From the Redevelopment of High-density Suburban Areas to Sustainable Cities

Andrea Boeri^{1*}, Danila Longo²

¹Professor of Department of Architecture, University of Bologna, Italy. E-mail: andrea.boeri@unibo.it,
*corresponding author.

²Researcher of Department Architecture, University of Bologna, Italy.

doi:10.5618/arch.2012.v1.n2.3 || Received: 06-05-2012, Accepted: 30-06-2012, Available online: 5-07-2012

Abstract

Most European suburbs are characterized by large residential housing estates mainly built during the second half of the twentieth century. Nowadays, these estates present serious social and economic issues as well as environmental related problems. These areas are often characterized by a low quality of life of their inhabitants, repetitiveness of buildings, degraded green and public spaces.

Many Countries have had to face and are still facing these issues and are dealing with them in different ways through some activities to set the buildings back to their original status or by improving the quality of the housing and the standard of living.

This paper presents some considerations about the regeneration of these areas, proposing methods, procedures and technologies previously defined for an Italian case study, aiming at the renovation and revitalization of these areas and, consequently, of the entire city, based on an adaptation of the uses to the new needs and to the environmental conditions. Broadly speaking, the objective is to propose a methodology of approaches to the interventions plan scaled to the district level, aiming at a sustainable urban development, as foreseen by the European goal of "Smart Specialisation Strategy" - in view of Horizon 2020 (next EU framework program for research and innovation 2014-2020).

Keywords: Regeneration; High density; Sustainable strategies; Retrofitting; Smart cities.

1. Introduction. The redevelopment of suburban areas as a driving instrument for urban renewal.

High-density neighborhoods, built during the Seventies to provide a quick response to the high demand for housing by low-income families, and featuring a

distinctive planning idea, are today still considered a real challenge [1].

A demolition, either partial, as in the instance of the "Vele di Scampia" in Naples (**Figs. 1-2**), or total, as in the instance of Runcorn (UK), is not considered a sustainable solution in social, economical and environmental terms, nor a solution to be adopted in general and without due consideration.

In view of a progressive reduction in the availability of controlled rent housing, and despite the repetitive conditions of social distress in terms of housing conditions, often below standards, social problems and petty crime, the existing stock of social housing is to be considered a wealth to be safeguarded and regenerated, particularly during the current period characterized by a drastic reduction in investments by public bodies.

To realize this objective, it is necessary to prevent the marginalization of these imposing social housing estates by increasing the number of services available, making them accessible not only to the local residents but also to the entire community, and meeting the needs of users with an improvement of all facilities, in order to reduce the relevant operating costs. For these reasons, a definition of strategies of requalification aimed at reducing the problems identified above, while improving the level of urban architecture and technological quality to favor integration, is required, coupled with a redefinition of the buildings image and of the public spaces usage.

Due to a growing demand for social housing in Italy [2], also caused by the current financial crisis, it is hoped that besides the construction of new buildings, a policy for the requalification of the existing housing stock is implemented to meet this new type of "emergency".

A rationalization of the existing social housing stock, its morphological and functional upgrading, its financial value and a reduction of its relevant operating costs are considered an effective strategy in meeting, at least in part, this growing demand, resulting in financial

investments of smaller amount than the ones necessary for the demolition (Fig. 3) of these buildings and the construction of new ones.

Figs. 1-2. "Vele di Scampia" in Naples, currently partially demolished (photo by "Chi Rom e chi no").

Fig. 3. A scale model of the Scampia area with demolished buildings (photo by "Chi Rom e chi no").

Fig. 4. Forte Quezzi district, Genoa. An example of high-density social housing in Italy.

Furthermore, an urban regeneration, carried out in a systematic manner on the most important areas of a city, such as high-density residential neighborhoods, is a valid and proved strategy for inducing development processes involving the entire city.

A redevelopment of the existing building stock (**Fig. 4**), beside being the compulsory choice in these difficult times, is also a way to save resources, both financial and environmental ones, and enhance the existing qualities.

Consequently, operating on the existing building stock offers different advantages to the community: it reduces the total environmental load, redeveloping the existing stock, and it allows to limit the amount of raw

materials and land needed. Rating systems for sustainability, such as the LEED (The Leadership in Energy and Environmental Design, created by the U.S. Green Building Council-USGBC), which aim at addressing project management in terms of achieving sustainable construction [3], are developing this theme, conferring positive values to strategies of maintenance (LEED EBOM, LEED for Existing Buildings: Operations and Maintenance).

From a broader perspective, the more ambitious objective is that of transforming our high environmental impact cities into smart cities, offering high standard of quality of life and of social relations (**Figs. 5-6**).

Figs. 5-6. Berlin - BIGyard - Zanderroth architekten. This project proposes an innovative solution for an urban problem area: the reconnection of an isolated block with the existing urban fabric. The distribution systems and indoor layout generates a series of different spaces for collective use, resulting an improved level of quality of life for its residents.

2. Cities and sustainable technologies

Cities consume 70% of the total EU energy. European Institutions consider this a potential source of energy saving, aiming to reducing by 20% all emissions by 2020 and, at the same time, develop a low-carbon economy by 2050. The identified formula associates a more rational use of resources with the integration of green technologies.

By way of example, the Smart City project is part of the Strategies of the Energy Technologies plan (SET plan), issued by the EU whose objective is to increase, coordinate and focus EU support on low-carbon key energy technologies: this provides for the creation of a network of thirty smart cities to be selected by 2020. A kind of a prototype of energy efficiency that goes hand in hand with a process of economical and urban development at low costs and low environmental impact

[4].

Electric cars that can be charged with the energy produced by the buildings, low-carbon areas and a creation of networks for the energy produced by renewable sources are some examples of the technologies suggested for a better building and mobility system.

The fundamental assumption these cities are based on is a strategic view where the level of education and awareness of its residents, a good governance based on innovative communication and participation channels between the citizens and the public bodies (e-governance), a low-impact transport mobility system, using modern technologies, plus safety, sustainability, energy efficiency and low CO₂ emissions, a better quality of life, a higher level of health and comfort, are in place.

Smart cities attract companies working in the field of innovation, create infrastructures and have a creative population, and for all these reasons they are considered

potential "innovation incubators" capable of: identify common challenges, develop solutions that are both innovative and of guidance; they attract and create business, creating new markets. Innovative solutions, that can meet the challenges and problems of the city and its residents, are often the result of new mixes of technologies and of close synergies between public bodies and private subjects.

Besides these technologies (ever evolving and quickly dating) the next essential element is the cultural and educational one, that is the creation of a new and different approach to everyday life by all the figures involved.

The residents need of a higher level of well-being and quality of life (**Fig. 7**) health and safety, education and knowledge should be the start and finish points of each strategy [5-6].

Fig. 7. Sports facility in Naples: local children use this underused public space as playground (photo by "Chi Rom e chi no").

3. An Italian case study

All these considerations lead to a research work, carried out by the University of Bologna, within the scope of the national project "PRIN08", on the Pilastro neighborhood (**Fig. 8**), located in Bologna (IT).

Pilastro, a social housing estate in the northern suburban area of Bologna, is considered one of the most important examples in our history of housing estates, whose dimensions and features can be compared with the best European experiences built after the Second World War.

Besides its symbolic meaning and the role it plays within the limits of the city of Bologna, Pilastro was also chosen based on the fact it represents all the social and technical issues present in most social housing estates built after the second world war, which in Italy, as well as in the greater part of Europe, are mainly located in suburban areas.

Even if some of them were built next to the city historical centre or were included in the expansion areas of city centers, many neighborhoods are still physical separated from the city itself with negative social effects

caused by this physical marginalization.

This is also the case for Pilastro, where all factors related to the model of settlement, the building typologies, the social conditions of its residents and the buildings features contributed to its significant and quick degradation.

As per many large social housing estates, built quickly during times where the demand was pressing and the financial resources were at a minimum level, the construction systems, tied to heavy prefabricated models, used for the Pilastro district, show characteristics of repetitiveness and evenness, sometimes to the limit, in its architecture.

A lack of attractiveness, a sense of disorientation, a restricted flexibility and possibility of modification in relation to the changing needs of users are comments very often made. Finally, the buildings were designed and built with no attention to the environmental and energy aspects that today are considered as priorities, also in terms of a reduction of the relevant operating costs and an improvement of the comfort conditions, often almost totally unsatisfactory.

Fig. 8. Aerial view of the Pilastro neighborhood (photo by ACER record office).

3.1 The analysis: themes and issues. The district was subject of a careful analysis, following a methodology based on a number of morphological, technical, functional and social factors previously identified, allowing to develop a survey matrix on the elements of quality in existence.

Based on this analysis, the strategies for sustainable regeneration were identified, taking into consideration the following aspects:

- architectural and technical innovation in order to improve the image and performances of the buildings (Fig. 9);

Fig. 9. The Pilastro district in Bologna: it needs an architectonic, technical, energetic and social redevelopment.

- social revitalizing and functional redevelopment, promoting a mix of uses to improve the quality of life of

the residents;

- energy retrofitting in compliance with the new regulations and to "save" the environment;
- sustainable use of available resources.

3.1.1 Historical context: the genesis of the neighborhood. The Pilastro neighborhood was a part of a PEEP (Piano di Edilizia Economica e Popolare - Plan for social housing) of 1962 prepared by the City of Bologna and built by the IACP (Istituto Autonomo Case Popolari) in a period ranging from 1966 to 1986, when it was completed the construction of the last of four towers which, together with the Virgolone building, were the implementation of the urban variant plan of 1975. It came at a time of a great housing emergency to meet the pressing demand for housing; assignees were mostly immigrants from southern Italy, strictly within the low-income bracket and already living in a condition of disorientation and discomfort, not helped by the segregation of what was soon to be perceived as a "ghetto", by both the residents and the rest of the city. When the first settlement, consisting of 411 apartments, was inaugurated in July 1966, 2.500 residents found themselves to have to walk through dirt roads with no public transport lines, the houses were with no water and heating, and the entire area had no services, schools, businesses or health structures. The rent was 30% lower than the average of the other areas on the outskirts of the city. For a long time it experienced a pronounced physical isolation, not yet fully resolved, determined by its distance from the city center, by the fact that good part of it is surrounded by the countryside and by large territorial infrastructures such as the ring railroad, the rail and the goods yard.

Soon, episodes of petty crime and youth problems occurred, steadily worsening during the following decades, and the Pilastro district was permanently labeled as a no-go area. However, as it often happens in the more marginal suburbs, great solidarity, dynamism and cultural vitality soon occurred. A highly distinctive feature of this was the participation of residents, who organized themselves effectively in a committee of tenants, and who directed the decisions affecting the future of their neighborhood, expressing needs, putting forward proposals and working to implement them. This battle gave rise to a shared sense of belonging, it built a brand identity and it is still remembered with pride by older people, who were the protagonists of many events.

3.1.2 Current situation. Today, the Pilastro district, with its 7.500 inhabitants (about 3.000 less than the Seventies), has gained a provision of neighborhood facilities surpassing the needs of the residents, attracting people from all over the city, it has a wealth of green spaces and public parks unmatched in Bologna, and an efficient public transport service linking it with the city center.

Most problems of social and public nature have been solved, but the strong cohesion among the residents has loosened and the participatory spirit of the past has been lost. It seems even more desolate and less frequented than when it suffered from total isolation: streets are now empty, public squares do not function as places where to meet and socialize, the few businesses on the promises of the homes are now empty.

Some of the causes of these dynamics are to be found not only in the changed social habits and in the demographic mutation, typical of many suburbs, but also in the rigidity of the urban plan and of the system of building types. There is a clear separation between residential buildings and the structures built for other purposes; it lacks of small businesses and personal services, which can create an attraction and a local polarization of users, consisting of a particularly high number of elderly people in strong need of relations with neighbors and of local services.

The strong monotonicity (**Fig. 10**) of fronts, which in the extreme case of the "Virgolone" building are systematically identical and uninterrupted for 765 yards, even if the result of projects that are still worth of appreciation, is now perceived by residents as a trademark that reveals its common origin and, in the absence of other cementing elements, it doesn't help to create an "urban effect" that also consists of a sense of belonging and recognition. The poverty of external finishes and the degradation so evident in many buildings, reveal the current difficulties of ACER

Bologna, the managing body of the public housing stock in Bologna, in coping with maintenance and with other works these buildings need. Social rents are very low: the average rent is 114 euro per month, while the one asked for households that fall within the most disadvantaged category is 27 € per month. ACER, in the absence of external sources of financing, can only do the works required by law and little else, with costs amounting to around € 4000 for each unit.

Fig. 10. The Virgolone building, 765 yards long, with 552 flats (photo by ACER record office).

3.2 Methodology for interventions. By analyzing the results of the investigation on the critical aspects detected in the social housing estates in Italy together with the considerations reported on the "Manifesto of the Social Housing" (Urbanpromo 2011[7]) and with the policies and the regeneration interventions carried out in Europe, it was possible to identify a range of proposals and regeneration guidelines for the existing built stock, that are considered potentially effective. [8]

The strategies proposed below were outlined on the basis of the possibility of linking them with the international best practices, proposed as a reference also for the Italian scenario, gauging its feasibility based on the specific local situation.

Furthermore, these strategies are also based on the analysis and considerations carried out in a case study involving the Pilastro district, assessing their application within a national frame, with the due adaptations and changes.

The subject is complex, therefore it is necessary to act at different stages of intervention with an integrated approach, the strategies of which are summarized in a table below and rated in relation to the issues involved.

First, the ones involving the entire districts are reported, then, the ones related to each single building or parts of the buildings are listed.

These strategies (Table1) can be applied individually

or together, depending on the resources and the specific objectives the regeneration process intends to achieve [9-10].

Table 1. Some schemes of strategies of intervention, divided into four main goals that can be achieved both at district and building level.

Urban integration

Correspondents between supply and demand

Architectural quality

Energy savings and indoor comfort

In particular, the strategies for urban regeneration, in terms of the neighborhood, include factors such as the enhancement and upgrading of public spaces, the mobility system and the collective use and morphological redefinition of the main elements characterizing the residential district.

All interventions involving the entire district of Pilastro aim to combine the urban growth with the sustainable and responsible use of the resources available.

Changes to both public and private transport systems, a production of energy onsite through renewable sources,

a reuse of urban waste to generate biofuel, a recycling of water, the energy retrofitting of the existing buildings are some of the possible solutions to be adopted as proposed in our project.

As concern intervention applied at building level, the research focused on the Virgolone building, located in the Pilastro neighborhood. All of these interventions, formulated on the basis of the main technological and typological issues previously identified and on the survey of the degradation factors, include an energy diagnosis of the building, as well as proposals of possible retrofitting intervention on its envelope and a plants or systems replacement/implementation in order to achieve energy class A, and, lastly, as well as a proposal for an intervention of morphological upgrading involving a volumetric addition, to give a new image and life to this large building.

3.2.1 Objectives and key actions for the improvement of the Pilastro neighborhood. The overall outlook of the Pilastro district described up to now highlights the need to adopt a strategy articulated in a series of actions that develop at different stages of intervention.

This district represents an urban unit, inside which processes, technological innovations, methodologies of application, architectonic and plant solutions that can be

defined of high quality standards were applied at district level and could be applied at methodological level to other "urban districts".

A plan for improving the conditions of this urban area, that could lead to its regeneration and redevelopment should consider as a priority objective an increase of its linking networks and a synergy between the different areas of this district, through an organization and enhancement of all its available resources. As already mentioned, these resources consist in a broad range of services already in existence in this district, positioned at the limits of the residential area, or problematic to reach, the presence of units still not in use or that could be converted to other uses, the wealth of green areas, sports facilities and parks. In particular, the design of the green areas could be an important opportunity for reconnecting this neighborhood to the surrounding areas and, through these, to the city to the south and to the environmental system and historical landscape to the north. It is proposed to confer an active role to the local public and private figures and to focus the attention not only on the physical renovation but also on the promotion and support of an integrated development, so not to be limited to actions within the residential building frame, but being able to act at multiple levels, raising the public conscience.

Fig. 11. Masterplan of main strategies of intervention at local level. Some solutions are suggested for meeting the residents needs in terms of services and for connecting the disaggregated and isolated parts of this neighborhood.

The physical and intangible reconnection therefore relies on a strategy that provides for the creation of a network connecting the different major areas in existence or planned, strengthening and enhancing the activities already acting as attraction points and creating other complementary ones, plus the creation of activities

necessary for the regeneration of the neighborhood and its integration in a circle of relations with the entire city and its surroundings, in order to put a stop to its isolation.

The district central points are connected by two parallel linear systems crossing the district East to West

and passing by other important units, some already used for specific activities, while others are still waiting for a destination of use (**Fig. 11**).

The strategy employed suggests the possibility of attributing specific themes to these linear systems, in order to offer an organized response to the needs of the residents and to the area potentials.

The north-south connections, called "tension-rods", provide an indication on the possibilities of linking the different central places, and in particular of overcoming the current fragmented layout of the district, characterized by several disconnected areas. A possible solution is the one involving the relationships between the many green areas and the sports ones: main paths inside the P.P. Pasolini park are identified, these could be linked with the east-west linear system through the creation of crossroads in correspondence of the edge of the towers wide base, making easier going past them and making safer the crossing of the main roads, leading towards the south where the sports facilities and the educational farm are located and where it is possible to access the park of Albereta.

The paths crossing the P. P. Pasolini park could find their starting point on the north side of the new volumes to be added on the ground floor of the Virgolone building. This would offer the possibility of breaking the total mono-functionality of this building, providing local services and leisure places that could take advantage of the existing green areas. The themes of the North-South tension-rods could be summarized in a few keywords, such as: "spare time-socialization-events", "youth", "culture and integration", "elderly", "educational and social services".

The design hypothesis aims at stimulating an "active role" on the residents part in a place considered as a no-go area, by investing on the "inside" synergies of the residents, currently untapped, and introducing new opportunities and attractive solutions in the neighborhood.

The functional, economical and social mix proposed for this suburban area, presenting signs of standardization and lack of self-identification, represents an opportunity for changing both the physical dimension of the buildings and the open spaces and the social ones, making this district a much more appealing center of attraction.

The basic idea aims to provide an example of urban regeneration of an area considered problematic through a series of solutions that could be applied even on a larger scale.

The possibility of transferring this study from a

restricted and limited territory to a wider one, makes it particularly interesting: the district considered as urban cell, "territorial district" or energy island with the broader goal of making of Bologna a smart city, that is a city aiming at a better quality of life for its own citizens.

This improvement is based on a series of parameters, such as energy efficiency, environmental safeguard, sustainable transport, reduction of harmful emissions, an increase of the links and of the exchange of information through ICT (Information and Communication Technology) systems, security, cyber security, improvement of logistics and transport systems, as well as used of smart-grids, that is a new configuration of electricity networks to enable their management at district level.

This smart grids are the main "enabling factor" for the achievement of the objectives described above [11].

The growing attention paid to the environmental issues and to sustainability calls for systems ever more efficient and eco-friendly and a fundamental instrument to achieve this higher level of energy efficiency is the smart grids.

The European Union has started different initiatives to promote them. The most important one is The European Electricity Grid Initiative (EEGI), included in the Strategic Plan for the Energy Technologies (SET Plan[4]), provided for giving momentum to the development and the distribution of low carbon technologies. In order to implement and support the networking process of EEGI for the period 2012-2014, the GRID+ project is being developed. It will contribute to maximize the effectiveness of EEGI, while strengthening the cooperation between all involved in this initiative, and therefore promoting cooperation and investments.

3.2.2 The intervention on the Virgolone building. A building of reference, called the "Virgolone", was studied in detail and chosen for its semantic relevance, its imposing size (552 apartments) and its particular construction techniques (**Fig. 12**).

Its energy behavior was verified and its weak points were checked through instrumental surveys (**Fig. 13**).

A model simulation of the energy behavior of the building was developed: it allowed to assess which component should be implemented to improve the energy behavior and to define the design guidelines for energy retrofitting.

This study offers proposals for the optimization of the inside spaces and their relevant use, and for their bringing up to standard, therefore making these units more flexible and capable of meeting the ever changing

needs of different tenants.

These proposals presents different stages of intervention, starting from the most simple one, in terms of financial investment and local impact and low level of inconvenience, up to the most complex one with high impact (**Fig. 14**).

The different stages articulate as follows:

- the first one consists in the improvement of the envelope energy performance and defined as "strategy for envelope insulation";
- the second one concerns the residential units and aims at improving the indoor layout and the adaptation of the rooms to the actual needs of modern families, defined as "strategy for residential units";

Fig. 12. The north facade of the Virgolone building.

Fig. 13. Current energy consumptions of the Virgolone building. The average corresponds to the units considered as a reference in the research simulation model.

- the third one aims at creating a functional mix, introducing satellite volumes on the ground floor next to the Virgolone building and on the front facing park and defined as "strategy for functional mix".

Fig. 14. Different hypothesis of intervention: the low-impact and the high-impact steps.

The intervention with the lowest level of impact could be carried out without having the residents moving out. It consists in the application of a thermal insulation coating and the replacement of the single glazed windows with ones of higher performance. This first step would already produce a positive result in terms of energy consumption and indoor comfort. Furthermore the application of the coating, made of panels of different color, gives a new image to the building.

The next step consists in a modification of the unit's layout bringing them up to standard without touching any bearing walls since the building presents a tunnel structure. It is possible to install solar panels for the production of hot water, once the above interventions are completed.

The high impact interventions foresee drastic changes to the building.

The most invasive intervention involves a redefinition of the building volume through a total replacement of the prefabricated panels of its facade with different ones of higher energy performance, changing at the same time the design of the facades and the positioning of its openings. The moving back or forward of the walls allows the creation of balconies and loggias and confers a higher degree of quality to the interior spaces.

This intervention can be integrated and finished off with an addition of self-supporting towers, both to improve the seismic behavior of the building, and offer an updated image of it, as well as generate new opportunities for an expansion of the flats.

The last step of the project involves the introduction of new volumes on the ground floor to be used for the housing estate additional services.

The different strategies of intervention on the building offer solutions aimed at reducing the estate operating costs: for instance, an improvement of all plants and systems with the replacement of power generation systems with higher performance ones, the installation of controlled mechanical ventilation systems with heat recovery units in each single flat, or the integration with renewable energy sources. The simulation model of the behavior of the building allows to verify the effectiveness of the interventions in terms

of a reduction in energy needs.

The primary energy demand of the building was progressively reduced step by step in each solution, reaching, in the last scenario, a PE index value equal to 24.86 kWh/m²year (Fig. 15).

Fig. 15. The energy consumption of the Virgolone building after the retrofitting intervention. The average corresponds to the units considered as a reference in the research simulation model.

The energy and financial aspects are interconnected (Fig. 16): a high energy performance solution usually involves higher costs, but savings generated during the life cycle are large enough to repay the amount invested.

The ability to deliver a sustainable construction project within acceptable cost constraints is a challenge and it involves specific modification to the conventional construction practices and to the building management [9]. Sustainable rating, final cost, project schedule and operating performance are the most important references to focus on for green building projects. [12-13].

The cost-effectiveness of interventions is consequently calculated by adding up the savings that every solution can generate in the long term. Therefore, the economic analysis takes into consideration the initial cost and the energy costs of each intervention and the energy savings obtained [14].

	Primary energy needs for heating and the production of hot water (kWh/ m ² y)	Costs for heating and the production of hot water (€/ m ² year)	Costs for intervention (€/ m ²)	Discounted pay-back period (years)	Pay-back period (years)	Savings (project) (€/m ²)
Current status	118,54	7,41	-	-	-	-
Replacement of windows (values by law)	90,20	5,64	25,68	16	12	42,52
Thermal insulation (values by law)	85,71	5,35	44,56	26	17	49,12
Replacement of windows, thermal insulation of the horizontal closures (values by law) + solar panels for the production of hot water	61,49	3,84	58,17	19	13	84,76
Replacement of windows, thermal insulation for the entire building (values by law) + solar panels for the production of hot water	44,09	2,75	82,84	21	14	110,36
Replacement of windows, thermal insulation for the entire building (higher values) + solar panels for the production of hot water	24,86	1,61	99,06	20	14	137,18

Fig. 16. The different stages of interventions and the relevant results in terms of EP, costs (calculated on a 30 year period) and savings. The pay-back period was calculated basing on different hypothesis, with or without the discount rate.

4. Conclusions

The scenarios outlined in this research could lead to a neighborhood designed according to the principles of sustainable city where the concept of satellite district or island has no meaning since there is no breaking up of connections and no discontinuity in the urban fabric.

The experience of Pilastro described in this paper meets in different ways the theme of sustainability in terms of energy for urban areas, especially as regards existing buildings and within the framework of the research PRIN08 it is considered as a significant reference. This case-study provides useful indications as regards the different aspects involved in the planning, design and implementation of interventions for the optimization of the use of renewable energy sources and for a reduction of energy consumption, as well as for social and economic sustainability.

This research identifies in the architectural and social parameters of quality the two main factors to be considered in a strategy for redevelopment intervention. However, these factors cannot be used as guidelines for the regeneration of suburban areas in general, as each of these areas has its own specificity and individuality.

The analysis of the critical aspects in terms of architectural, functional, technical and social factors, cost-effectiveness and the assessment of the priorities the residents attribute to each of them should be the basis on which a regeneration program should be

defined. This in order to obtain the best final result and the application of correct management methods.

References

- [1] AA., Una nuova stagione per l'housing, Be-Ma, Milano, **2009**
- [2] CECODHAS, White EB, Housing Europe 2007-Review of Social, Cooperative and Public Housing in the 27 EU Member State, **2007**
- [3] Wu P. and Low S., Project Management and Green Buildings: Lessons from the Rating Systems, J. Prof. Issues Eng. Educ. Pract., 136(2), 64–70, **2010**
- [4] <http://setis.ec.europa.eu/about-setis/technology-roadmap/european-initiative-on-smart-cities> - **June 2012**
- [5] Di Giulio R. (edited by), Improving the quality of suburban building stock, Unifeppress, Ferrara **2012**
- [6] Grecchi M. (edited by), Il recupero delle periferie urbane. Da emergenza a risorsa strategica per la
- [7] <http://www.urbanpromo.it>, **March 2012**
- [8] Di Giulio R. (edited by), Improving the Quality of Suburban Building Stock, COST Action TU0701, University of Malta, **2010**.
- [9] Sassi P., Strategies for sustainable architecture, Taylor & Francis, New York, **2006**.
- [10] Di Giulio R. (edited by), *Suburbanscapes*, Alinea, Firenze, **2012**
- [11] European Technological Platform SmartGrids,

- Strategic Deployment Document for Europe's Electricity Networks of the Future (<http://www.smartgrids.eu/documents>), **September 2008**
- [12] Robichaud L. Anantatmula V., Greening Project Management Practices for Sustainable Construction, *Journal of Management in Engineering*, 27(1), 48-57, **2011**
- [13] Korkmaz S., Horman M., Rile, D., Key Attributes of a Longitudinal Study of Green Project Delivery, *Construction Research Congress*, ASCE, **2009**
- [14] Boeri A., Gabrielli L., Longo D., Evaluation and feasibility study of retrofitting interventions on social housing in Italy, «*PROCEDIA ENGINEERING*», 21, pp. 1161 - 1168 (International Conference on Green Buildings and Sustainable Cities, 2011) Elsevier Ltd, **2011**