Building construction/renovation: Procura+ Key Criteria - Extended version

1 Introduction

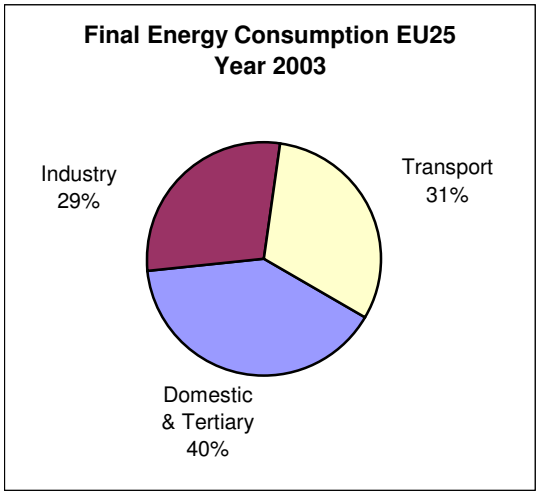
For most public authorities building construction and renovation works represent a major share of annual expenditure – in some cases over 50%. Additionally, the running costs of publicly owned buildings, including heating/cooling, electricity, waste, hot and cold water, are a significant drain on public finances. Furthermore a large proportion of all construction works are publicly financed, with procurers therefore able to exert considerable influence on the market as a whole.

1.1. Key environmental/social impacts

Impact		Approach
• The consumption of energy for heating, cooling, ventilation, hot water, and electricity, and resulting CO_2 emissions	→	Ensure high energy efficiency standards Encourage the use of localised[1] renewable energy sources (RES)
• The consumption of natural resources	→	Encourage the use of sustainably harvested resources
• Emission of toxic substances during the production or disposal of building materials leading to air and water pollution	→	Encourage the use of non-toxic building materials
• Negative health impacts on building users due to building materials containing toxic substances	→	Encourage the use of non-toxic building materials

[1] "Localised RES" means RES generating capacity within the building site itself (e.g. solar panels, biomass boilers, wind turbines etc.)

Figure 1: Energy & transport in figures, European Commission, Directorate-General for Energy and Transport, 2005



Buildings are of critical importance for sustainable development in Europe. The environmental and social impacts of construction works are many and complicated. For the purposes of simplicity, and focusing attention on the most important aspects, the Procura+ key criteria focus on energy performance and the use of sustainable building materials, though some further ideas are also presented in section 3.

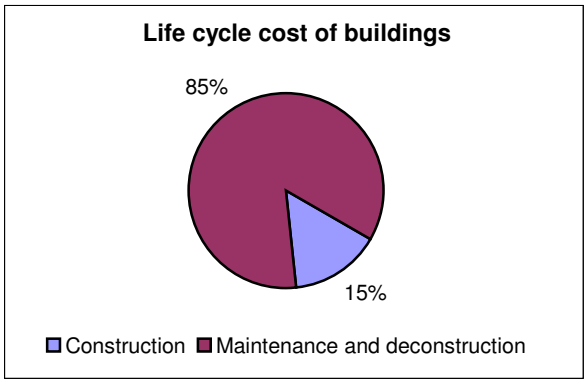


Figure 2: Life cycle cost of buildings, IFZ

1.1.1 Energy

The largest material and energy streams are to be found in the building sector. Buildings are the major consumers of energy in Europe, around 40% of final energy consumption in the European Community (EC) takes place in the building sector. The main areas of energy consumption are heating, cooling, ventilation, hot water supply and electricity. When approaching green building design, the principle focus understandably tends to be on the energy efficiency of the building. EC research has indicated that by improving energy efficiency, carbon emissions from buildings and related energy costs could be reduced by 42%. Enormous potential for improving energy savings exists in the renewal of the existing building stock, so the main focus for energy relevant measures should be on renovation work.

1.1.2 Sustainable building materials

Whilst the energy performance of a building during use remains the most significant aspect in terms of sustainability, the choice of materials used in construction has a substantial influence on environmental impact – the primary energy content of the materials themselves (from extraction, through processing, transportation and disposal), the use of toxic or harmful substances, and the consumption of non-renewable resources.

Construction activities consume more raw materials by weight (about 50%) than any other industrial sector and consequently construction and demolition activities also cause the largest waste streams (between 40 and 50%), although the majority of this is recyclable. Furthermore in Europe, over 20,000 different materials and products are used to construct buildings and infrastructure, which means high demands on stock flow and waste management.

1.2. Procurement considerations

In terms of procurement the construction sector is extremely complex both in procedural terms, as there is usually competitive tendering for the architectural design, the construction work, and the building services (heating, cooling, ventilation, hot water supply, electricity) and in terms of the variety of materials and services procured.

The table below outlines a typical process for construction work in a European public authority, however, the following scheme may vary in terms of the exact stages gone through. This is significant as the level of technical detail about the final structure, and hence the accuracy of any calculation of energy performance or the use of sustainable building materials, increases from stage to stage. The number of different services tendered can also vary (architect, construction company, building services) and thus the opportunities for inserting demands into tendering procedures will also differ from case to case.

1. Project development	Probably this stage is one of the most important phases in the building process. All project stages are based on specifications made in this phase, so here we can find the highest potential for sustainable building design. The public authority has to develop specifications for: ▪ Choice of site, orientation ▪ Costs ▪ Size (e.g. room allocation plans) ▪ Design – construction (e.g. light weight or solid construction) ▪ Materials to be used ▪ Standards for the energy performance of the building if possible (e.g. benchmarks for heating and cooling, renewable energy sources for the building services)
2. Preliminary design / architects' competition	▪ Architects' competition – competitive tendering to select the architect to carry out design work[2] ▪ Revised preliminary design, including preliminary selection of superstructure, building materials, constructions
3. Submission planning	Final design for submission to building authority for planning permission (determination of superstructure, building materials, constructions)
4. Implementation planning	Final selection of superstructure, building materials, constructions, systems for building services as the base for tendering for the construction work.
5. Construction work and implementation of building services	Selection of construction firm through competitive tendering to carry out the construction work according to the implementation plan. This should include clear quality assurance measures for monitoring energy and ecological performance.

[2] Competitive tendering may not always be carried out to select the architect, this may well depend on the size of the project

Competitive tendering has a substantial influence on how environmental performance standards can be applied in construction projects, and in particular how competitive tendering can be used to achieve the best possible offer.

At the stage of the invitation to tender for the construction work some major decisions, which are relevant for the environmental performance of a building (e.g. choice of superstructure and constructions), have (or should have) already been taken. This implies that in contrast to other procurement fields, major decisions are taken outside the direct competitive procurement process itself. For this reason, it is important to ensure that environmental considerations are included in the specifications for the design. These specifications can be used either as the basis for architect competitions or if no competition is being held, as direct targets for the design which have to be fulfilled by the architect. While in some countries this is already a common practice, in other countries it is still a hurdle to set ecological targets for the architect, as it is difficult in the preliminary design phase to calculate environmental performance with any degree of accuracy.

1.3. Cost implications

The procurement of energy efficient materials and/or services by public bodies has the potential to become a major driving force for their market penetration.

To provide concrete figures on the savings achievable as result of carrying out the energy efficiency improvements outlined in the guidelines is a difficult task for a number of reasons. Firstly, the huge number of variables which influence the cost of building work makes a comparison between the more and the less ecologically sound models very complex. Secondly, both energy prices and the costs of the necessary energy saving measures differ considerably across Europe, making generalisations unrepresentative. Furthermore, it is important to also consider how energy prices will develop over time, as energy saving measures will of course prove financially beneficial over the entire life-span of the building.

In general, over the life-span of a building, running and maintenance costs will exceed the initial costs of construction by far . Thus, more action should be undertaken to make life-cycle costing a standard procedure on which decisions relating to construction work are based. The whole life-cycle costing should include every cost incurred in relation to the facility from inception to disposal, including, for example, operation, energy, maintenance, cleaning, but also in-house resources, the economical life-span of each part of the facility and consultancy fees.

1.4. European framework for sustainable construction

1.4.1 Energy

- **European Directive 2002/91/EC on the Energy Performance of Buildings**

The European Directive 2002/91/EC on the Energy Performance of Buildings (EPBD – included in this CD-ROM)requires all member states to develop calculation procedures for determining energy performance in accordance with a number of requirements determined by the Directive. They will also have to set minimum energy performance standards for both new buildings and major renovations with a total useful floor area over 1000 m2. At present, there are major differences in the overall approach used in member states for determining the energy performance level of a building regarding which energy flows are included,

calculation procedures itself and format of output data (e.g. net energy or gross energy, heat energy requirement, final energy or primary energy).

Each country is free to select the method for calculating energy performance and the standards set. As such there will be no single methodology, no indicator and no performance benchmark for energy performance applicable in all countries. Furthermore, although all Member States were required to implement this Directive by January 4th, 2006, in the majority of cases this has not been achieved, and full transposition is unlikely to occur for some time.

- **CEN - Comité Europeén de Normalisation[3]**

CEN (Comité Europeén de Normalisation) is working on the harmonisation of calculation procedures, however this is progressing slowly, and will unfortunately be too late feed in to the transposition of the EPBD into national regulations. For residential buildings EN 832 is state of the art, but most of the standards related to the EPBD are in most cases only proposals for standards (pre standards). A document further explaining the relationship between the EPBD and CEN is included in this CD-ROM, entitled N36 Umbrella Document.

1.4.2 Sustainable building materials

- **Communication from the Commission of 11 February 2004 "Towards a thematic strategy on the urban environment" [COM(2004) 60 - Official Journal C 98 of 23.04.2004][4]**

The main issues covered by the Communication (included in this CD-ROM) are sustainable urban management, sustainable urban transport, sustainable construction and sustainable urban design. The development of a common methodology for evaluating the overall sustainability of buildings and the built environment is the main target of this thematic strategy. Aspects such as the life cycle assessment of buildings and the development of indicators for life-cycle costs are part of this strategy. The commission obliges all Member States to develop programmes for the implementation of sustainable construction. The Communication focuses not only on energy related aspects, such as increasing the renovation rate, but also on labelling of building products and strategies for the prevention and recycling of waste.

- **CEN - Comité Europeén de Normalisation**

Beyond developing standards for energy performance, CEN is working on the development of:

- a standard for overall environmental performance of buildings,
- a horizontal standard for Environmental Product Declarations (EPD) for building products/materials.

- **ISO - International Organization for Standardization[5]**

The International Organization for Standardization (ISO) is also working on developing standards related to sustainable construction. In particular ISO/TC 59: Developing standards for sustainability in building constructions for buildings and constructed assets:

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[3] www.cenorm.be/cenorm/index.htm

[4] europa.eu/scadplus/leg/en/lvb/l28152.htm

[5] www.iso.org/iso/en/ISOOnline.frontpage

- Environmental declaration of building products
- Framework for assessment of environmental performance of buildings and constructed assets
- Terminology
- Sustainability indicators
- General Principles
- Buildings and construction assets – Service life planning – Part 6: Guidelines for considering environmental impacts

1.4.3 Setting universal standards within the current European framework

As with all other products, the initial aim within Procura+ was to develop simple, universally applicable standards/criteria which any European public authority could simply insert into tendering documents. Unfortunately, given the complexity of the "product group" and the differing national legislative frameworks, such an approach has not been possible, and an adaptable set of recommendations or guidelines has instead been produced.

There are five principle hurdles to the development of universally applicable standards for sustainable construction:

1. Differing national calculation methods and standards for energy

As noted above, the EPBD states that all Member States must put in place methodologies for calculating the energy performance of all new buildings and major renovation works, and to set minimum energy performance standards.

However, the Member States themselves are responsible for determining what the indicators and calculation methods for determining energy performance should be, and to set their own minimum standards. Given that setting universal criteria clearly requires specifying indicators and calculation methods this makes a Europe-wide standard impossible.

Furthermore the implementation of the EPBD in national/regional law has not started in most of the European member states (even though EPBD requirements should already have been transferred into national law since January 2006).

2. Different construction procedures

The procedures followed for new constructions and major renovations differ significantly between and even within countries, and also for differing sizes of construction projects. As such it is difficult to specify precisely where in the construction procedure environmental standards should be inserted, and the level of detail possible to use

3. Different climatic zones

It goes without saying that the different climatic zones in Europe have a substantial impact on the energy demands of a building in terms of heating and cooling, and the potential use of local renewable energy sources in the building. As such no universal minimum standards can be set.

4. Lack of universally valid LCA construction tools

A number of sophisticated tools now exist which are aimed at calculating the full environmental impact of the materials used in construction, or of the entire building, using LCA (Life-cycle analysis). In the future, it may be possible to recommend that a single tool is used in all cases across Europe, however currently these tools are applicable only at a national or regional level, and also often require a fair amount of technical expertise to apply.

5. Local/national differences in availability and sustainability of materials used

It is a major challenge to define what constitutes a more "sustainable building material". In the future the use of EPDs (Environmental Product Declarations), should provide the contracting authority with the possibility of comparing the environmental impact of different materials used, however this approach is not yet sufficiently advanced on European markets to be currently applicable. A valid current alternative is to use ecolabelled products, however the most important construction materials are mostly not yet covered by many ecolabels, and the availability of ecolabelled products varies significantly between countries.

2 Procura+ Guidelines for sustainable construction

As mentioned above it is inappropriate to propose universal standards, which can be directly applied in all cases. Instead a series of concrete guidelines have been developed providing alternative approaches which may be used. The public authority wishing to use these guidelines will need to determine which alternative is most appropriate for their situation. The guidelines principally apply to the energy performance of buildings and the use of sustainable building materials.

Thematic sections

These guidelines are split into 5 thematic sections:

1. Energy consumption
2. Use of renewable energy sources (RES[6])
3. Use of sustainable building materials
4. Monitoring and user aspects
5. Experience of the architect

In each section a number of **alternative (sometimes complementary) approaches** are presented for addressing the main issue.

Construction process

Furthermore the guidance indicates where in the construction process the tendering criteria can be applied. Either:

A) Preliminary design/architects' competition
B) Tendering of the building construction
C) Tendering of the building services – "Building services" are: heating, ventilation, air conditioning and refrigeration (HVACR). A specialist building services company may be contracted to design and install (and sometimes maintain) these services for the building.

The above mentioned tendering stages have been identified as the most common stages of procurement in the European building sector. However, this scheme may vary, both in terms of the exact stages gone through and the number of competitive tendering rounds. **If there is only one tendering round including all stages, all approaches and criteria should be addressed in this tendering stage**.

[6] RES: Renewable Energy Sources. The following energy sources are considered as RES:
- Solar energy:
- Passive
- Active (thermal, electrical)
- Biomass (wood, energy plants, biogas)
- Environmental and process heat (heat pumps, heat recovery)
- Geothermal power
- Small water power stations

Tendering stages

Each proposed option also indicates where in a specific tendering procedure the criteria should be inserted.

In many cases the criteria are designed for inclusion in the **Technical Specifications** for the work to be carried out – i.e. they set minimum standards which the bidding companies must meet.

Some criteria are designed for use in the **Award/evaluation stage**, where different offers which meet the minimum standards are compared. At this stage environmental performance can be used as one of the evaluation criteria, together with other aspects such as price. The weighting given to the environmental performance criteria suggested below must be determined by the contracting authority, but it is recommended that this is at least 10-20%. In some cases several environmental performance criteria could to be introduced at the award/evaluation stage (e.g. for net energy consumption (option 1.A.2) and use of solar panels (2.A.1) during the architects' competition). The award points given in the options below are simply examples to be used for guidance.

Renovation work

The criteria presented below are designed to be used for both the construction of new buildings and also major renovation work. The procedure and tendering stages followed for renovation work will again vary across Europe, and also depending on the type of renovation work. This must be taken into account in defining where to include the criteria. Criteria, which are not applicable for renovation work, are clearly mentioned below.

Numbering of the Options

The options presented below are numbered to indicate which thematic issue is being addressed (the first digit), and which stage of the construction process they should be applied at (the second digit). The last number is to differentiate between different options covering the same thematic area and to be used at the same stage.

Examples:

Option 1.A.1 relates to Energy consumption (number 1), and should be used during the preliminary design/architects' competition (letter A).

Option 3.B.2 relates to the use of sustainable building materials (3), and should be used during the tendering for the building construction.

2.1. Energy Consumption[7]

The ideal approach for ensuring a high standard of energy performance in new constructions and major renovation works is to set a specific minimum standard which must be achieved when preparing the initial technical specification of the building. Standards for any of these options should be based on existing national/regional minimum standards and calculation methods. Problems may occur when standards are not yet available for that country, or if the standards set are not sufficiently ambitious.

Where this is not possible an alternative approach is to set minimum standards for the U-Values[8], which provide a rough but effective measure for minimising energy consumption.

A further alternative is to set standards for the shape/volume ratio of the building. For building categories without common standards for shape/volume ratio a ranking of the best projects has to be done during the award phase.

A) Preliminary design / architects' competition

In this stage mainly design-related energy issues can be addressed such as a definition of heated/cooled areas, shape/volume ratio, area and disposition of windows, building position and orientation. In most countries it is too early at this stage to focus in much detail on the technical systems used to provide the energy demanded.

The most appropriate approach to take will depend largely on the existence of national/regional calculation methods and standards for net energy demand[9], U-values and/or shape/volume ratio, and on the access the contracting authority has to expert advice.

Option 1 represents the most comprehensive approach and requires set national/regional approaches or considerable expert input, whereas Option 4, though still effective, requires essentially no expert input.

Option 1.A.1 –Minimum standards for net energy demand

Specifications/	Net energy demand must not exceed X

[7] There are mainly three different ways to specify energy consumption, depending on the definition of the system boundaries:

- **Net energy**: Energy that is available to consumers for use in appliances and systems. Calculation considers only the building properties and not those of the heating/cooling system and results in the net energy use. To perform the calculation of net energy, data for indoor climate requirements, internal heat gains, building properties and outdoor climatic conditions are needed.
- **Final energy**: Energy consumption measured at the final use level. For a building, energy inflow measured at the gate of the building
- **Primary energy**: Energy consumption measured at the natural resource level/primary energy content

[8] The U-value represents the air-to-air transmittance of an element. This refers to how well an element conducts heat from one side to the other, which makes it the reciprocal of its thermal resistance. The U-Value is a property of a building component (walls, slabs, windows). Its units are Watts per square metre and Kelvin (W/m² K)

[9] "**Net energy"** means energy to be supplied by the energy systems to provide the required services, such as maintaining the building at the specified internal temperature, lighting or ventilating a space, etc, taking account of useful heat gains

minimum standards	
(Optional) evaluation/award criteria	Additional points awarded for net energy demand better than the minimum standard Example: • 10 (out of 100) points will be awarded to the offer with the lowest net energy demand, for other offers every 1% increase in demand reduces the number of points by 1%. • 90 (out of 100 points) will be awarded for other aspects including price

Implementation notes

Specifications (expert input requirements): The contracting authority will need to define a minimum standard for net energy demand. There may, for example, be a national or regional standard to follow, or a reference building may be used. For these purposes it will also be necessary to define the U-Values for the building. A degree of expert input will thus be required.

The contracting authority will also need to define the exact calculation programme and indicators to be used in determining the net energy demand of the different offers. This would likely be an excel sheet allowing the bidding architect to input figures on the shape/volume ratio, the area and disposition of the windows, building position and orientation, total heated/cooled area, in order to calculate net energy demand. This programme would also include the U-Values predefined by the procurer. Again this calculation programme may follow a national or regional standard.

Award phase: Where the optional evaluation criteria are used the contracting authority will need to determine the relative weighting of price and net energy demand in the evaluation

Option 1.A.2 – Competition around net energy demand

Evaluation/award criteria	Additional points awarded for net energy demand Example: • 10 (out of 100) points will be awarded to the offer with the lowest net energy demand, for other offers every 1% increase in demand reduces the number of points by 1%. • 90 (out of 100 points) will be awarded for other aspects including price

Implementation notes

Specifications (expert input requirements): As with Option 1.A.1, the calculation programme, indicators and U-values will need to be defined by the contracting authority, however no minimum standard for net energy demand needs to be set, but is instead the basis of a competition between competing bidders.

Award phase: Where the optional evaluation criteria are used the contracting authority will need to determine the relative weighting of price and net energy demand in the evaluation

Option 1.A.3 – Minimum standards for U-Values and/or shape/volume ratio

Specifications	• The shape to heated gross volume ratio in the proposed design must not exceed X.
Contract conditions	• The U-Values must not exceed X.
(Optional) evaluation/award criteria	Additional points awarded for shape/volume ratio **(Not applicable for renovation projects)** Example: • 10 (out of 100) points will be awarded to the offer with the best shape/volume ratio, for other offers every 1% increase in ratio reduces the number of points by 1%. • 90 (out of 100 points) will be awarded for other aspects including price

Implementation notes

Specifications (expert input requirements): Expert input will likely be required to define U-Values and minimum shape/volume ratio. This will likely be easier for shape/volume ratio and this criteria can be used alone if it is difficult to access experts.

For U-Values these can either be defined for different building parts (walls, windows…) or as an average U_m-Value for the whole building. The U-Values need not be included in the specifications for selecting the architect, but would rather be included as a contract condition which the selected architect must respect throughout the design process.

For the shape/volume ratio, "shape" means the relevant thermal shell of the building; "volume" means the heated/cooled volume.

Award phase: Where the optional evaluation criteria are used the contracting authority will need to determine the relative weighting of price and shape/volume ratio in the evaluation

Option 1.A.4 – Competition around Shape/volume ratio

Evaluation/award criteria	Additional points awarded for shape/volume ratio **(Not applicable for renovation projects)** Example: • 10 (out of 100) points will be awarded to the offer with the best shape/volume ratio, for other offers every 1% increase in ratio reduces the number of points by 1%. • 90 (out of 100 points) will be awarded for other aspects including price

Implementation notes

Specifications (expert input requirements): This approach requires no expert input, with a simple competition around the shape/volume ratios offered by the competing bidders. As this is a major factor in determining the energy efficiency of the building this is still a very useful approach to take if there is limited expertise available to the contracting authority.

Award phase: The contracting authority will need to determine the relative weighting of price and shape/volume ratio in the evaluation

B) Tendering for the building construction

In this project stage the exact definition of the thermal building shell and other components of the building can be addressed. Based on the preliminary design, at this stage the quality of the thermal building components has the most significant impact on energy performance (mainly the U-values).

In almost all cases better U- values will mean higher construction costs – so this is difficult to handle, and can best be addressed through using the award phase of tendering. Extra points can be offered based on the U-Values presented by the competing bids.

Option 1.B.1 – Competition around U-Values – evaluation on price and U-Values

Evaluation/award criteria	Additional points awarded for U-Values Example: • 10 (out of 100) points will be awarded to the offer with the best U-Values, for other offers every 1% increase in U-Values reduces the number of points by 1%. • 90 (out of 100 points) will be awarded for other aspects including price

Implementation notes

Specifications (expert input requirements): For this approach there is no need to set minimum U-Values, and therefore requires minimal expert input

Award phase: The contracting authority will need to determine the relative weighting of price and U-Values in the evaluation

Contract conditions: Appropriate financial penalties will need to be put in place to ensure that the target stated in the original offer from the bidder is met in the final design at the end of the contract

C) Tendering for the building services

This stage will define the final provision of building services – heating, cooling, ventilation, lighting etc. – including issues such as generation, storage and distribution. The efficiency of the systems put in place, together with the energy/fuel type used to run them (electricity, oil, gas, localised RES) have a key impact on the overall energy consumption of the building

whether in terms of Final Energy (the energy needed to run the building services), or Primary Energy (which takes into account the different sources of energy used).

These issues can be addressed in the building services stage, either by setting specific standards for Final or Primary Energy, or by using this as the basis of competition between competing bidders (or both).

Whether Final or Primary Energy are used as the indicator will principally be decided by what is demanded in national/regional regulations. Primary Energy is the most comprehensive approach, however it is more complex to manage. The basis for the calculation of Final or Primary Energy must be the Net Energy consumption calculated during the design stage. Expert input will be needed to determine which approach is used.

Option 1.C.1 –Minimum standards for primary/final energy consumption

Specifications/ minimum standards	Final/Primary energy consumption must not exceed X
(Optional) evaluation/award criteria	Additional points awarded for final/primary energy consumption better than the minimum standard Example: • 10 (out of 100) points will be awarded to the offer with the lowest energy consumption, for other offers every 1% increase in consumption reduces the number of points by 1%. • 90 (out of 100 points) will be awarded for other aspects including price

Implementation notes

Specifications (expert input requirements): The contracting authority will need to define a minimum standard for energy consumption. The basis for this will be the Net Energy Consumption figure determined during the design phase, but whether Final or Primary energy is used, the calculation method and a minimum standard must be determined by the authority, either using national regulations or independent expert input.

Award phase: Where the optional evaluation criteria are used the contracting authority will need to determine the relative weighting of price and primary/final energy consumption in the evaluation

Contract conditions: Appropriate financial penalties will need to be put in place to ensure that the target stated in the original offer from the bidder is met in the final design at the end of the contract

Option 1.C.2 – Competition around primary/final energy consumption

Evaluation/award criteria	Additional points awarded for lower final/primary energy consumption Example: • 10 (out of 100) points will be awarded to the offer with the lowest energy consumption, for other offers every 1% increase in consumption reduces the number of points by 1%.

	• 90 (out of 100 points) will be awarded for other aspects including price

Implementation notes

Specifications (expert input requirements): As in Option 1.C.1The contracting authority will need to define whether Final or Primary energy is used for comparison of bids and the calculation method, either using national regulations or independent expert input. However, no specific targets need to be set

Award phase: the contracting authority will need to determine the relative weighting of price and primary/final energy consumption in the evaluation

Contract conditions: Appropriate financial penalties will need to be put in place to ensure that the target stated in the original offer from the bidder is met in the final design at the end of the contract

2.2. Use of renewable energy sources

There are significant opportunities for using localised renewable energy sources (RES) (i.e. included in the building itself, such as solar panels, biomass boilers etc.) within a building itself. Again the most effective approach is to demand a minimum percentage of RES of the primary, final or net energy consumption of the building (for heating, cooling, ventilation, domestic hot water, and electricity).

For the most effective use of solar power in the building it is advisable to set minimum requirements at the architect's competition stage, as the panels need to be integrated into the building shell, however this will require a good estimation of the net energy demand for the building, and also selecting appropriate solar panels which the architect must use.

Further improvements can be made at the stage of tendering for the building services. Here it is possible to either set a minimum percentage of final, primary or net energy consumption to be provided by RES (not just solar, but also biomass, even wind power), though again this will take some expertise and knowledge of the local climatic and market potential for localised RES in selecting the minimum standard.

Alternatively there can be competition around the percentage of energy consumption provided by RES in the building services tender, which reduces the level of expertise needed.

A) Preliminary design / architects' competition

The preliminary design stage is too early to make specific demands on the full use of RES in the energy consumption of the building, but can be used to encourage elements to be included in the basic design of the building – such as solar panels.

Option 2.A.1 – Minimum use of solar power

Specifications/ minimum standards	A minimum of X% of net energy/hot water/space heating/cooling/electricity demand must be provided by X solar panels.

Implementation notes

Specifications (expert input requirements): The contracting authority will need to define the target percentage. The authority must also decided which specific energy demand (overall energy demand, just hot water, space heating, cooling, electricity demand, or a combination) will form the basis of the target. This figure must be set by the authority itself.

The authority will also need to define the exact type of solar panel to be used in meeting the targets set, and the method for calculating the energy generated by each panel in situ.

C) Tendering of the building services

At this stage major decisions will be made about how the energy services of the building will be met, and so the use of RES should be strongly encouraged. This can either be done by defining in advance a minimum percentage of energy consumption which should be met from RES, or having this as an award criteria in the evaluation stage.

The choice of whether calculations are based on primary, final or net energy will depend on the method selected at the national or regional level. If no method has been set, expert advice will need to be provided, with a calculation model defined by the contracting authorities for the competing bidders to follow.

Option 2.C.1 – Minimum percentage of localised RES

Specifications/ minimum standards	A minimum of X% of (primary, final or net) energy consumption must be provided by localised renewable energy sources.
(Optional) evaluation/award criteria	Additional points awarded for the percentage of (primary, final or net) energy consumption provided by localised renewable energy sources, above the minimum standard set in the specifications. Example: • 10 (out of 100) points will be awarded to the bid with highest percentage, for other bids every 1% decrease in the offer decreases the number of points by 0.5. • 90 (out of 100 points) will be awarded for other aspects including price

Implementation notes

Specifications (expert input requirements): The contracting authority will need to determine whether primary, final or net energy consumption is used as the appropriate calculation method, together with a specific percentage target. This will require either national/regional regulations or independent expert input.

Award phase: Where the optional evaluation criteria are used the contracting authority will need to determine the relative weighting of price and the use of localised RES in the evaluation

Contract conditions: Appropriate financial penalties will need to be put in place to ensure that the target stated in the original offer from the bidder is met in the final design at the end of the contract

Option 2.C.2 – Competition around percentage of localised RES

Evaluation/award criteria	Additional points awarded for the percentage of (primary, final or net) energy consumption provided by localised renewable energy sources. Example: • 10 (out of 100) points will be awarded to the bid with highest percentage, for other bids every 1% decrease in the offer decreases the number of points by 0.5. • 90 (out of 100 points) will be awarded for other aspects including price

Implementation notes

Specifications (expert input requirements): The contracting authority will need to determine whether primary, final or net energy consumption is used as the appropriate calculation method, however no specific percentage target need be set, as this will be the basis of competition.

Award phase: Where the optional evaluation criteria are used the contracting authority will need to determine the relative weighting of price and the use of localised RES in the evaluation

Contract conditions: Appropriate financial penalties will need to be put in place to ensure that the target stated in the original offer from the bidder is met in the final design at the end of the contract

2.3. Use of sustainable building materials

Whilst the energy performance of a building during use remains the most significant aspect in terms of sustainability, the choice of materials used in construction has a substantial influence on environmental impact – the primary energy content of the materials themselves (from extraction, through processing, transportation and disposal), the use of toxic or harmful substances, the consumption of non-renewable resources.

In the future, the likely increase in EPDs will ensure that users have comprehensive information on product alternatives to inform their choice. Currently, however it remains difficult to define in simple terms what counts as a more "sustainable building material". Some LCA tools exist for calculating the primary energy content of building materials though these are only national or regional in applicability. Where possible, public authorities should encourage the use of such tools by architects and construction companies when selecting materials for the final design, though they will need to find an appropriate tool (see section 5 below for some suggestions).

Some independent (Type 1) ecolabels also label building products and using ecolabel criteria can be seen as a first step towards improved sustainability of the materials used. Where a contracting authority has good knowledge of the national market availability and relative price of ecolabel-compliant products it may be possible to set minimum quantities of such products to be used in construction. However, if this is a new area for a public authority, it may be left to the bidding companies to set their own targets for the use of such products. The most appropriate place in the construction process to insert these criteria will again depend on local procedures and responsibilities, but will likely be at the final building construction stage.

Furthermore, certain products can be excluded from use in construction and renovation works. This final alternative should be used under all circumstances.

B) Tendering for the building construction

Following the initial design stage, at the building construction stage decisions will be taken about the actual materials to be used (and purchased) for the construction work.

For all construction work it is possible to exclude the use of certain substances (Option 3.B.1), however this should be accompanied by a requirement or preference to use more sustainably produced materials (Options 3.B.2 and 3.B.3). In this case a sustainable building material is taken to mean one that complies with the criteria underlying any Type 1 ecolabel[10] meeting ISO standard 14024.

Option 3.B.1 – Exclusion of certain materials

Specification / minimum standard	The tenderer must declare that the following materials/substances will not be used in the construction: • Recycled timber not accompanied by test documents from an independent third party that they contain no hazardous substances (as defined by national regulations). • Products which contain hydrofluorocarbons (H-FKW) • Products which contain sulphurhexafluoride (SF_6) • Indoor paints and varnishes with a content of solvents[11] higher than – for wall paints (according to EN 13300): **30 g/l** (minus water) – for other paints with a spreading rate of at least 15 m²/l at a hiding power of 98% opacity: **250 g/l** (minus water) – for all other products (including paints that are not wall paints and that have a spreading rate of less than 15m^2/l, varnishes, woodstains, floor coatings and floor paints, and related products): **180g/l** (minus water) • Non-sustainably or illegally harvested timber[12] All virgin wood from forests and plantations shall originate from forests and plantations that are managed so as to implement the principles and measures aimed at ensuring sustainable forest management. In Europe, the principles and measures referred to above shall at least correspond to those of the Pan-European Operational Level Guidelines for Sustainable Forest Management, as endorsed by the Lisbon Ministerial Conference on the Protection of Forests in Europe (2-4 June 1998). Outside Europe they shall at least correspond to the UNCED Forest Principles (Rio de Janeiro, June 1992) and, where applicable, to the criteria or guidelines for sustainable forest management as adopted under the respective international and regional initiatives (ITTO, Montreal Process, Tarapoto Process, UNEP/FAO Dry-Zone Africa Initiative). **Verification for timber:** Where virgin wood from certified forests or plantations is used, the applicant shall provide an appropriate certificate(s), for example the FSC (Forest

[10] Type 1 ecolabels are declarations which meet criteria set by independent third parties (ie not by the manufacturer or retailer themselves), and are based on life cycle impacts, like the EU Ecolabel and labelling schemes such as the Blue Angel and Nordic Swan

[11] Solvents are volatile organic compounds (VOCs) with a boiling point of 250°C maximum.

[12] Criteria and verification procedure taken from the underlying criteria of the EU ecolabel for copying and graphic paper: eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002D0741:EN:HTML

	Stewardship Council) Label, together with supporting documentation showing that the certification scheme correctly assesses the above-mentioned principles and measures of sustainable forest management. For virgin wood from forests that are not certified as being from sustainably managed forests or plantations, the applicant shall provide the appropriate declarations, charter, code of conduct or statement, verifying that the above requirements are met.

Implementation notes

Contract conditions: The exclusion of the above substances/materials should also be included in the contract conditions, with the winning contractor required to provide appropriate documentation to demonstrate they have not been used.

Option 3.B.2 – Minimum quantity of sustainable building materials

Specifications/ minimum standards	The tenderer must declare that a minimum of X% of materials to be used in construction (by value) must be produced in compliance with the standards underlying a Type 1 ecolabel according to ISO standard 14024. ***Verification****:* Products carrying a type 1 ecolabel will be deemed in compliance of these criteria. Alternatively credible documentation that the standards of a given type 1 ecolabel are met will also be accepted.
(Optional) evaluation/award criteria	Additional points awarded for the percentage of materials used in construction (by value) produced in compliance with the standards underlying a Type 1 ecolabel according to ISO standard 14024, above the minimum standard set in the specifications. Example: • 5 (out of 100) points will be awarded to the offer with highest percentage, for other offers every 1% decrease in percentage decreases the number of points by 1%. • 95 (out of 100 points) will be awarded for other aspects including price

Implementation notes

Specifications (expert input requirements): To set a minimum percentage of ecolabel compliant products to be used will require some knowledge of the market for such products locally (availability and price)

Award phase: Where the optional evaluation criteria are used the contracting authority will need to determine the relative weighting of price and of use of sustainable building materials in the evaluation

Contract conditions: Appropriate financial penalties will need to be put in place to ensure that the target stated in the original offer from the bidder is met in the final design at the end of the contract

Option 3.B.3 – Competition around the use of sustainable building materials

Evaluation/award criteria	Additional points awarded for the percentage of materials used in construction (by value) produced in compliance with the standards underlying a Type 1 ecolabel according to ISO standard 14024. Example: • 5 (out of 100) points will be awarded to the offer with highest percentage, for other offers every 1% decrease in percentage decreases the number of points by 1%. • 95 (out of 100 points) will be awarded for other aspects including price

Implementation notes

Specifications (expert input requirements): Using this method it is not necessary to have much knowledge of the market for such products, simply to indicate (through the relative weighting given to each award criteria) how much extra you are willing to pay to use sustainable building materials

Contract conditions: Appropriate financial penalties will need to be put in place to ensure that the target stated in the original offer from the bidder is met in the final design at the end of the contract

2.4. Monitoring and user aspects

No matter how efficient a building is in design, the actual energy consumption is of course highly dependent on the behaviour of the building users. Furthermore, if energy consumption is effectively monitored it is much easier to identify areas for improvement.

Several suggestions are provided here, all of which can be used together and are applicable in any European context. Again, where to include these criteria in the process will depend on local procedures and responsibilities.

B) Tendering for the building construction

Option 4.B.1 – Compulsory blower door test

Specifications/ minimum standards	Where mechanical ventilation is included in the building, the winning bidder must ensure that a Blower Door Test is carried out at …<Insert appropriate building stage>…. This must be repeated until the appropriate standard is achieved

Implementation notes

The appropriate time for a blower door[13] test to be carried out will depend on the type of building (e.g. for wooden construction after the assembly of windows, doors and steam brakes).

C) Tendering for the building services

Option 4.C.1 – Regular book keeping

Specifications/ minimum standards	An independent company must be contracted to provide a regular bookkeeping service for the first three years, who will provide the building manager with monthly figures on energy consumption for heating, cooling, ventilation, hot water, and electricity

Option 4.C.2 – Energy consumption display panel

Specifications/ minimum standards	A display panel must be installed prominently in the building indicating daily energy consumption for the whole building.

Option 4.C.3 – Training session for building manager

Specifications/ minimum standards	A training session must be given to the building manager on the energy efficient use of the building following completion of construction/renovation.

2.5. Experience of the architect

Whatever criteria are used to ensure the sustainability of the building, using an architect with experience in sustainable construction is arguably as important. Furthermore a number of tools using life-cycle analysis (LCA) methods for ensuring the sustainability of the design and

[13] An adequate airtightness rate is not only an assumption for faultless building physics, but is also very important for the energy performance of a building. Air change rates have to be adapted to the energy standard (e.g. passive house standard n50 < 0,6 h-1) and to the type of ventilation system (e.g. with or no heat recovery). For quality assurance, a blower door test per EN 13829 is essential. Therefore tendering a blower door test is very important for the procurement. n50 value means the amount of leaking air in comparison to the volume of the building measured with a 50 Pa pressure difference between the indoor building volume (or parts of it) and the outside. For example n50 = 1 h-1 means, that the measured air volume of the building changes once per hour at a pressure difference of 50 Pa. For passive houses n50 values under 0,6 h-1 are essential for the operating of the heat recovery system

the materials used. The availability, scope and applicability of these tools vary from country to country, however this is a good opportunity to encourage their use.

A) Preliminary design / architects' competition

Option 5.A.1 – Selection based on experience with sustainable building design

Selection criteria	The architect must have sufficient past experience with sustainable building design. Each applicant is required to submit a 2-page document outlining past experience in the following areas (indicative list): • Energy efficient construction design. Including if available specific energy demand per m² space including heating, cooling, lighting for a previous construction • Airtightness and air exchange systems with heat recovery • The use of RES and co-generation • Bioclimatic architecture, to achieve energy efficiency, thermal and optical comfort, avoiding mechanical systems, e.g. light supply with daylight systems • Use of LCA tools in design • Use of sustainable building materials • Achievement of good indoor air quality standard

Implementation notes

Judging the experience of the architect of course requires experience from the contracting authority. It may be appropriate to bring in external expertise to help judge the relative experience. This list is indicative and can be expanded/reduced to fit the situation. It will be necessary for the authority to determine what sufficient past experience means.

Option 5.A.2 – Compulsory use of LCA tool during design

Contract condition	In carrying out the design work …<Insert name of selected LCA tool> … must be used.

Implementation notes

It will need to be explored what LCA tools exist for use locally, and determine which aspects of design and material selection this can cover. Or this can be determined at the contract negotiation stage together with the winning architect. Again, this will likely require external assistance.
This contract condition must be clearly advertised in the tendering documents, so that bidding architects are aware of what the contract will entail.

3 Further ideas

As already noted, there are an enormous number of environmental impacts throughout the life-cycle of a building, from the choice of site right through to the disposal of materials. The most significant of these impacts are addressed with the criteria outlined above. However many other aspects can be taken into consideration to further improve environmental performance. A number of these are indicated below.

In addition the social implications of construction works are significant, especially given the sector's position as a key European employer. ICLEI is currently co-ordinating a project to look at the inclusion of social conditions in construction procurement, and when finalised, a set of guidelines will be added to this section (for up-to-date information visit www.procuraplus.org)

3.1. Sustainable site and building design

The first question that needs to be addressed is whether a new building is really needed in order to meet the space requirements or if existing buildings can be used. If existing buildings can be used, the authority needs to decide which renovation measures are necessary. Given the large amount of energy used in the preparation and transport of construction materials and in the construction process itself, it is usually a more environmentally friendly option to refurbish, reuse or redesign existing buildings rather than construct a new one.

Decisions about the location and appraisal of the site will fundamentally influence the sustainability of a building. The consideration of ecological and social aspects during landscape and spatial planning, as well as regional and urban planning and in urban planning competitions, is an important prerequisite for sustainability.

Basic building design decisions have a fundamental effect on the lifetime performance and environmental impacts of buildings as well as on the energy performance and the range of applicable building materials. It is important that proper consideration is given to the durability, form and structure of a new building.

3.2. Indoor quality

Healthy people need healthy buildings – energy efficient and resource efficient construction should also provide a healthy living and working environment and reduce the risk of building-related illness (sick building syndrome). Thermal comfort, daylight or good lighting systems, humidity and noise control are fundamental requirements for occupant comfort.

3.3. Sewage and rainwater management

Ecological sewage systems (reuse of waste water, water saving armatures etc.) and the use of rain water may produce both ecological and financial benefits.

3.4. Teamwork

Sustainable construction relies on continuous dialogue and co-operation between all actors involved in the design and construction process as well as the use and maintenance of the building. An integrated team should be formed before design and maintained throughout the building process.

3.5. Lifetime costs of construction works

In most cases the running and maintenance costs of buildings by far exceed the initial construction costs. Running costs may constitute up to 85% of the total costs. On the same scale, the design costs are likely to be 0,3–0,5% of the lifetime costs, and yet it is through the design process that the largest impact can be made on the 85% figure. Besides the assessment of the environmental impacts over the lifetime, costs should also be considered over the entire lifetime and the methods of life-cycle costing should be promoted and introduced.

Alternative cost models (e.g. third party financing, energy performance contracting) offers ways to overcome the gap between construction costs and life cycle costs.

3.6. Behavioural aspects

The consumption of heat, hot and cold water, electricity etc. are of course not only determined by the design and construction of the building, but also by the behaviour of those using the building. No matter how efficient your office heating system is energy consumption will considerably increase if it is left on all weekend. Measures can be taken to address this issue, one of which is the training of building users in energy- and water-saving behaviour. The establishment of an energy accounting system or environmental management system are possible measures for ensuring the systematic and continuous monitoring and improvement of such aspects. A complementary approach carried out by the City of Stuttgart (see Box 1 below) involved the installation of monitoring equipment which indicated very precisely how much energy was being consumed, when and where in the building, allowing a very accurate analysis of where potential savings may lie.

The City of Stuttgart has been running an energy management scheme for over 25 years, carefully monitoring energy consumption in public buildings with the objective of highlighting areas for improvements in energy efficiency.

Energy consumption is analysed in various ways. A data carrier exchange with Neckarwerke Stuttgart AG (the local public utility), for example, enables an analysis of the annual energy consumption of all municipal facilities. However, for highly effective energy management it needs to be possible to monitor real time energy consumption within buildings, and make appropriate responses.

Carrying out such monitoring involved the installation of an intelligent monitoring station as a building substructure and a transmission system for the gathered data. At the time of the system's installation it was necessary for Stuttgart to develop both the data transmission system and the software for effectively analysing the data received as no suitable hard – or software was available on the market.

The resulting system – the Stuttgarter Energiekontrollsystem (SEKS) – has enabled municipal buildings' energy consumption to be reduced by up to 20% in some cases. In overall terms in the 25 years the City of Stuttgart has been running its energy management programme, the savings made have been five times higher than the money invested in the energy management system and other improvements.

Box 1: Energy management in Stuttgart

3.7. Promote renovation work

The highest savings in energy efficiency can be achieved through the renovation of the existing building stock (reuse of buildings rather than new construction should also be encouraged). Therefore actively promote renovation, rather than wait until forced.

4 Relevant product labels

4.1. Transnational and national Eco-labels

Transnational Eco-labels	
European Eco-label	www.eco-label.com • Hard floor coverings • Indoor paints and varnishes
	EU Eco-label - Co-operation with international Eco-labels http://ec.europa.eu/environment/ecolabel/other/int_ecolabel_en.htm
Nature Plus	www.natureplus.org • Building materials based on at least 85 mass percent renewable or mineral resources: • Insulation materials • Floor coverings (wood, linoleum) • Paints and varnishes • Mortar, adhesives, plasters • Roofing tiles • Wood based products and boards • Boards for dry building
National Ecolabels	
Nordic swan	www.svanen.nu • Adhesives • Floorings primarily made of renewable materials • Wall coverings • Windows
German eco-label: Blue Angel	www.blauer-engel.de • Low emission composite wood panels • Low emission wall paints • Low emission wood products and wood-base products • Low pollutant varnishes
Austrian eco-label	www.umweltzeichen.at • Hydraulic bonded bricks • Insulation materials based on fossil resources with hydrophobic properties • Insulation materials based on renewable resources • Resilient floor coverings

	• Textile floor coverings • Varnishes and glazes • Wood based products and boards • Wall paints
	IBO –Prüfzeichen www.ibo.at/produktpruefung.htm - pruefzeichen
Dutch eco-label: Milieukeur	www.milieukeur.nl • Adhesives • Paints • Linoleum • Subfloors

4.2. Wood product labels

Forest Stewardship Council	www.fsc.org/en
Pan European Forest Certification (PEFC)	www.pefc.org

4.3. Building assessment labels

- International

BREEAM

www.breeam.org

EcoHomes

www.breeam.org/ecohomes.html

Passive House certificate / Passive House Institute Darmstadt

www.passiv.de

TQ-Tool

www.argetq.at

- National

Minergie (Switzerland)

www.minergie.com

klima:aktiv haus (Austria)

www.klimaaktiv.at/article/articleview/50114/1/15115

5 LCA tools

BEAT Denmark	A PC tool for performing environmental assessment of products, building elements and buildings, consisting of a database containing data for energy sources, means of transport, products, building elements and buildings; a user interface which allows the user to add, edit and delete data in the database and an inventory tool, which allows the user to perform calculations for products, building elements and buildings. www.dbur.dk
Build it Germany	A Design for Environment Software for assessment of buildings with integrated calculation of U-values, mass and heat insulation, based on LCA.
EcoEffect Sweden	This is a method to calculate and assess environmental loads caused by a building during its lifetime. It is based on LCA. www.ecoeffect.tk
Eco-Install Netherlands	A software tool that calculates the integral environmental effect of an installation within its civil construction. The environmental analyses is based on LCA methodology. The result can be used for conceptual choices in the design stage.
Ecopro Germany	Ecopro is a calculation tool to optimise the material mass-, the energy-flows and the costs during a early planning process. Basics are the element method and LCA.
Eco-proP Finland	EcoProP's developed use is the setting of performance-based requirements for building construction projects. The application can be used in the project planning phase but also later users can add targets and goals. EcoProP is based on a generic and holistic building property. cic.vtt.fi/eco/e_ecopro.htm
Eco-Quantum Greencalq Netherlands	These programmes makes it possible to express the environmental performance of buildings in one or more figures, calculated on the basis of the LCA method. In the design phase already, the computer program makes the performance clear far as the sustainability of a building is concerned. www.sbr.nl/default.aspx?ctid=2322 (dutch)
EcoSoft	ECOSOFT is a software-tool to calculate the ecological performance of the erection of a building. It uses data from Switzerland, Austria and Germany. It results in classification factors as e.g. Green house potential or primary energy consumption renewable and non-renewable. www.ibo.at
Ecotech Germany, Austria	Software tool for physical, technical, ecological and economic calculation of buildings with an interface to CAD programmes. There are LCA data integrated for the ecological assessment.

OI3-Index Austria	www.ecotech.cc OI3-Index: Software tool used for social housing subsidy in Austria, dealing with primary energy non renewable, GWP-, and AP- potential of building materials with interface to common programmes for building physics. Part of the calculating for the heating energy consumption. www.oebox.at
Envest UK	is a software tool that simplifies the otherwise very complex process of designing environmentally friendly buildings. Designers input their building designs (height, number of storeys, window area, etc) and choices of elements (external wall, roof covering, etc). Envest identifies those elements with the most influence on the building's environmental impact, and shows the effects of selecting different materials. It also predicts the environmental impact of various strategies for heating, cooling and operating a building. www.bre.co.uk/service.jsp?id=52
Equer France	is a simulation tool in order to predict the environmental consequences of design choices over the future life cycle of the studied building. The life cycle assessment methodology has been chosen for accounting environmental impacts during the different phases (fabrication of materials, construction, utilisation, renovation and demolition) and it is linked with a thermal simulation tool. www.uni-weimar.de/scc/PRO/TOOLS/fr-equer.html
GEQ	GEQ – Gebäude.Energie.Qualität (www.zet.at) is designed for calculating energy building certificates. Now it also possible to calculate the classification factors Green house potential, primary energy consumption renewable and acidification potential.
LEGEP Germany	This is a design tool within a CAD system, with integrated quantity surveying, energy calculation and LCA. www.legep.de
OGIP Switzerland	OGIP is an instrument for realising an architectural and environmental optimised project within given costs. www.uni-weimar.de/scc/PRO/TOOLS/ch-ogip.html
TEAM International	This carries out an environmental evaluation of a building, based on LCA. www.ecobilan.com
survey about different tools and instruments related to buildings	www.uni-weimar.de/scc/PRO/TOOLS/inter.html

6 Harmful substances

6.1. CFC, HCFC, HFC, SF_6

As chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) contribute to ozone depletion, they are subject of the Montreal Protocol. Under Regulation (EC) 3093/94, the production of chlorofluorocarbons, other fully halogenated chlorofluorocarbons and other ozone depleting substances (ODS) has been phased out. Council Regulation 2037/2000 is the European Union's current legislative instrument to phase-out ODS. The most relevant application of HCFCs for the building sectors has been the production of foams. From 1 January 2004, the use of HCFCs for the production of all foams, including polyurethane spray and block foams, shall be prohibited.

While hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) do not deplete the ozone layer, they belong to the six main greenhouse gases (the others are carbon dioxide, nitrous oxide, methane and perfluorocarbons), which are subject to the Kyoto Protocol and have to be included in the national greenhouse gas inventories. Some member states have prohibited or constrained the use of HFCs and SF_6 by national regulations. A number of public authorities have also enacted council resolutions concerning the renouncement of HCFCs (before Council Regulation 2037/2000 was adopted) and HFCs in public procurement.

6.2. Volatile organic compounds (VOC)

It is a matter of definition whether a chemical is to be regarded as being a VOC or not. A common definition of a volatile organic compound (VOC) is an organic compound having a boiling point less than or equal to 250ºC measured at a standard pressure of 101.3 kPa.

VOCs undergo chemical reactions in the atmosphere, that cause a number of indirect effects, in particular the formation of photochemical oxidants such as tropospheric ozone, which is one of the big remaining air quality problems in the EU. When highly concentrated in the air, ozone can impair human health and can damage forests, vegetation and crops, reducing yields.

Furthermore, VOCs are one possible source of indoor pollution. VOCs may also cause headaches, fatigue or irritation to the eyes, nose, throat, lungs or skin. Additionally, some solvents can also be absorbed through the skin (e.g. butylglycol).

Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations (the so-called VOC Solvents Directive) sets emission limit values (expressed in terms of the maximum solvent concentration in waste gases) and fugitive emission values (expressed as a percentage of solvent input). However this directive focuses on industrial emissions and does not regulate the content of VOC in products.

On 23 December 2002 the European Commission adopted a new proposal for a directive on the limitation of emissions of volatile organic compounds due to the use of organic solvents in decorative paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC [COM(2002) 750]. The proposal will, for the first time, set EU-wide limits on solvent content in paints, varnishes and vehicle refinishing products to come into effect in two phases: 2007 and 2010. Limit values for decorative paints in phase I range from 50 g/l for water borne primers to 750g/l for some special solvent borne primers (the so-called “binding primers”). For phase II, limit values will be further lowered significantly for most categories. As this directive is not yet in force, and still within the decision making process of the EU institutions until 2007 it is suggested to set limits in the specifications for the procurement of paints and varnishes.