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Integration of Renewable Energy Systems in the Urban Spaces

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SH3-10: Urbanization, cities and rural areas
PE8-6: Energy systems (Application)
PE8-12: Sustainable design
PE8-13: Lightweight construction
SH5-11: Cultural heritage, cultural memories

Abstract:
The research concerns the design of urban space; it aims to integrate technologies from renewable sources in "sensitive" places by evaluating the relationship between the available technologies and the settlement. We have outlined a methodology for the analysis and design able to relate integration needs with those determined by the characteristics that define the micro-urban areas. We analyze systematically the architectural, climatic and technical aspects, we also study the perceptual relationships that develop between the people and public space. It is, finally, drawn a design methodology that respects the architecture of the place, imagining a process of integration of the existing spaces able to promote acceptable transformations of the ways to build.

Knowledge and experience of the group
The morphological and functional integration of energy production systems in urban and architectural scale, have been for many years one of the main research areas of this working group. The aspects that we studied are the methods of analysis, evaluation criteria, and guidelines for the project.
The tools for the analysis refer to the formalization of discovery protocols for the classification of the architectural elements and recognition of surface alterations of buildings[1]. We have studied the control of climate and environmental quality of public spaces, and the socio-cultural and perceptual effects related to the integration of energy systems powered by renewable sources. This research has prompted a re-reading of the studies that have addressed the same issues in order to propose new ways of reading and develop not deterministic intervention strategies[2].
The phenomenological analysis of life in public spaces, which featured a line of research of urban culture in recent decades, is the reference method for the assessment of environmental quality and perception of urban places.
The contributions for the design of public space produced during the twentieth century, has been an essential reference for reading and analysis of urban spaces on the small scale characterizing the existing city[3].
The phenomenological analysis of the life that takes place in public spaces which featured a line of research of urban culture, is the reference method for assessing the psycho-perceptual quality and fruition of urban voids[4].
The project that considers the participation of the users and climatic aspects in a system of formal rules is a powerful tool to develop intervention methods for urban and building scale[5].
The bioclimatic approach, in agreement with the thought of Victor Olgyay (1963), addresses the ecological approach to the design of open spaces by placing them in relation to the buildings. The relationship between space and building determines the climatic conditions of micro-urban areas: this creates healthy places that encourage social interaction between people[6]. The contribution of the research on the topic of architectural

technology has produced, since the founding statutes of the discipline, theoretical and operational guidelines for the preliminary stages of the project[7].
The integration of technologies for energy production from renewable sources was addressed in the literature focusing on different scales, from the planning to the energy integration building. The planning of the solar city is the subject of European research analyzing and promoting the use of solar energy in large scale in urban areas[8].
The integration of technologies from renewable energy sources is at an advanced stage in the building design, where components and systems are becoming elements of the language of architecture. In relation to the open space, these technologies become only elements of street furniture, without contributing to the construction of a new language in the design of public space[9]. The themes of the qualification of the urban void in the relationship between aspects of technical efficiency and the shape of space remain to explore[10].

Theory and Methodology[11]
The integration of the renewable energetic sources with the public area requalification project is our main research subject since the 2008 PRIN project[12].
Indeed, this subject joins two specific education fields: the urban open area project and the integration of technologies from renewable sources. In particular, the subject is connecting Photovoltaic system (PV) with frameworks and components, which characterize the “urban empty spaces”.
Which are the main functions of the open area? Moreover, which are the benefits that a well-projected area can provide both to inhabitants and to the environment?
These benefits are applicable to the environmental and ecological context, to the human and social one and finally to the symbolic and aesthetic context.
The environmental and ecological context refers to the climate control aspects, the sound quality, the management of the hydric sources and the defence of animal and plants.
The social context is connected to the direct usage of the urban open area for the amusement and the interpersonal connection of people, and influences people health and wellness.
Finally, the symbolic and aesthetic context involves the feeling of belonging to a place and the aesthetic values.
The renewable energy technologies show the issue of integration in “sensitive” areas, they stimulate the interest for relationship between available technologies and local contexts at different levels (from the building to the city).
In any case, it is crucial to overcome the logic of basing exclusively on technical-energetic requirements, at all the levels of the intervention and in all the different stages of decision. By contrast, it is crucial to develop approaches that favour the area cultural values (landscapes settlement), and that use methods of analysis, evaluation and prevision of transformations.
The attention for the comfort, in public area use, is strongly connected to bioclimatic strategies, and characterizes both the urban project and the technologic project of systems integration. Indeed, it joins the perceptive and environmental quality, and the technical and economic efficiency of the energetic production.
Therefore, the research is approaching the critical issue of a planning integrated and aware of the solar systems active in historical city, solving both the technical aspects connected to integration, and the morphological ones connected to the “perceivable” context.
The product of the research is the conception and diffusion of innovative solutions characterized by multi-functionality and adaptability to context and by use flexibility.
Furthermore, we pay particular attention to new configurations and geometrical-dimensional characteristics, which are determined by integration between old and new materials, and between traditional and innovative components.
To this end, we elaborated a protocol to measure and analyze the public area and a checklist for the requalification project preliminary phases, based on integration of renewable energetic sources.
In particular, we propose indications to define instruments for the beginning phases of the project, in the interest of the intervention promoters and controllers. Descriptions and auxiliary supports provide instruments to precisely measure the characteristics of the intervention places, in order to highline the deficiencies and the improvement necessity and formulate the demands of the next projecting phases[13].
Concerning the objects system and the compatible functions, we propose the reduction of the “visual noise” through functions and performances, through modification of the components, and through the survey of practices, flexible and complementary to the season variation and to the day/night alternation[14].
Finally our point of view regarding the morphologic integration takes into consideration the PV systems as technological/linguistic stratification that substitute sub-system and components of the shell. This is presently thinkable thanks to the innovation, which is proposing the progressive dematerialization of grabbing system and the availability of new chromatism and new textures.
In addition, we propose the main decrease of isolated, mono-functional components of the street furniture, replacing them with a system as much as possible absorbed in the vertical and horizontal surfaces of the living spaces. We also propose micro-structures characterized by more integrated functions (seats, signals,

public lights), where the energy production system is a dematerialized functional layer and a part of the complex element, thus integrating morphology and function.

The methodological model for the preliminary analysis[15]

The preliminary reading of urban micro-contexts aimed at integration of technologies from renewable energy sources was conducted on the systemic analysis model, considering the public space sub-system structured in *spaces* and *curtains*. The *spaces* are the units accommodating homogeneous activities. The *curtains* are all the limits of the urban open space and can be identified as spatial elements of the urban pattern.
The analysis levels took into account the material and immaterial aspects characterizing the urban space, in which the relationship dynamics prevail on the mere articulation of functions (Tab. 1).
A methodology was defined, aimed at identifying the design requirements for the improvement of environmental quality of the open space in the consolidated city, using PV systems for energy self-sufficiency of all new and/or upgraded.
We have identified four categories of analysis: functional, geometric, microclimate and use. We are used analog (survey, direct evaluation, interviews) and digital tools, simulation software and data processing (Townscope, Arcview, Sketchup, Comfa+).

Tab. 1. *Character of the open space*

Morpho-geometric	*Bioclimatic*	*Surfaces*	*Types and use*	*Environmental aggressiveness*
- Form (central plan form stretched" mode) - Dimensions - H / D (sections)	- Exposure - Sky view factor (solid angle of view of the sky from an urban area) - Protection from the sun and hours of exposure - Porosity and wind protection - Solar radiation - Maximum and minimum temperatures - Sky conditions (sunny, mixed, covered) - Presence of vegetation - The presence of water	- Type - Absorbency - Albedo (reflectance) - Characteristics of the materials	- Typology - Destination of use	- Air pollution - Noise - Light pollution

The analysis is structured in phases, each related to a specific aspect of the urban system:

1. Acquisition of site data – Identification of place in the urban context, its geometric characteristics of the planning constraints, of physical entities present in it.
2. Analysis of microclimate – Data collection and processing referring to the sun and energy potential of the site.
3. Analysis of the materials – Data collection and processing to the knowledge of the physical characteristics of the place and his attitude to integration according to the morphological and technological characters.
4. Analysis of the social meaning – Data collection and processing on the knowledge of the presents uses and functions (real uses, user groups, usability of the park, the view, and the way).
5. Psycho-perceptive analysis – Survey on characters of the urban space that produce psycho-emotional reactions and feelings of cultural identity and place identifiably.

The five examinations of the open space levels describe its character in the graphic-analytical form and provide the information base for the development of the transformation project (Fig. 1 and 2).

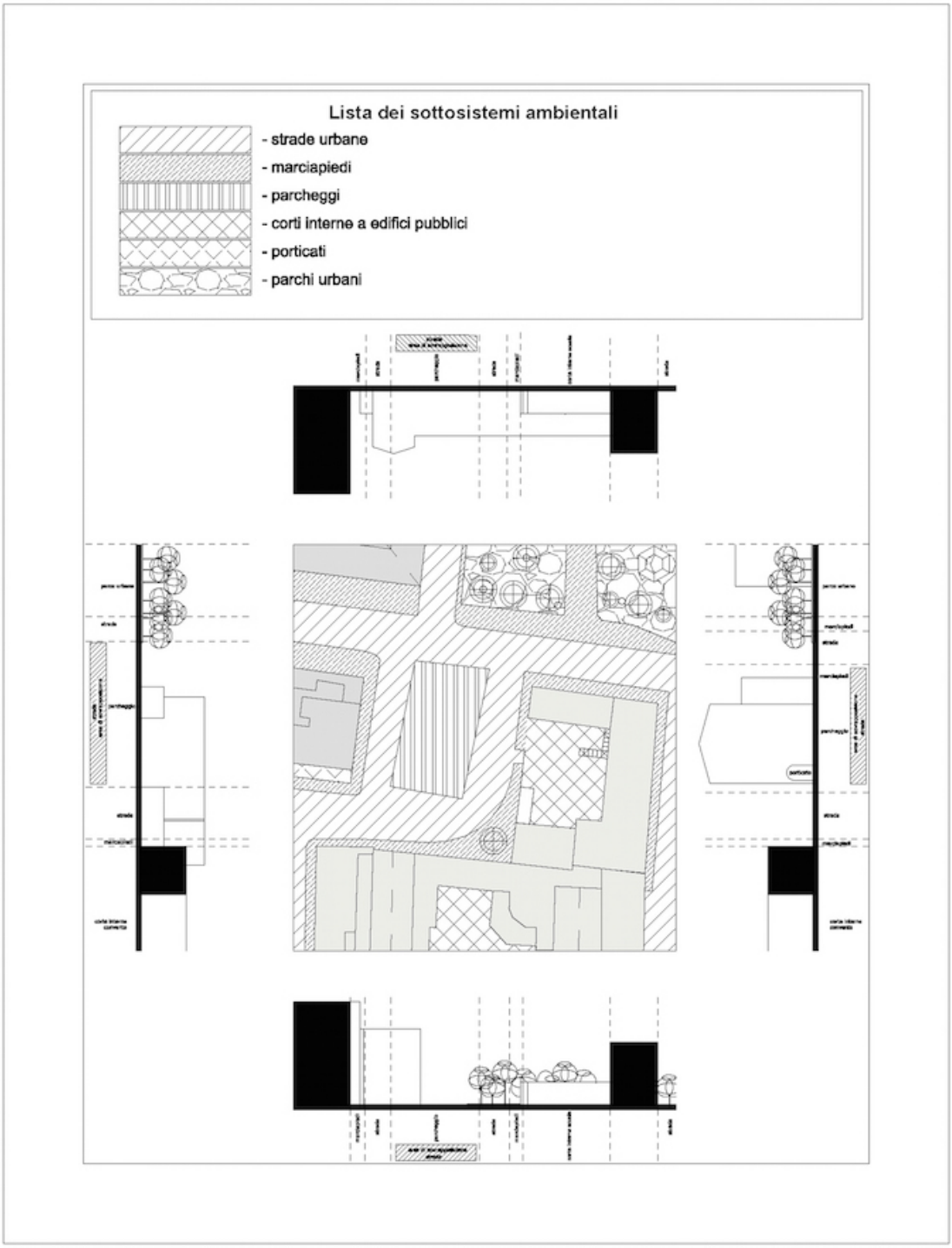

Fig. 1. Environmental subsystem analysis – Don Diana Square, Aversa

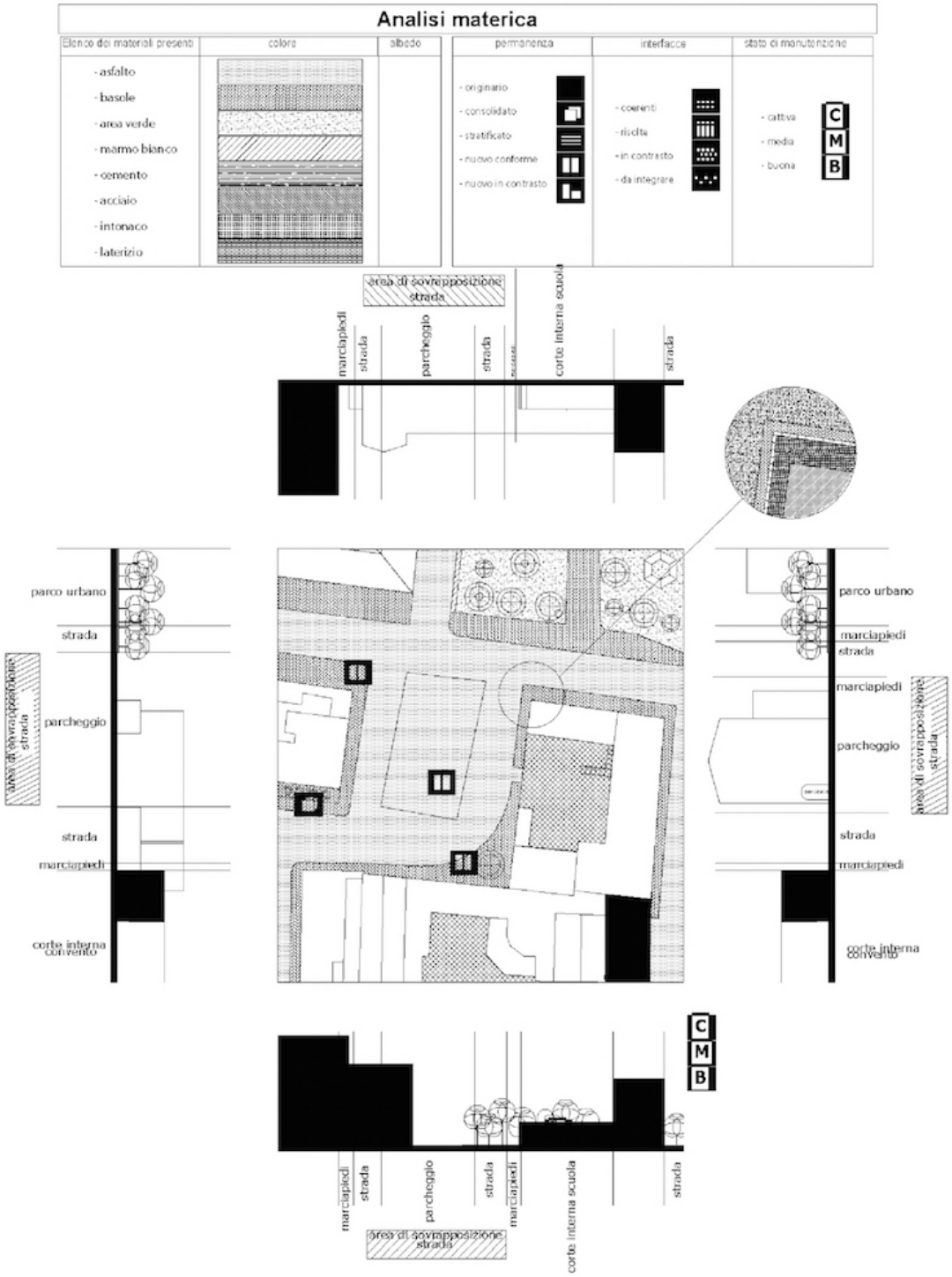

Fig. 2. Technological subsystem analysis: materials analysis – Don Diana Square, Aversa

The procedure identifies the tools able to support feedback of functional, geometric, microclimatic and of use type, in relation to the phases of the survey. The evaluations are then translated into diagrams supporting the micro-climatic, materials, social and psycho-perceptive analysis. The intersections determined by the overlap of the diagrams are the basis of reference for the geometric description of the location, in relation to the information obtained.

The physical data and activities taking place within the same particle are treated as input and output flows of material and energy. All these streams are geo-referenced, so that information is processed in a Geographic Information System, enabling the integrated assessment of the site environmental capacity in relation to the installation of PV systems to improving the environment.

The model proposed has been tested in a real context, consisting of a set of squares in the old city of Aversa. The place consists of a system of three interconnected spaces, each with different morphological and fruition characters. The location is right in the city centre, in a rich historical matrix, which over time has been altered by urban transformations.

The analysis was conducted separately for each of the three squares, according to the protocol survey methodology. We obtained environmental data with the support of software Townscope, which processes the parameters of the environmental conditions and the physical characteristics of the surfaces defining the space, and provides qualitative and quantitative data relating to the potential of the solar location. The output information dealing with solar access, open to the sky, the lengths views, visibility and thermal comfort. We have conducted surveys of matter of the horizontal and vertical surfaces, the uses of the open spaces and activities at the ground floor of the buildings, all the urban furniture. The psycho-perceptual analysis has been structured surveying and identifying: the parameters of the site (paths, edges, districts, nodes, references); points of view and perspectives defined by the particular characteristics (curtains, paths, articulation of the facades of urban green); the landmarks (architectural and/or artistic buildings or their parts, vegetable elements that make up visual and/or cultural site cues); areas where particularly favourable or unfavourable comfort conditions exist.
The information gathered was revised in space areal mapping associated with detailed descriptions of the morphological and technological characteristics of objects and surfaces. Each level of analysis represents a layer of reading a specific aspect of the micro-urban system analyzed. According to the multicriteria analysis, it allows processing the indicators to represent the level of morphological integration and performance between the energy components and sub-urban systems described and classified.

Analysis and evaluation of micro-urban areas[16]

Reading urban spaces means seeking the meaning of the places in accordance with the basic approach outlined, by Christian Norberg-Schulz (1979), and more specifically for the analysis of perception, by Kevin Lynch (1960). The application of these theories to the study of urban spaces outlines an analytical model listening to places, catching suggestions, references, and echoes, cultural and sensorial stimuli.
The memory engraved on the walls and on the city streets is a key factor of belonging to the inhabitants, but the complexity of migration and economic development of recent years makes nowadays more difficult than in the past, the task of interpreting the dynamics transforming spaces and behaviors of metropolitan places. You cannot consider therefore the city today only the “place” of memory and shared values but, more likely, we have to read it as the substrate of values that Berque (1990) called “milieu”. *The milieu is composed of an objective part (the historical and environmental heritage) and a subjective part (the local society). The meeting between the two terms, however, is not deterministic. Between the two terms is established a two-way relationship in which the heritage offers potential that the local society may or may not play by connecting the symbolic and the objective as to the transformation of matter into a resource*[17].
The main task of urban design is, today, to create a deep connection with the places of the city. Only a conscious project activity can rethink urban spaces inherited from the past, to make them recognizable to the younger generation, because today the urban space appears to many people as a beautiful meaningless picture. We must act on the meaning rather than on form, making sure to bring out forgotten symbolic contents, we must attach new meanings to balance two harmful attitudes if uncritically applied: on one hand the tendency to create museums and on the other, the change in name of “modernity”.
The redevelopment of a site requires preliminary surveys allowing to support and justify choices, along with a careful study of the historical, cartographic, and bibliographic sources. This need is so integrated to the practice of every designer so that it may appear as not necessary to redefine the manner and content. Nevertheless, we firmly believe that it is still useful develop new theories that can enrich the skills of analysis and evaluation of directors and designers working on micro-urban areas. We study the perceptual quality of the place and the psychological and social implications that determine the relationship between the city and the user. In particular, with regard to the integration of renewable energy systems in urban areas, we can identify specific features that must be highlighted, such as the character of architectural surfaces, the sunshine and the sky view of the open spaces, the ratio between buildings and public space.
All these issues are perceived by decision makers and planners as essential but the judgment on them is always expressed in free-form and without objective validation: each operator tends to emphasize characteristics of the site that justify decisions already taken on the basis of preconceptions. Such choices often depend on personal taste or economic considerations.
Once formalized within a coherent structure, the information listed above could reduce the randomness of the choices by providing new instruments for the project. Administrators may make demands that are more accurate and consistent with the quality of the sites, the designers instead would have a powerful tool to target within defined limits their ability.
The idea behind this reasoning considers the urban environment as an inseparable combination of matter and behaviour, history and modernity. We must define flexible strategies, as it is necessary to use different reading parameters and evaluation for different places. It is therefore necessary to define a sort of atlas of the places based on axiomatically obvious structural features. The main categories of evaluation can be divided into more sub-categories based on the characters of urbanity, rurality, historicity, “no place” and “third landscape” of each site.
The three systems structuring the image and meaning of urban micro-landscape are the building facades, public space, and green spaces. We can evaluate the perceptual quality of these sets by dividing each of

them in the following fourteen sub-systems: architecture, history, symbolism, shape, age, decay, uses, materials, color, light, climate, pollution, noise, safety (Tab. 2).

	Invaso spaziale	Verde	Cortine edilizie
Architettura			
Storia			
Valore simbolico			
Forma			
Età			
Degrado			
Destinazione d'uso			
Materiali			
Colore			
Luminosità			
Clima			
Inquinamento			
Acustica			
Sicurezza			

Tab. 2. Matrix criteria/elements of the urban scene

The assignment of subsystems listed in each of the three sets determining the quality of urban life depends on their nature which may be material (spatial, linear) or intangible (environmental, social). Through the analysis and judgment of each subsystem/attribute, we can measure the perceptual quality of the urban sector.

We work on the basis of a simple reconstruction of the area, based on photo righting of the facades and taking cadastral information (number of units, destination of the property, etc.). Even the climate data and other environmental information are easily obtainable from paper reports (Fig. 3).

Fig. 3. Building curtain with photo straightening

More specifically, we have developed a methodology to evaluate the micro areas forming part of the city and, in particular, of their historic centres. For this reason, the criteria and methods of assessment adopted are descended from this particular setting. The multi-criteria analysis is carried out by the method AHP (Analytic Hierarchy Process) based on a comparison of the elements of a hierarchy connecting objectives, criteria,

and alternatives. The partial results achieved so far, must be considered as an experiment in progress that we may integrate and improve.

macro criteri	*numero*	*criteri di terzo livello*	*funzione di calcolo*		*valori*	*forma del dato/ unità di misura*	*funzione obiettivo*
MC1 QCE Qualità cortina edilizia	**C1**	**PE** Permanenza edilizia	$[n_{50}(m+1)]/n$	n_{50}= numero di edifici oltre i 50 anni m= numero di edifici monumentali n= numero edifici che formano la cortina		n/n adimens.	max
	C2	**AU** Attrazione utenze	$n_{(uff)}/n_{(ui)}$	$n_{(uff)}$= numero uffici (pubblici e privati) $n_{(ui)}$= numero unità immobiliari		n/n adimens.	max
	C3	**AC** Attrazione commerciale	$n_{(ac)}/n_{(ui)}$	$n_{(ac)}$= numero attività commerciali $n_{(ui)}$= numero unità immobiliari		n/n adimens.	max
	C4	**R** Residenzialità	$n_{(res)}/n_{(ui)}$	$n_{(res)}$= numero residenze $n_{(ui)}$= numero unità immobiliari		n/n adimens.	max
	C5	**VC** Verde di cortina	**(vc/lc) * i * k**	vc = verde di cortina in ml lc= lunghezza cortina in ml i= indice di pregio verde k= indice di visibilità del verde	i=(1=basso 2=medio 3=alto) k=(1=scarsamente visibile/inaccesibile 2=scarsamente visibile/accessibile 3=mediamente visibile/naccessibile 4=mediamente visibile/accessibile 5= altamente visibile/inaccessibile 6=altamente visibile/accessibile)	m/m adimens.	max
	C6	**DC** Degrado cortina	$[n_{(edeg)}/n]*j$	$n_{(edeg)}$= numero edifici degradati n= num. edifici che formano la cortina j= livello di degrado	j=(1=basso 2=medio 3=alto)	n/n adimens.	min
MC2 QVU Qualità verde urbano	**C7**	**E** Estensione	**SV/AS**	SV= superficie a verde AS= superficie del settore urbano		mq/mq adimens.	max
	C8	**V** Visibilità	**GIUDIZIO ESPERTO**		(1=basso 2=medio 3=alto)	giud. sint. adimens.	max
	C9	**F** Fruibilità	**GIUDIZIO ESPERTO**		(1=basso 2=medio 3=alto)	giud. sint. adimens.	max
	C10	**DV** Degrado verde	**GIUDIZIO ESPERTO**		(1=basso 2=medio 3=alto)	giud. sint. adimens.	min
	C11	**A** Attrezzature	**GIUDIZIO ESPERTO**		(1=basso 2=medio 3=alto)	giud. sint. adimens.	max
MC3 QI Qualità dell'invaso	**C12**	**VI** Verde di invaso	**GIUDIZIO ESPERTO**		(1=assenza 2=verde isolato e rado 3=verde areale o filari significativi)	giud. sint. adimens.	max
	C13	**AI** Attrezzature di invaso	**GIUDIZIO ESPERTO**		AI= media dei valori a+b+c+d+e+f a) illuminazione (1=assente 2=media 3=ottimale) b) riparo (1=assente 2=pensiline/pergolato 3=portico) c) seduta (1=assenza 2=presenza degradata 3=presenza ottimale) d) informazione (1=assente 2=comunicativa/pubblicità 3=comunicativa/utilità interattiva) e) vendita/servizio (1=assente 2=media 3=ottimale) f) conforto/benessere (1=assenza 2=presenza degradata 3=presenza ottimale)	giud. sint. adimens.	max
	C14	**FO** Finiture orizzontali	**GIUDIZIO ESPERTO**		(1=pavimentazione di bassa qualità 2=pavimentazione di media qualità 3=pavimentazione di pregio)	giud. sint. adimens.	max
	C15	**U** Uso	**GIUDIZIO ESPERTO**		(1=pedonale/carrabile senza marciapiede 2=pedonale/carrabile con marciapiede 2,5=pedonale 3=pedonale/ciclabile)	giud. sint. adimens.	max
	C16	**SWO** Vista cielo	**GIUDIZIO ESPERTO**		1=bassa(<20%) 2=media (20%<SWO<45%) 3=alta (>45%)	giud. sint. adimens.	min
	C17	**IAT** Inquinamento atmosferico	**GIUDIZIO ESPERTO**		1=bassa concentrazione 2=media concentrazione 3=alta concentrazione	giud. sint. adimens.	min
	C18	**IAC** Inquinamento acustico	**GIUDIZIO ESPERTO**		1=basso(<30 dB) 2=medio (30dB<IAC<60dB) 3=alto (>60dB)	giud. sint. adimens.	min

Tab. 3. Summary table of the macro-criteria, criteria and values indicating the preferability

Sustainable innovation in the design of public space

The method and the operational tools proposed have been tested in teaching developed at the university of Aversa, proposing the use of innovative technologies for the redevelopment of urban sensitive spaces[18].

The students had been exploiting the systemic interpretation of space and the multi-criteria analysis developed by the research. The synergistic interpretation of the data has allowed identifying the most suitable areas able to integrate disseminated systems of micro-generation energy.

The method of analysis for the detection of design strategies has also been adopted in urban areas with special and extreme features, such as places with depopulation trend, in which the public space is strategic to the conditions of appeal, in accordance with the historic character of the place in environmental.

The approach proposed micro-interventions on “closed” public space, can produce a strong value in the process of urban regeneration. The rehabilitation of small residual artefacts aims to achieve micro-buildings with high sustainability and high-value and experimental demonstration. The relationship with the characters of the local architecture takes place through a support process and integration able to activate transformations of the construction languages.

Notes

1. The contributions to the assessment methodologies of characters and quality and/or performance of the built environment involved the perception of urban space and the propensity to integrating new technologies in building and micro-urban scale. A thorough reflection was conducted also referring to formulate new training methods to qualifying the figures involved in the implementation of innovative sustainable strategies. Noteworthy, for the reading and evaluation of the built environment: Bosco, Capasso (1993), Rinaldi (1993), Bosco (1994), Rinaldi (2002), Bosco, Scognamiglio (2005), Rinaldi (2006), Arena (2011). Per le nuove metodologie formative: Arena M. (2012) *Sistemi formativi integrati per la diffusione dell'innovazione nel settore delle costruzioni*, tesi di dottorato in tecnologia dell’architettura (XXIII ciclo) Seconda Università di Napoli.

2. Bosco, Rinaldi, Valente, (2013).
3. In this respect, the theories of Gordon Cullen and Kevin Lynch identified the urban space as a system of flows, functions and relationships based on the interaction between the observer and the observed system user. Cullen (1961); Lynch (1960).
4. Jan Gehl assumes that the animation of collective space of living, namely the presence of people, the succession of events and the occurrence of activity, constitutes the highest index of the quality of the public space. Gehl (1987).
5. Among these Christopher Alexander with his Pattern Language for the cultural complexity that underlies the methodology and application, "automatic" and computer-assisted. The aim of creating quality spaces, starting from BottomUp participatory decision-making models, is fully applicable in the placemaking philosophy of the founding assumptions which are due to research American urbanist William H. Whyte (1980). The focus on the relationship between the building and the context is the basis of numerous studies, which have been outlined based approaches morphological, and procedural performance. Among the studies directed towards the morphology of the project, of particular interest is the work of Ralph L. Knowles on the aesthetic implications of the design according to the criteria of nature (Knowles, 2008).
6. Until about thirty years ago there were no specific tools for bioclimatic control of outdoor spaces. Only since the early 2000s there have been major attempts to establish a specific disciplinary body. Among them one of the most important is certainly the European Research RUROS (2004).
7. Significant, the "weather matrices of site" proposed by Grosso (2005) to optimize the location of a building, but also for the choice of the destination of use of the external spaces according to the thermal comfort of the users. An assessment of comfort with the tools of conduct of needs-performance analysis is offered by Dessi (2007), which looks at the requirements related to the use and environmental requirements for identifying design solutions that improve the urban microclimate and the use of space open relationship.
8. According to a classification of the IEA-PVPS Task 7 types of Not Building Structures (NBS) with integrated PV systems are divided into:
1. Urban Street Equipment: Parking meters, information signs, ticket vending machines, information boards, etc.
2. Barriers: Fences, gates, noise barriers, etc.
3. Shelters: Bus stops, telephone boxes, parking, umbrellas, information stands, etc.
4. Kiosks: Pavilions, toilets, refreshments, news-stands, etc.
5. Single "Upper-floor" Structures: Street lights, street signs, commercial signs, road signposts, etc.
6. Multi "Upper-floor" Structures: Screen road signs, screen publicity structures, etc.
9. From the IEA-PVPS program (International Energy Agency Photovoltaic Power Systems Programme), started in 1993 with the aim of increasing international cooperation to accelerate the development and use of solar photovoltaic technology, have been developed in Europe other collection programs programs and widespread use of PV systems in cities. More recently, the POLIS project, funded under the Intelligent Energy Europe Programme, explored aspects of planning and the identification of strategic measures to local politics to activate the solar capacity of urban structures in European cities.
10. An important recent contribution, the result of a PRIN research is published in: Scudo (2013).
11. Chapter written by Sergio Rinaldi.
12. Search by title: The systems integration of renewable technologies in the built environment. Coordinated by prof. G. Scudo of Politecnico di Milano, with the research unit of the University of Genoa, Florence and the Second University of Naples. The research has the objective of identifying procedures for integrating energy production systems from renewable sources in the architecture and the environment, according to the three points of view of the process, project and product. The research unit of S.U.N. (responsible prof. S. Rinaldi) operated in the context of the project, with the aim of developing tools to support the integration of PV systems in urban open spaces, considering the factors affecting the performance behavior and govern the 'morphological integration and landscaping.
13. The aim is to overcome the traditional Preliminary Design Documents to navigate to the Design Brief, which becomes the synthesis of analytical, methodological prerequisites and object of research. In this regard cfr. Dal DPP verso il design brief per il progetto dello spazio aperto urbano (Rinaldi, 2013, in G. Scudo (2013), p. 81 -85).
14. An original definition of new categories of requirements for the design of public space is provided by (Valente, 2013, in Bosco, Rinaldi, Valente, 2013, p. 133-169).
15. Chapter written by Mariarosaria Arena.
16. Chapter written by Antonio Bosco.
17. Cfr. Poli D. (1998).
18. Course Design of innovative construction systems in CDLM Architecture and Civil Engineering, a.a. 2010-2011, prof. Sergio Rinaldi. It 'was organized a workshop entitled microarchitecture for the public spaces of the historic center of Aversa, whose main theme was the design of micro-architectures for high integration of environmental technology and energy self-sufficient, for the use and renewal of the public spaces of the city.

Authors

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Sergio Rinaldi, architect, Phd, associate professor in architecture technology at Second University of Naples. Member of the board of the inter-university centre A.B.I.T.A,
He is interested in higher education in technical, transfer, and dissemination of results of research to operators in the construction industry. The scientific outline result strictly connected to architecture technology with particular reference to building system and to its relation with environmental context. Actually, he researches about architecture integration of renewables energy sources in the historic cit and on this theme directed a research unit of a PRIN (Research Program of National Interest).

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