

# TeMA

Journal of  
Land Use, Mobility and Environment

This special issue collects a selection of peer-review papers presented at the 8th International Conference INPUT 2014 titled "Smart City: planning for energy, transportation and sustainability of urban systems", held on 4-6 June in Naples, Italy. The issue includes recent developments on the theme of relationship between innovation and city management and planning.

Tema is the Journal of Land use, Mobility and Environment and offers papers with a unified approach to planning and mobility. TeMA Journal has also received the Sparc Europe Seal of Open Access Journals released by Scholarly Publishing and Academic Resources Coalition (SPARC Europe) and the Directory of Open Access Journals (DOAJ).

# INPUT 2014

papers selected

## Smart City

planning for energy, transportation  
and sustainability of the urban system

## SMART CITY

## PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

Special Issue, June 2014

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# TeMA

Journal of  
Land Use, Mobility and  
Environment

TeMA. Journal of Land Use, Mobility and Environment offers researches, applications and contributions with a unified approach to planning and mobility and publishes original inter-disciplinary papers on the interaction of transport, land use and environment. Domains include engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science, and complex systems.

The Italian National Agency for the Evaluation of Universities and Research Institutes (ANVUR) classified TeMA as scientific journals in the Areas 08. TeMA has also received the Sparc Europe Seal for Open Access Journals released by Scholarly Publishing and Academic Resources Coalition (SPARC Europe) and the Directory of Open Access Journals (DOAJ). TeMA is published under a Creative Commons Attribution 3.0 License and is blind peer reviewed at least by two referees selected among high-profile scientists by their competences. TeMA has been published since 2007 and is indexed in the main bibliographical databases and it is present in the catalogues of hundreds of academic and research libraries worldwide.

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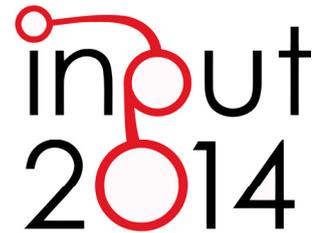
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# TeMA

Journal of  
Land Use, Mobility and  
Environment

This special issue of TeMA collects the papers presented at the 8th International Conference INPUT 2014 which will take place in Naples from 4th to 6th June. The Conference focuses on one of the central topics within the urban studies debate and combines, in a new perspective, researches concerning the relationship between innovation and management of city changing.



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## EIGHTH INTERNATIONAL CONFERENCE INPUT 2014

### SMART CITY. PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

This special issue of TeMA collects the papers presented at the Eighth International Conference INPUT, 2014, titled "Smart City. Planning for energy, transportation and sustainability of the urban system" that takes place in Naples from 4 to 6 of June 2014.

INPUT (Innovation in Urban Planning and Territorial) consists of an informal group/network of academic researchers Italians and foreigners working in several areas related to urban and territorial planning. Starting from the first conference, held in Venice in 1999, INPUT has represented an opportunity to reflect on the use of Information and Communication Technologies (ICTs) as key planning support tools. The theme of the eighth conference focuses on one of the most topical debate of urban studies that combines , in a new perspective, researches concerning the relationship between innovation (technological, methodological, of process etc..) and the management of the changes of the city. The Smart City is also currently the most investigated subject by TeMA that with this number is intended to provide a broad overview of the research activities currently in place in Italy and a number of European countries. Naples, with its tradition of studies in this particular research field, represents the best place to review progress on what is being done and try to identify some structural elements of a planning approach.

Furthermore the conference has represented the ideal space of mind comparison and ideas exchanging about a number of topics like: planning support systems, models to geo-design, qualitative cognitive models and formal ontologies, smart mobility and urban transport, Visualization and spatial perception in urban planning innovative processes for urban regeneration, smart city and smart citizen, the Smart Energy Master project, urban entropy and evaluation in urban planning, etc..

The conference INPUT Naples 2014 were sent 84 papers, through a computerized procedure using the website [www.input2014.it](http://www.input2014.it) . The papers were subjected to a series of monitoring and control operations. The first fundamental phase saw the submission of the papers to reviewers. To enable a blind procedure the papers have been checked in advance, in order to eliminate any reference to the authors. The review was carried out on a form set up by the local scientific committee. The review forms received were sent to the authors who have adapted the papers, in a more or less extensive way, on the base of the received comments. At this point (third stage), the new version of the paper was subjected to control for to standardize the content to the layout required for the publication within TeMA. In parallel, the Local Scientific Committee, along with the Editorial Board of the magazine, has provided to the technical operation on the site TeMA (insertion of data for the indexing and insertion of pdf version of the papers). In the light of the time's shortness and of the high number of contributions the Local Scientific Committee decided to publish the papers by applying some simplifies compared with the normal procedures used by TeMA. Specifically:

- Each paper was equipped with cover, TeMA Editorial Advisory Board, INPUT Scientific Committee, introductory page of INPUT 2014 and summary;
- Summary and sorting of the papers are in alphabetical order, based on the surname of the first author;
- Each paper is indexed with own DOI codex which can be found in the electronic version on TeMA website ([www.tema.unina.it](http://www.tema.unina.it)). The codex is not present on the pdf version of the papers.

## SMART CITY PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM Special Issue, June 2014

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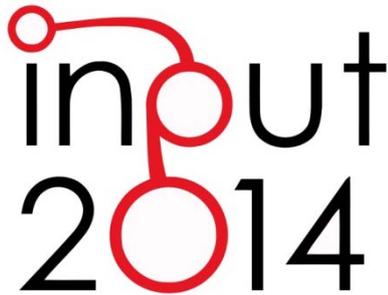
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SPECIAL ISSUE

Eighth International Conference INPUT  
Smart City - Planning for Energy, Transportation and Sustainability  
of the Urban System

*Naples, 4-6 June 2014*

The logo for the INPUT 2014 conference. It features the word "input" in a lowercase, sans-serif font, with the "i" and "n" connected by a red line that forms a stylized shape. Below "input" is the year "2014" in a large, bold, sans-serif font. The "0" in "2014" is also connected to the red line above it.

## ENERGY AND ENVIRONMENT IN URBAN REGENERATION

STUDIES FOR A METHOD OF ANALYSIS OF URBAN PERIPHERY

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### ABSTRACT

Despite planning of urban regeneration has been theorized from several decades, today activating concrete programs encounters major difficulties. Moreover, the structural nature of economic crisis and the operators tendency to maintaining obsolete models of urban transformation certainly do not help to overcome the stalemate.

The article argues, however, that this framework appears to evolve under the influence of some external factors that bring to the fore the importance of the energy - environmental components in the renewal of the existing city.

This address, focused on the concept of urban environment, seems to identify new principles of economic environmental sustainability of the city that converge towards social models of smart community and urban models of smart city.

The article then describes the research in progress regarding an operative method to define explicit and replicable bases of the urban environment concept to be considered in plans of urban renewal. Main fields of observation and measurement are "urban comfort" and "anthropogenic load (pollution)". An experimental application of the analysis is developed on the eastern area of Rome. Finally, the paper offers specific lines for the research development.

### KEYWORDS

Urban rehabilitation and renewal, Mapping urban environment, Urban Heat Island, Urban comfort

## 1 INTRODUCTION

Since the mid-80s of the last century, if not earlier (Campos Venuti 1987), planning regulations' focus has been on urban regeneration. In plan contents, settings for widespread programmes improving existing settlements quality, especially in the chaotic urban and metropolitan areas, have found an increasing role. Recently, there have been two converging variations on this theme: the stop of the land's use for new constructions and the redevelopment of brown field sites. In real processes, however, there have been no positive signals on both fronts. Despite the prevailing economic crisis, land use is still growing, so that at the institutional level the ISPRA Institute (i.e. *Istituto Superiore per la Protezione e la Ricerca Ambientale*)<sup>1</sup> has raised the alarm. Even with only a superficial observation, there has also been a strongly unbalanced relationship between the increasing number and size of brown field sites (especially in the suburbs) and the smallness of the upgraded or reuse areas.

The same AUDIS association (i.e. *Associazione Aree Urbane Dismesse*), despite the growing opportunities associated to urban heritage, detects a large difficulty for launching regenerative and wide-ranging programmes, so that exclusively considers and promotes them in a future perspective and with respect to a radical change in approach and application models than in the past<sup>2</sup>.

The structural nature of the crisis is in fact recognized by many observers, as well as the obsolescence of traditional of traditional urban transformation models, simply based on the push real estate. Nevertheless, the express opening of new directions and standards for the qualification of existing settlements encounters obstacles and inertia, especially in cultural terms and on the part of the operators.

This frame seems relatively fast-moving.

Some factors, outside the established relations system "government-private actors", are beginning to press a change and to overcome the stagnation in the economy of the city. The push to urban transformation begins to take on the energy and environmental value in the qualification of the existing city, more and more in terms of cultural, ideological, programme and urban policies.

These pressures come from:

- progressive enhancement of citizens sensitivity to the energy and environmental issues; the focus is on preservation of natural resources but also on protection of inhabitants health, that is under threat from the effects of unhealthy patterns of settlement; it is widely recognized as the settlements organization (or disorganization) affects the physical health of citizens in terms of pollution, hostile microclimate conditions (European Environment Agency, 2012)<sup>3</sup> and induction of unhealthy behaviour patterns<sup>4</sup>;
- radical addresses from the EU environmental policies (for example: The 2020 Climate and Energy Package<sup>5</sup>; Commissione Europea 2011; ECORYS SCS Group 2011), programmes and operational initiatives (for example Covenant of Mayors<sup>6</sup>), increasingly directed to local authorities, communities, users, stakeholders, thus overcoming the actions of Nation States and promoting networks at the European level;
- the emergence (just at the beginning) of a new urban economy, no longer based on real estate and construction, but made up of a wide range of sectors related to the so-called knowledge economy and

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<sup>1</sup> <http://www.isprambiente.gov.it/it/events/il-consumo-di-suolo-in-italia>.

<sup>2</sup> <http://www.audis.it/index.html?pg=12&sub=38&id=13&y=2013>.

<sup>3</sup> See in particular Box 2.3 Recent major heatwaves in Europe (p 18).

<sup>4</sup> See chapter on "Urbanizzazione ed obesità" in Brown LR, 2002.

<sup>5</sup> <http://ec.europa.eu/clima/policies/package/>.

<sup>6</sup> [http://www.covenantofmayors.eu/index\\_en.html](http://www.covenantofmayors.eu/index_en.html).

the green economy; but especially to finding of an economic structure whose actors are different from the traditional ones (builders, property developers and something like that), because are more sensitive to innovation, environmental protection, cultural-scientific processes and changes that are proposed for urban areas (new sectors such as ICT, Renewable Energy Sources, bio-agri-food, advanced logistics, new materials, advanced services, etc.; and new actors of the social economy such as new forms of cooperatives, groups of crowd funding, formal and informal associations of citizens, etc.).

The future outlook seems to address urban regeneration towards new economic and environmental standards of city's sustainability, aimed to cultural growth of population and their inclusion in transformative processes, as well as to defined models smart community. To these, dialectically correspond smart city's settlement patterns (European Parliament 2014), where the energy and environmental component, shared and owned by the settled community, is one of the main development drivers of the model itself. Developing such address, it is important to study and decoding the urban environment concept, as defined by the EU (Commissione delle Comunità Europee 2005), as a result of the settlements impact in terms of damage to the finite natural resources and their effects on ecosystems and on the quality of life, as well as the scope of the community attention. So it is necessary an in-depth study on the impacts that spatial configuration and functional organization of settlements exercise on urban environment.

## 2 APPLICATION OF RESEARCH TO THE EASTERN QUADRANT OF ROME

To provide a contribution and an improvement to the above study, paper's authors have been experiencing, after a long time, a research on energy and environmental characterization, applied to the vast suburban area to the east of Rome. This research has been experimenting with an analysis and intervention method that combines traditional urban systems analysis with other specific issues, arising from systemic reading of the territory and use of energy, integrated, ecological and environmental parameters with urban ones. In order to build a course of action for urban regeneration, aimed at improving urban environment quality, the environmental value rises additional terms rather than replace the traditional content of the plan. However, it assumes a structural nature, as tends to disturb and to permeate the other parameters that converge in the project.

The choice of an area in the Roman suburbs was driven by the belief that these urban and metropolitan areas currently produce the greatest impacts on the urban environment and they can be a collection of positive outcomes for living communities and for the entire urban area. In particular, the area, deeply populated and overlap of different practices (formal and informal) of urbanization after World War II, is located in the eastern part of Rome (the current IV and V Municipality), and is assumed as more representative sample in terms of specificity (local, natural, agro-forestry, historical and identity resources, etc) as well as critical aspects of the city (high building density and population, pollution from vehicular, settlement and industrial load), and more generally, to the contemporary one.

The goal of the survey methodology is to direct the urban regeneration processes (and the instrumentation of planning) towards the quality (ecological and environmental performance) of the urban environment's improvement. The human activities and, in particular, the urban pollutants factors (transport, heating of buildings, manufacturing activities) – or in other words the same physical and functional organization of the settlements – in fact, alter the physical, chemical, biological and morphological features of the natural environment; lead to dramatic consequences on the natural environment and human health in the first place, and not least on ecosystems and the cultural and historical heritage.

### 3 THE ENERGY AND ECOLOGICAL CHARACTERIZATIONS OF THE CITY: ELEMENTS FOR THE CONSTRUCTION OF A METHODOLOGICAL FRAMEWORK

The main research goal refers to articulate components in order to define the urban environment's concept in urban regeneration, through explicit and replicable basis.

At this early stage of investigation, we have been considering some factors that characterize urban environment, although they positioned between the main nodes of the contemporary city, are still not scientifically declined in the urban planning:

- residential load, in terms of pollution;
- fossil fuels' energy uses and traditional inefficient systems;
- microclimatic comfort of urban space.

These factors are obviously interrelated in cause-effect relationships and their separate treatment is instrumental, useful mainly in analytical terms, and suitable for the reconstruction phase of the project. This is true in terms of their relationship with physical and functional organization of the urban system, in order to address the plan/process toward combined strategies of adaptation and mitigation, according to the approach used by the European Environment Agency. The ultimate aim is urban sustainability's pursuit, according to the conceptual relativism of the transition (Efficiency in Transition). Defining these factors' features permits a qualitative and quantitative measurement of the observed phenomena through indicators and the resulting graphical representation with the help of indirect variables, because of specific environmental and disaggregated data's lack. The developed experimentation refers to a process plan as a cross between the top-down path (for example the General Plan, i.e. PRG, or the metropolitan one) and the bottom-up one, resulting from participatory procedures and therefore physiologically generated in limited areas. We believe that at the meeting of these two pathways (descending and ascending) it is possible effectively to intercept the above-mentioned environmental factors, as well as the total binder of the content and parts of the master plan. The environment characterizations, as previously established, are particularly evident in the compact urban periphery, as the East Area of Rome, where it is set the experimentation and where it is proposed a hypothesis of comparison and integration of these issues with the addresses of the new General Plan (PRG). The methodological route adopted in the first phase of experimental application follows two main directions of investigation, related to:

- assessment of urban comfort;
- anthropogenic load's determination, in terms of pollution.

In order to evaluate urban comfort, are taken into consideration:

- permeability of the soil, i.e. evapotranspiration's capacity in urban areas, responsible for temperature's mitigation processes. It is evaluated surface coverage of the individual blocks, in order to have the mainly artificial areas and also more permeable ones;
- quantity and quality of the green areas, a parameter closely linked to the previous size and also responsible for the mitigation's processes, as well as the improving of the open spaces' liveability; the analysis focuses on the natural heritage that is examined as the maintenance degree and the green areas' usability;
- *albedo*, as reflected fraction of solar radiation, linked to the colour and nature of the surface materials and the settlement's parts;
- urban heat island – or rise in urban temperature compared to rural surroundings, because the physical and functional features of the settlement – is considered the evidence test of urban metabolism. It represents the result of the above mentioned factors plus other effects (such as thermal trap,

anthropogenic heat, pollution, particulate matter, etc.) and is useful in locating the main urban conditions of discomfort in our latitudes in terms of microclimate; its evaluation is done by parametric simulations (fig. 1).

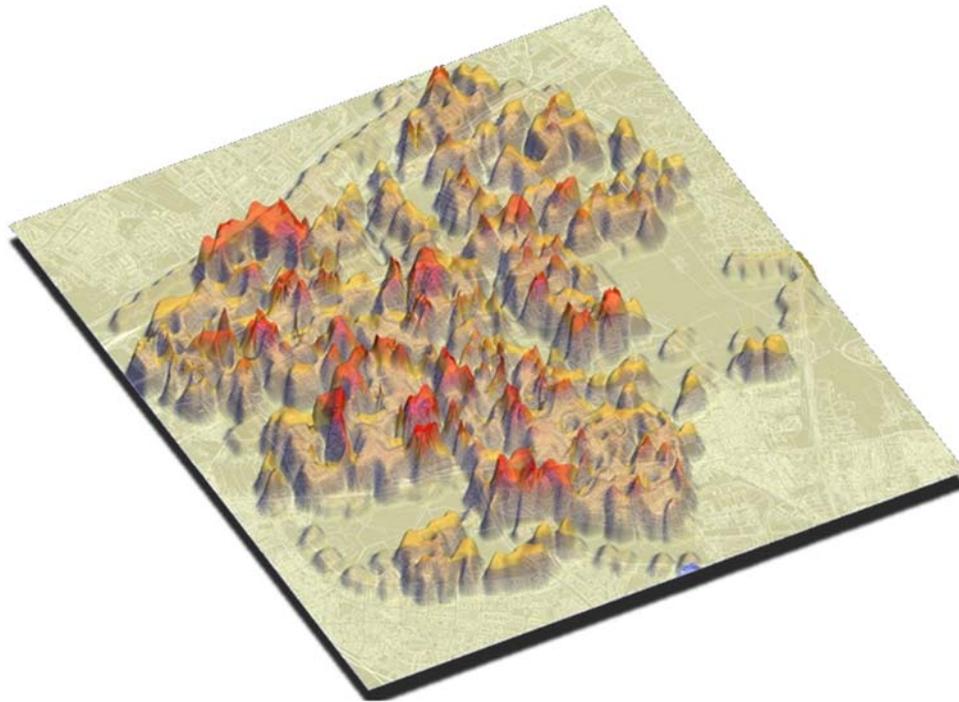


Fig. 1 Representation of heat island for the Eastern quadrant of Rome

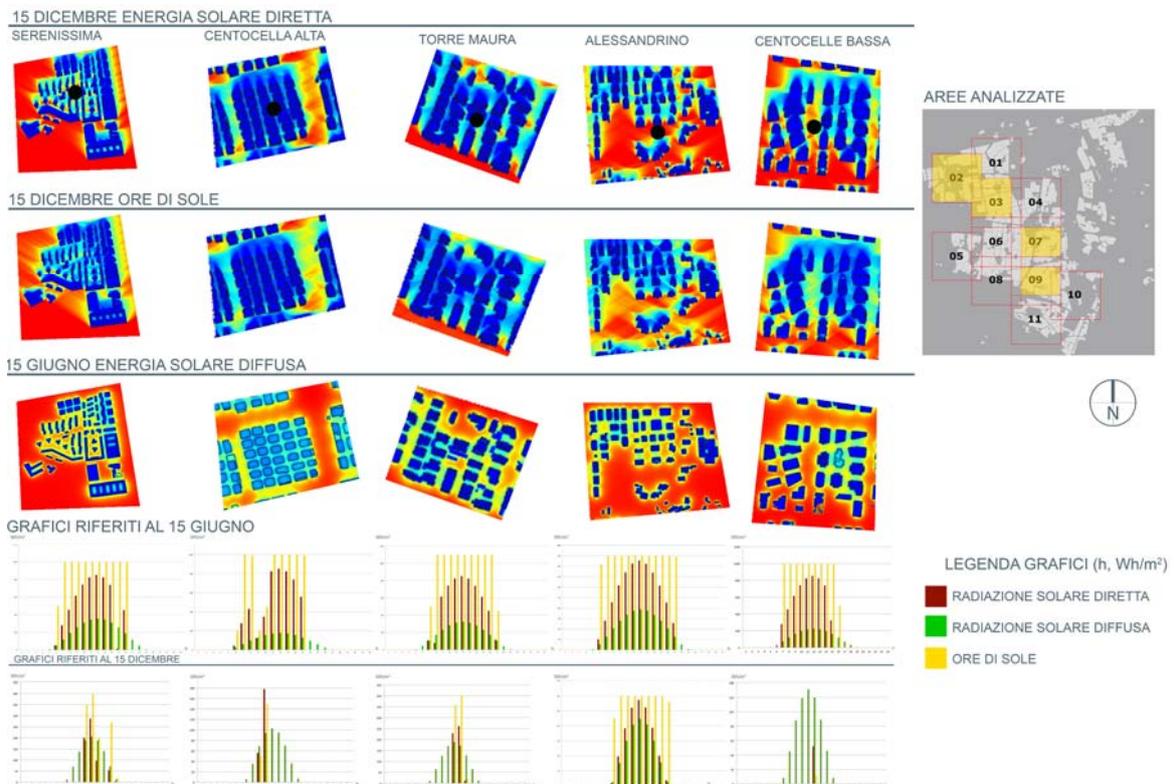


Fig. 2 The urban comfort represented by Townscope 3.2

Deeper analyzes on urban comfort are carried out on a smaller scale using specific simulation software and then different part are reassembled. The software is able to connect urban form to urban microclimate conditions through some specific factors (sky view, solar accessibility, orientation and wind protection) (Fig. 2). These assessments can be carried out *ex ante* and *ex post*, to validate the plan indications. To assess anthropogenic load that persists in the chosen urban sector, we evaluated the main components responsible for energy consumption and corresponding emissions in the three major functional areas: residential, vehicular and industrial load. The outlined analysis certainly simplifies the various interrelationships between different urban contexts (an impact does not end just inside the block and / or in close proximity to roads), as well as the various sectors involved (the interaction between the various loads, in fact, it is often more important than the sum of individual ones).

For the residential load is used an indirect indicator, such as the population density, that proceeds up to the block's level for more dense areas and census section's terms (census section) for more sparse ones. The density calculated in this way identifies "full" residential areas, in terms of crowding index, but especially of energy demand - with a certain degree of approximation, acceptable to large scale and certainly more detailed than other studies carried out by specialized institutions (for example by ENEA, De Pascali, *et al.* 2012, 97) and then in the most general sense of pollution. For the vehicular load, we have analyzed the values from a flow diagram (*Flussogramma del traffico*, realized by the municipal public transport - ATAC) that through a road graph represents equivalent vehicles/hour, actually transiting on the road, not just locally. Depending on these values and interfacing them with the most critical nodes of the roads (seen directly through targeted inspections at different times of the day) we have determined the most affected infrastructure networks by noise, combustion and particulate pollution.

Finally, for productive activities have been identified "charge" areas through a cross-examination between the pollution's level of the various activities with the number of employees (size of the business), according to the census section, inductively aggregating in families impacts (low, medium and high intensity). This process does not consider any abandoned production activities linked to the recent crisis, but more importantly, for technical and procedural needs, "spreads" over the census section the entire productive load, because it would be too complex succeed in locating every single industrial plant. Also in this case the approximation's area is acceptable for large-scale evaluations.

Once you have defined these parameters, we were able to determine critical areas (i.e. the contexts with the most significant levels of discomfort and pollution), on which is a priority action.

Referring to the ordinary urban analysis and interfaced them with the processing outlined above, the survey methodology involves a synthesis map, for the territorial synthetic evaluation, in terms of the critical and value elements.

In particular, overlapping polluting elements to the environment system (in terms of its ecological and landscape quality, variety and state of repair of uses, ...), to the settlement one (with an emphasis on the completeness or not of the functional and morphology structure in the residential blocks) and the relational one (Fig. 3).

It is possible to notice how there are urban settings with a particular population's density and at the same time a significant concentration of pollutants from transport (for equivalent vehicles/hour and critical infrastructure nodes). But not only. There are also more or less informal and/or semi-structured parts of blocks, marginal to the man-made environment and next to productive activities, relevant to the type of pollutant, number of employees, as well as the overall size (large areas waterproofed used for the loading and unloading of goods) and accessibility. Substantially the critical areas are defined relatively to the whole area and not in absolute terms, as results of overlapping quantitative parameters (maximum values of pollution and discomfort) and qualitative evaluations (green quality). The limits of the areas, although

indicative, are useful to identify the origin of the observed phenomena on which to intervene, and to take into account their variability. The achieved approximation is still consistent with the urban plan scale, according to the discipline statute (Mazza 1997) describes urban planning as approximate research). Contributing to this the imprecision of the tools and available data. Further analysis is performed at lower scale with appropriate simulation tools.

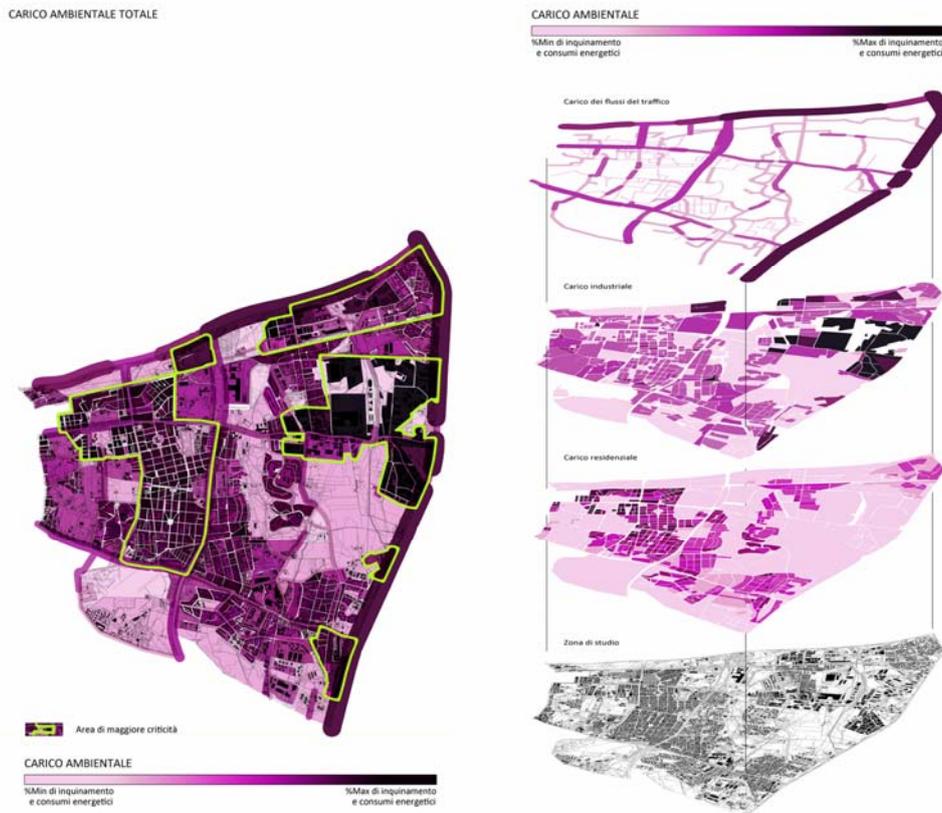


Fig. 3 – Representation of the anthropogenic load

Subsequently, and in parallel to collecting of ad hoc references, it is outlined an energy and environmental value process, in terms of

- entire urban sector (general layout of the study area with the preparation of a master plan according to three thematic analysis' levels - ecological and environment system, settlement system and relational one - interconnected each other in order to outline a holistic and systemic urban regeneration);
- thematic analysis (i.e. detail and critical evaluation and possible resolutions relating to the operational scales of reference that are considered more significant), in order to identify by priorities actions, able to exploit in the analyzed context the valuable elements and minimize the critical ones, identified in the previous phase synthesis.

A specific line of research also concerns the use of innovative graphic representations about the territorial aspect of the phenomena, with the aim of producing representative and evocative images, as well as useful to activate any participatory processes.

## 4 CONCLUSIONS

From the advance of research, and in particular from the comparison of methodological hypotheses with real situations, emerge different lines of development for the future. At least two of these need an in-depth knowledge to proceed in the methodological and operational research.

- Urban environment analysis collides with the detailed and disaggregated data's lack, especially in urban settlements areas, where you do not realistically make direct campaigns and field survey. That raises a need of simulation codes, on at least some important parameters (for example energy consumption and related emissions, not only connected to residential activities but also transport and production ones). Such simulators have to be both reliable (the level of approximation is within the degree of acceptability for an urban plan) and expeditious (easily usable with available data and also replicable in every situation). In this context, it is necessary an applied research, possibly in cooperation with other specific groups and experts, for simplifying prototype's development, adapting to our urban situations and producing quality cartographic tools, usable also in participatory processes. So it is necessary going deeper into the state of the art, about the pervasive and embedded systems (such as sensor), low cost and easy to use technologies, for direct and continuous measurements.
- The current deep economic crisis does not help in creating the conditions for an urban regeneration's start. The thrust of the housing market appears to have structurally weakened; it appears necessary, and in some ways can't be postponed, to follow other engines for urban regeneration, more closely to the contemporary city. In this sense, the eco-energy sector seems to have the potential to become, also because its significant and economic potentialities, its congruence with the stringent EU policies and because of opportunities in social involvement and inclusion.

It is however necessary recover the non-research and development in the field, mainly caused during a long period when the central energy system has locked up the local initiative. In this sense, it seems extremely important studying the settlement patterns' integration, based on widespread eco-energy systems, with participatory and inclusive social models, starting from the analysis of best practices and experiences, developed in other European countries.

The objective of the paper and the outlined search path is to contribute to broadening the debate and collaboration on the study of the environmental parameter in urban planning. It seems evident that the physiological evolution of what was called "democratic planning" cannot fail to pursue the quality of the urban environment as it is produced by the organization of settlements, in integration and synergy with the statutory originate contents.

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## IMAGES SOURCES

Figg. 1, 2, 3, 4: Students works from Course of urban recovery and requalification, resp. Prof. Paolo De Pascali, Sapienza, University of Rome.

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