137: A sustainability evaluation method: the former Italgas Media Village's case study

Elena Montacchini, Silvia Tedesco

Department of Human Settlements Science and Environmental Technology, Polytechnic University of Turin, Turin, Italy
elena.montacchini@polito.it

Abstract

Environmental quality and sustainability are evaluated by means of a method developed by the UNI (National Standards Organisation, Italy) Commission. This paper describes the method and an example of its partial application, namely to the "Italgas Media Village", whose buildings are located in a former industrial area in Turin. The method is based on the requirements and performance of the project. Its environmental requirements are defined with reference to: the use of climatic resources; the environmental quality of the external spaces; reduction of resources consumption; reduction of the environmental load; the quality of the internal spaces. Such method is consistently similar to international evaluation system, so a critical analysis is also included with specific reference to Italgas Media Village, with particular attention to aspects highlighting the application limits as well as the main assets of the applied method.

Keywords: Sustainability assessment, Environmental requirements, Building life cycle

1. Introduction

Assessment of sustainability in the building industry is a complicated topic that has been the subject of investigation and research for several years, both in Italy and abroad. An advance has been made from the consideration of energy certification systems to environmental evaluation systems that go beyond the energy performance of a building and take account of a wide range of factors.

This paper describes the results of an assessment of the environmental quality and sustainability of the projects included in the programme for the 2006 Turin Winter Olympic Games. It is divided into three parts: description of the evaluation system, its methods and indicators; illustration of the case study assessed, namely the "Italgas Media Village", now the Turin University campus, the ecocompatibility of the project and the results of the evaluation; comparison with the requirements, parameters and weightings considered in other national and international evaluation systems.

2. Evaluation of building sustainability. The UNI method

The UNI Commission (National Standards Organisation, Italy) - Building Process Commission, WG on Building Sustainability - has developed a method to evaluate the environmental compatibility of buildings and urban design. This method has been partially applied to assess the environmental quality and sustainability of the projects comprised in the programme for the 2006 Turin Winter Olympic Games in terms of an appropriate indicator: Urban and Topological Quality.

2.1 The method

This method is based on the requirements and performance of a project. Environmental requirements are defined with reference to:
- the use of climatic resources;
- the environmental quality of the external spaces;
- reduction of resources consumption;
- reduction of the environmental load;
- the quality of the internal spaces.

The following table sets out the requirements for each of these needs.

Table 1: Sustainability requirements.

NEED		REQUIREMENT
1	The use of climatic resources	1. Use of winter solar radiation
		2. Use of air movement for natural ventilation
2	The environmental quality of the external spaces	3. Control of winter winds
		4. Control of summer winds
3	Reduction of resources consumption	5. Use of building products with ecological labelling
		6. Use of recycled materials and elements
		7. Use of materials and elements with a low enviromental load
		8. Use of thermal insulation
		9. Sostitution of fossil fuel with renewable sources
		10. Solar control to avoid

		overheating
		11. Use of thermal inertia
4	Reduction of the environmental load	12. Reduction of potable water consumption
		13. Recovery of storm water for compatible use
		14. Use of material and elements highly recyclabe
		15. Use of construction techniques, which facilitate disassembling at the end of life
5	The quality of the internal spaces	16. Use of natural daylighting
		17. Control of acoustic comfort
		18. Control of toxic emmissions

2.2 Requirements and Indicators

The evaluation form devised for each requirements defines its field of application (building or settlement), evaluation indicator, checking method and value classes. The calculation and indicator evaluation procedures refer to normative sources, the results of ongoing researches in specific sectors, and external bibliographies.

The assessment method takes into account the life cycle of a building, including its production stage, construction, lifespan, recycling and final disposal.

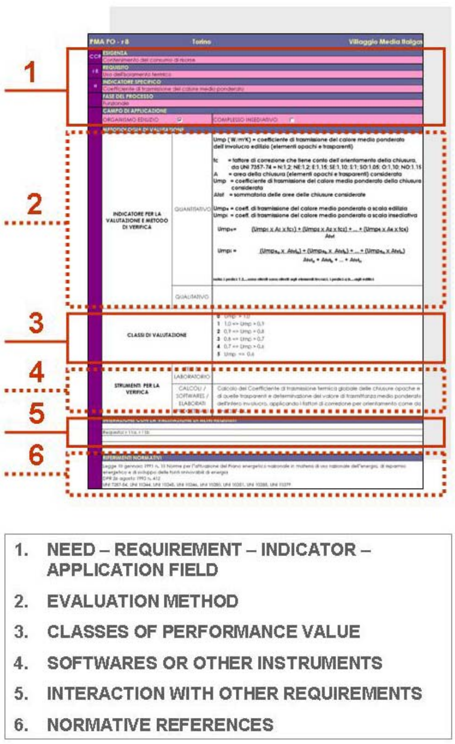

Fig 1. Evaluation form.

2.3 Benchmarking and Weighting

The weighting system employed evaluates the requirements in accordance with six (0 to 5) pre-defined performance value classes to be applied to the 18 indicators:

- score 0: baseline benchmark, related to current practice and regulation standards;
- score 3: best practice benchmark, related to the best environment-conscious practice;
- score 5: optimum target benchmark, the highest possible target performance value compatible with the local technology and state of the art.

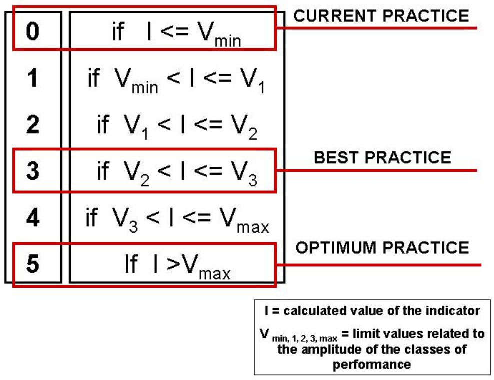

Fig. 2. Performance value classes and benchmark levels.

If several indicators correspond to a requirement, they are weighted to obtain a single value class.

The following schema illustrates an example of weighting in the whole of the evaluation process (indicators - needs - requirements).

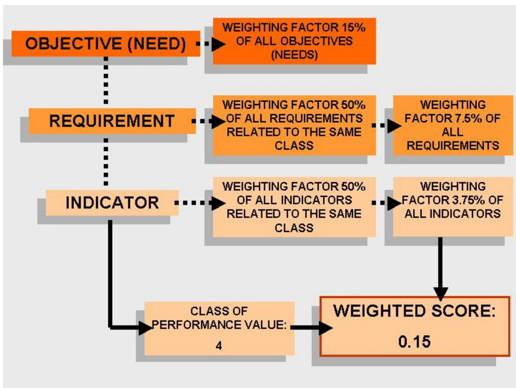

Fig 3. Schema with a scoring example.

3. Italgas Media Village - Turin University campus

The Italgas Media Village (established in 2005 and designed by ATC Proje.to) is now a university residence. Its evaluation was the subject of research commissioned by Toroc from the Turin Polytechnic's DINSE Department (Evaluation of the Urban and Topological quality indicator. Prof. Gabriella PERETTI, Prof. Mario GROSSO).

The Media Village is an ecocompatible design experiment whose significance can be measured on several scales. The layout of the buildings on the area and their morphology, the design of the external spaces, and the construction technologies and materials adopted show that the aim of the project was integration with its environment. This attention was not confined to the local climate, but extended to all the resources of the natural physical surroundings (water, vegetation, soil, air) so as to secure the best comfort, reduce the consumption of energy, and safeguard the environment as a whole.

3.1 Localization and description of the Village

The Village is located in what was a methane storage area belonging to Italgas beside Corso Regina Margherita, a few blocks away from the inner city and the Mole Antonelliana. It became the Turin University campus after the Olympic Games.

The Village consists of four residential buildings and three service buildings. The residential buildings have four floors like others nearby. The service buildings have a single floor. The large area in which the Village stands is being converted into a pole by the University of Turin.

3.2 Aspects of environmental ecocompatibility

The Media Village is an example of ecocompatibility in terms of its project, construction and management. Its buildings face north and south, and are well spaced from each other. Their south fronts maximize the input of solar heat during the winter and have wide glass walls. The north sides have massive walls.

A wooden "brise soleil" screen has been installed to reduce overheating in the summer.

Fig 4. South front with sun screen composed of wooden slats.

The north-facing windows are smaller to reduce heat losses in the winter while ensuring a sufficient level of natural lighting.

Fig 5. North front.

The project ecocompatible approach is also evident in the building technologies, materials and components employed.

The vertical framework is composed of bricks made of clay and wood flour that allow excellent thermal inertia and have a U-value higher then the legal requirement. The other ecoefficient technological equipments are described in paragraph 3.3.

Energy saving is also a feature of the HVAC and electricity production systems. The rooms, for example, are heated by means of low-temperature radiating panels. Heating is provided by methane-fuelled condensation boilers.

Reduction of the consumption of potable water is achieved by means of cut-off taps and differentiated flushing toilets.

3.3 Excellence requirements

Evaluation of some of the requirements whose scores were in classes 3 to 5 will now be described to illustrate the design strategies and the technologies adopted to achieve these results. An excellent performance was recorded for the following requirements:

- r11 - the use of thermal inertia for winter and summer climate control;
- r18 - control of toxic emissions linked to the choice of materials in direct contact with the internal spaces.

Thermal inertia of the opaque enveloping surfaces for winter climate control results in excellent performance thanks to:

- layering of the flat roof with insulated wood-cement, 8 cm thick cork sheets, and a 15 cm layer of expanded clay (total thickness 48 cm, thermal decrement fator 26 hours);
- layering of the envelope in half-full blocks 38 cm thick (without plaster) made of porous brick with wood flour. These blocks are laid in parallel rows with a bedding mortar composed of lean lime and sand; a 1 cm thick by 10 cm wide strip of natural fibre is placed above each row at the centre of the blocks to break the thermal bridge created by the mortar joint.

Control of toxic emissions linked to the choice of materials is in the best class because the

materials in direct contact with the internal spaces do not give off volatile organic compounds (VOC), persistent organic pollutants (POP), heavy metals or toxic substances in the event of a fire.
Excellent performance was also recorded for the requirement:

- r1 – use of winter solar radiation.

Correct exposure to winter solar radiation is one of the main features of this project. The ground plan and volume arrangement of the buildings with their main fronts facing south are in keeping with the minimum solar distance (critical distance) criterion.

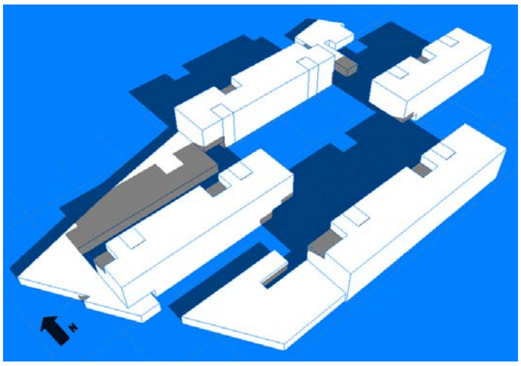

Fig 6. Midday shadows on 21 December.

Since the position of the sun on the horizon is lower in winter, the consumption of energy is reduced because the discontinuity of the slats of the brise soleil allows its rays to pass and warm the rooms.
Sliding wings have been applied to the larger windows to improve the natural lighting during the winter.
The residential quarters are mostly located on the south front to ensure their direct insolation. The plant rooms, stairways and lift wells are located on the north front and serve as buffers against winter heat losses.

Good performance was recorded for the following requirements:

- r3 - control of the dynamics of the winter winds;
- r4 - control of the dynamics of the summer winds;
- r7 - use of materials, elements and components with a low environmental load;
- r10 - solar control to avoid overheating;
- r12 - reduction of potable water consumption.

A good ecocompatibility score has been reached thanks to these requirements of excellence, other features of the project and the other building technologies employed.

Fig 7. Winter wind tracks.

3.4 Total score and graphs

The following synoptic polar diagram illustrates the performance results achieved by the evaluation procedure. It shows the ecocompatibility value attained by each requirement through the position and colour of its points. The total building ecocompatibility score is 2.30.

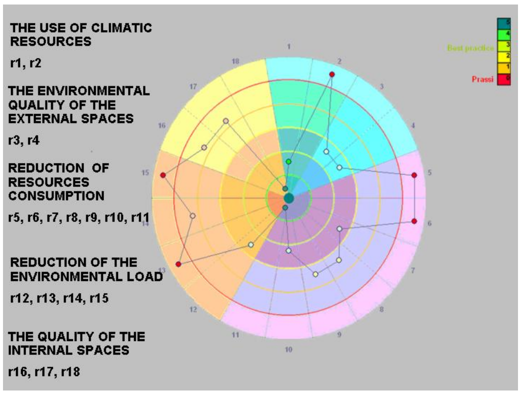

Fig 8. Synoptic polar diagram.

4. National and International evaluation system: a comparison

The method described in this paper (DINSE - TOROC method) is substantially similar to other international evaluation systems. Of these, GBTool, now the most widely used, assesses the environmental impact of a building throughout its life cycle by means of a performance score that classifies it on a quality scale.
The seven performance evaluation areas are:

a. Site selection, Project planning and Development
b. Energy and Resource Consumption
c. Environmental Loadings
d. Indoor Environmental Quality
e. Functionality and Controllability of Building Systems
f. Long-term Performance
g. Social and Economic aspects

A weight is assigned to each area. Some areas are comparable with the UNI system.
The table shows the need classes examined and compares the weights assigned in the evaluation systems.

Table 2: Comparison betweeen need classes and weights.

GBtool		DINSE - TOROC	
Site selection, Project planning and Development	5%	–	–
Energy and Resource Consumption	24%	Reduction of resources consumption	35%
		The use of climatic resources	20%
Environmental Loadings	14%	Reduction of the environmental load	20%
Indoor Environmental Quality	19%	The quality of internal spaces	15%
Functionality and Controllabilty of Building Systems	14%	–	–
Long-term Performance	14%	–	–
Social and Economic aspects	10%	–	–
–	–	The environmental quality of the external spaces	10%

GBTool and the DINSE -TOROC method use the same evaluation classes (0-5) and adopt analogous benchmark levels:

- score 0: Acceptable Practice
- score 3: Good Practice
- score 5: Best Practice

Application of the two methods to the "Italgas Media Village" case study gives the following ecocompatibility scores:

	Total building score
DINSE -TOROC	2.3
GBTool	2.0

The similarity of the final scores shows that both systems, albeit differing in some of the aspects evaluated, provide a complete and congruent picture of environmental sustainability.

Other ecocompatibility evaluation systems are being employed in Italy by local government officers in order to assess the eligibility of building projects for grants or tax breaks on the grounds of their asserted environmental sustainability.
The Itaca protocol elaborated by the Comitato Tecnico per l'Edilizia Sostenibile at ITACA (Istituto per l'innovazione e la trasparenza degli appalti e per la compatibilità ambientale), in conjunction with iiSBE Italia and the scientific support of ITC CNR and the Università Politecnica delle Marche, for example, consists of descriptive forms relating to every evaluation criterion considered. A weighted score is then assigned after the specific calculations.
Sb100, elaborated by Anab (Associazione Nazionale Architettura Bioecologica) in conjunction with IRE, Istituto di ricerca Ecopolis and local groups, applies a very different form of evaluation in which each ambit has the same weight. It is composed of 3 thematic areas (Biological, Ecological and Social), each with a list of its objectives and the actions (100 in all) needed to attain them. By contrast with the other systems, each action corresponds to one point and hence they are all thus of equal weight.
The following parameters have been employed to compare the systems:

- users to whom the instrument is addressed
- intended employment of the evaluable buildings
- evaluator
- type of attestation provided
- structure of the method
- evaluation areas
- input data
- output data
- user interface
- presence of user manual
- presence of normative and bibliographical references

Comparison and application of the systems bring out certain considerations ranging from evaluation of the user interface and the applicability of the software (of average complexity for all the systems), to the evaluation criteria, the environmental needs and resources assessed, the weights assigned, and the stages in the building of the subject of the evaluation.
Aside from their analogies and differences, all these evaluation systems contribute to the diffusion of building practices directed to sustainability.

5. Conclusion

Evaluation systems are essential guides for a project since they suggest a set of methods, criteria and technological choices aimed at sustainability.
Application of these tools on a wide scale is also essential since they are useful for:

- the diffusion of sustainable building practices, even in Italy, where there has been a delay of several years in getting started by comparison with other European countries in both the introduction of legislation and the building construction;
- arousing the awareness of end users and exerting an effect on the real estate market;
- comparing case studies.

Application has its difficulties, however. Furthermore the universities need to train competent specialists.
Emphasis must be placed on the local importance of establishing the weights to be assigned.
Some topics, such as the ecocompatibility of materials, are still devoid of adequate support on the part of enterprises and firms on the Italian building market.
Evaluation methods are thus important contributors to research and innovation concerning the energy and environmental quality of both new buildings and those in the process of renovation.

6. References

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