factor in deciding the optimal length of a LEnSE assessment. It is the project team's view that, assuming a competent assessor has collated all the necessary building information, producing a final LEnSE rating should take no longer than two or three days. The final framework and content of the method will therefore work within this timescale.



# Outlook

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## Defining the final framework and content of the method

The previous section outlined the principles that will be adopted by the proposed framework for the methodology. These principles, along with the finding of sub task 1.2, are currently being utilised to steer the development of the framework for the methodology. The results of this will be outlined in report deliverable 2.1, due to be finalised by the end of November 2006.

In addition to developing the framework, the next project deliverable will define the content of the methodology, i.e. the building assessment criteria. This task will utilise the list of issues identified in work package 1 to create a set of assessment criteria representative of the range of key environmental, social and economic issues.

To reinforce the findings from work package 1 the content of the method will focus on ten key areas. It may be the case that each of these areas is broken down further into a number of sub issues to ensure robust coverage of each category however, where possible the method will utilise indicators that represent a wide range of associated issues. This will help limit the number of sub-issues and associated requirements, which can add to the bureaucracy of a methodology and length of assessment.

On completion of deliverable 2.1 the project team will select a limited number of issues to develop into full criterion for testing the methodology. In selecting these issues consideration will be given to the data collection and assessment requirements, accounting for the differences which need to be considered at a national, regional and local level.

Development of the content of the method will continue up to the start of the piloting phase and, to account for feedback from the pilots, throughout the remainder of the project.

## Testing of the methodology

Piloting of the framework and content of the method will take place in the latter half of the project. This will be carried out using a prototype assessment tool developed specifically for LEnSE. Whilst the scale of LEnSE will encompass the whole building life cycle, its application at the testing stage will concentrate predominantly on new building type design, specifically residential and commercial. Feedback from the piloting process will be analysed to identify some of the potential differences in application that exist between the life cycle stages. This analysis will be used to establish guidelines to steer the expansion of the methodology to cover the existing buildings (in use and maintenance) stage.

To account for this, and feedback from the piloting phase as a whole, deliverable 2.1 will be re-visited and updated in the latter stages of the project. In addition, feedback on the pilots will be presented in the third and final thematic stepping stone publication due for publication in October 2007 and at the second national stakeholders meeting.

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LEnSE

# Methodology Development towards a Label for Environmental, Social and Economic Buildings