The role of IPES social housing in the EU Sinfonia Project for a "Bolzano Smart City"

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Abstract. Bolzano is experimenting an integrated approach to improve the quality of life and to implement the features of sustainability; within 2018 it will become, together with Innsbruck, the first "smart city" in Europe in the framework of the European Sinfonia Project. In this in-depth analysis, the role of IPES (*Istituto Edilizia Sociale Provincia Autonoma di Bolzano*) has been studied within the design Project of two specific sites. The general aim is to understand how the construction process has been implemented by the Institute, highlighting both any possible boundary to the development of energy-efficient solutions on an urban scale learned in parallel with the economic and social impact of the design itself.

Keywords: Bolzano Smart City, IPES multivariable approach, Social Housing, Sustainability, Innovation as process

The study of the experimentation taking place in Bolzano should be important if wondering about the challenges arising from of a "smart approach" in a city development. The city candidate several social building and urban infrastructures to the European Sinfonia Project "*Smart Initiative of Cities Fully Committed to Invest in Advanced Large-scale Energy Solutions*"[1], to be the first medium-sized European city (together with Innsbruck, in Austria) to test urban-scale strategies for a sustainable "smart" residential model.
Sinfonia, co-funded under the 7th Framework Programme through the competition "*Energy - Smart Cities & Communities 2013*", brought to Bolzano 8.7 million Euros of the European Union out of a total actual cost of the activities of 30 million, with a substantial contribution from other regional and national promotional measures and from the own funds of the Bodies involved.
The "Smart" choice of the area is based on activities having an immediate impact on citizens, thanks also to the innovative boost promoted by research centres and public bodies on the production system and the designers, the so-called "*cooperation at triple helix level (government, academy, industry)*" (Vettorato, 2017). Throughout the European Region Tyrol-South Tyrol-Trentino[2], this kind of strategy receives substantial backing thanks to the co-existence of many other activities co-financed by the Autonomous Provinces of Trento and Bolzano, by partly state-owned companies and by the European Community, which are highly complementary to one another. The work of making the innovation systematic is therefore taking place here in areas larger than the mere city and that can be recognised by their cultural, social and geographical identities.
It actually criticized the effective contribution of the so called "smart urban declination" to meet the living needs within the urbanised environments. The American writer Bruce Sterling, who teaches "Media and Design" at the European Graduate School, recently made a severe analysis about the socio-economic consequences of a 'global connection' in terms of divide in technology, people control and risk of marginalization (Sterling, 2018). Moreover, looking at Europe, we are well aware of the role of "smart" approaches and digital technologies on the fragility of cities, affected by: change in population, people aging, new flows of immigrants, obsolescence of buildings and infrastructures (functional and technical) and demands for a better connection between new economies and suitable conditions to develop them (regulations, networks, etc.).
Focusing on a "smart vision" of the city just on energy-related aspects, as defined by the European Sinfonia Project, entails the risk of taking care of technical benefits, from the functioning of urban systems and infrastructures to that of housing and components to test a scaling, from the city to the building, but outside a real global effect on the modification of living styles. In this framework IPES exploits the chance of a European comparison between energy efficiency model to emphasise its own specific aims of social cohesion, building quality as a whole and economic management of their real estates.

Bolzano Smart City

In Bolzano, several organizations are taking part in the Sinfonia Project: EURAC Research[3] (*Accademia Europea di Bolzano*, district leader); the Bolzano City Council[4]; IPES[5] (*Istituto per l'Edilizia Sociale*); Alperia Spa[6] (former SEL Spa); Agenzia per l'Energia Alto Adige-CasaClima[7] and the TIS Innovation Park[8]. Started in June 2014, the "pilot" stage will end in May 2019.
The project concerns both the refurbishment of existing social building complexes and measures for improving the efficiency of service networks on an urban scale.
IPES, the largest builder in South Tyrol and expert in social building, alongside the Bolzano city council, within all planned networking activities, aims to lower the energy consumption of its real estate of 40% and to bring the availability of renewal sources up to 20% by cutting energy consumption, providing links to district, photovoltaic systems, SWH systems and LEDs for both street lighting systems and the common areas of requalified buildings. The final results will be checked by the Alto Adige CasaClima Energy Agency, to refine the new Certification Standard for Refurbished Buildings ("CasaClima R"[9]), so as to calibrate the potential improvement of performance achievable by existing buildings.
The activities on an urban scale include intelligent devices installed by the Council, 150 totems providing LED street lighting, in addition to allowing recharging of electric bicycles and (one out of three) also of electric cars. They will be installed on the outskirts due to reasons of safety of the inhabitants, along cycle paths and within the Sinfonia building refurbishments. This approach to "smart points" suggests for a new path for urban design aimed at safety and not just on energy purposes.
The specific attention on environment has been translated, in Sinfonia, on analysing new methods to increase renewable

ISSN online: 2239-0243 | © 2018 Firenze University Press | http://www.fupress.com/techne
DOI: 10.13128/Techne-22735

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01 | Demonstration for designers, condominium managers and tenants, showing the innovations applied to the IPES building complex in Bolzano (Via Brescia) within the Sinfonia Project

sources and to reduce air pollutants. This section of the project is based on the Council's plan already taking place to provide connections to the district heating system (not included in Sinfonia as it has already been financed), alongside the monitoring by EURAC of the environmental performance of the activities, by lowering nitrogen oxide levels thanks to the new LED street lighting, to promotion of electric transport systems and to district heating of homes.

EURAC coordinates the monitoring of all the project's activities and feeds back the results, through the multi-factor "Activity Schedule" envisaged by Sinfonia, to be a base for similar experiences in the five European cities due to follow Bolzano and Innsbruck (the so-called "Early Adopter Cities": Boras, La Rochelle, Paphos, Rosenheim and Seville) and then many other "Replication Cities", already applying to join the project.

As in all European projects, great attention is paid to the demonstration of the "work in progress", developed here by EURAC supporting IPES, by scheduling Study Tours during which technicians and trainers are available to illustrate (above all to private designers and condominium managers) all the improvement activities carried out and the technologies adopted, using a demo home and illustration panels. The work done with the inhabitants, guided by designers, is addressed to a participated planning of the districts as a whole that should be better analysed as soon as all meetings took place. The stages explained during the field tours include, as an example, the opening times of the windows to be correlated with the forced ventilation, the care of the insulating cladding and the layers of vertical and horizontal closings, with a set of models made by the winning building contractors (Fig. 1).

The driving role of IPES proceeds according to the EU's indications focussing on global local conditions: «The main policy goals are to spur novel solutions and partnerships to urban challenges and to create an open community of practice»[10] (European Commission, 2013).

IPES's multivariable approach

The peculiarities of IPES's working method contribute to a decisive extent to achieving the aims of Sinfonia.

The Institute defined the minimum design standards and managed the works, thus closely monitoring the progress and the outcomes of the choices made, leaving to outside professionals (selected through design competitions) the developing of new functional and architectural models.

The design work is guided by IPES *Technical Regulations*, including *Design Criteria and Standard Technical and Construction Solutions,* a document continuously up-dated in parallel with the Institute yearly experience in construction and maintenance activities. This method can be defined a "multi-variable approach", relating the requested levels of quality (referred to energy saving, safety, exploitability, etc.) to the available economic resources, using unit prices defined in the feasibility plan. This strong shift towards the contractor of the responsibility for checking the preliminary project is currently in line with the latest ANAC provisions for national public contracts.

While in the *Preliminary Project* stage IPES works towards obtaining the best quality/price ratio, it is in the following stages of the *Final Project* and the *Executive Project* that preparation of the design strategy, on the basis of which the contractors are able to formulate their offers, is achieved.

Also when it comes to contracting out the works, planning how the worksite is organised and working out the *detailed calculations of measurements* and the *estimated measurements*, the contractors can propose solutions in terms of quality (70 % of the score) and of prices (30% of the score). IPES provides, as a basis for the calculations, a set of *Selected items of the specification*, including standard materials and building systems to be used, together with the relevant *Unit Prices*.

One tender after the other, the feasible solutions at the disposal of IPES increase, thus improving the reliability of its decision-making process (requisites, performance, cost), having more available choices at the time of the executive project, when specific importance can be attributed (and it has to be properly managed) to different factors such as low energy consumption, the guarantee of durability and maintainability (simple and inexpensive).

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	Europa-Novacella Quarter, via Brescia 1-3-5; via Cagliari 10-10/A	Don Bosco Quarter, via Similaun 10-12-14
Map **Plot map**		
Gross volume	31,700.00 m^3	16,798.00 m^3
Gross surface	9,402.54 m^2	4,863.53 m^2
N. of dwellings	106	59

02 | IPES's complexes in Bolzano involved in the Sinfonia Project

Faced with solutions that have already been verified, the contractors can suggest variants, showing their ability to provide a better quality/price ratio. Offering solutions better than standard quality can enable contractors to be awarded a contract.

The technological culture of social building

To illustrate this multivariable approach, the complexes in Via Brescia and in Via Similaun in Bolzano, requalification of which as envisaged in the Sinfonia project were chosen as examples of activities. Their requalification has almost been completed, without making the inhabitants move out[11] and safeguarding the comfort of the inhabitants during the building works (Fig. 2). The activities were planned by Studio Tecnico Vettori and Area Architetti Associati, both of Bolzano.

The study was developed by visiting and investigating in depth two of the worksites chosen as study cases, so as to evaluate in the field different design strategies. One of the means for acquiring knowledge consisted of interviewing parties such as designers, site engineers, persons in charge of the single activities and the Project Manager following all the experimenting for IPES. This analysis followed the in-depth investigations into the field of construction in South Tyrol and of IPES's work, which have already been published (see references).

The works with people living in the flats, in order to lower the social impact but also to save the costs for moving people away, led IPES to promote site management techniques keeping the inconvenience for the inhabitants, the length of the stages of work affecting the single inhabitants and the interference inside the common areas, to a minimum. Indeed, when evaluating the bids, at the time of awarding the works to the contractors, in both cases analysed, it was precisely the organisation of the site that rewarded the winning contractor.

The accessibility of all the homes and the usability of the services is guaranteed by the contractor, in one case with a site elevator and personnel available 24 hours a day to help the inhabitants and, in the other one, with the installation of temporary kitchens outside the buildings.

The experimenting with the buildings included in Sinfonia, now half-way along its path, enabled definite synergies to be developed between requalification of buildings (comfort and maintainability) and of the district concerned (social safety and improvement of formal quality) and then of the whole city (intelligent public lighting, studies for up-grading the existing district heating network and for lowering nitrogen-based pollutants).

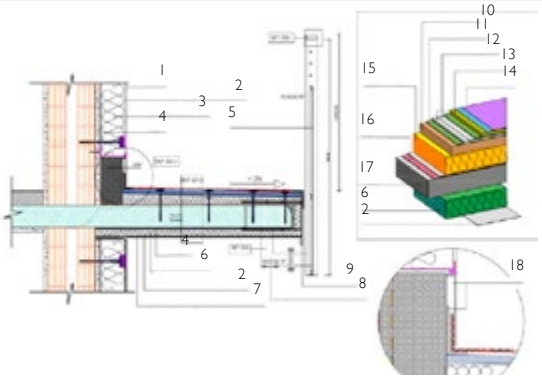
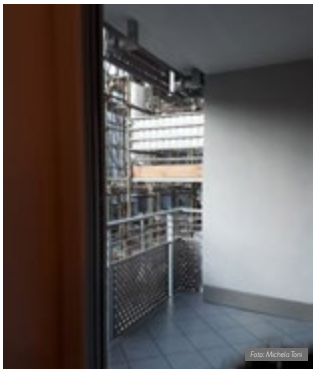
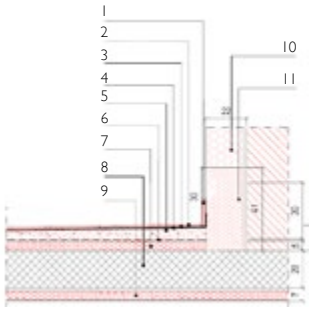
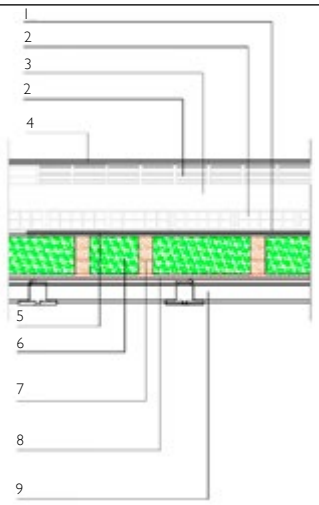
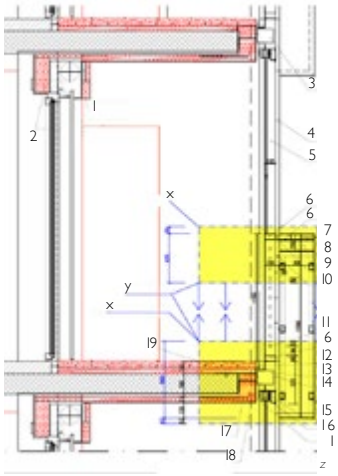
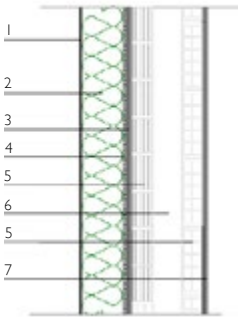
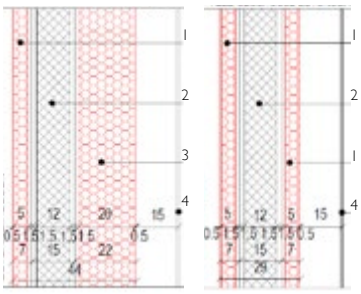
At building level, both projects called for better control of the common areas, thanks above all to closing of the condominium areas, stronger lighting and use of LEDs in the common parts as well as requalification of the green areas.

The configurations of the two projects can be grasped with the formal features distinguishing them, without any prejudice for the similarity of the energy performance and comfort (Fig. 3).

The demolition of the concrete parapets on the balconies has been planned so as to ensure a continuity of the external insulation of the walls and floor flabs, replacing them with lighter materials. In particular, in Via Similaun, a new façade system realized with a steel structure anchored to the building supporting a wooden sun-screens, provides a solar control and the integration of solar heating systems.

Lowering of the energy consumption is envisaged in both buildings, from 180 kWh/sqm per year to about 20 kWh/sqm per year (Fig. 4), as well as the installation of roof-photovoltaic and SWH panels. In addition, in Via Brescia a new multi-purpose façade with SWH has been installed on the South side (Fig. 5).

The great insulation of buildings and the high percentage of en-

	Europa-Novacella Quarter, via Brescia Images: © Studio Tecnico Vettori	Don Bosco Quarter, via Similaun Images: © Area Architetti Associati
Balcony refurbishment (thermal bridge)	 1 Paintwork 2 6 to 7-mm thick silicate plaster 3 16-cm thick rockwool 4 Adhesive 5 3-mm thick rockwool panel 6 5-cm thick rockwool panels 7 Enamel paint 8 Corner for hooking the parapet 9 Aluminium cover 10 Fibre-cement panel 11 Primer 12 Waterproofing 13 Self-levelling layer 14 Finishing of creative design 15 Insulation with slope 16 Separating layer 17 Floor slab 18 Aluminium flashing 	 1 Porcelain stoneware skirting 2 Porcelain stoneware tilles 3 Cement-based adhesive 4 Elastic two-component waterproofing liquid 5 Concrete screed, slope 1 % 6 Separating layer 7 5-cm thick XPS panels 8 Floor slab 9 5-cm thick rockwool panels 10 20-cm thick rockwool panels 11 30 cm high XPS skirting 
Multifuntional Façade and wall section	1 Plaster 2 Wall made of hollow bricks, 10 cm 3 Air space, 6 cm 4 Inside plaster 5 Adhesive 6 15 cm thick rockwool panel 7 6x16 cm wooden uprights 8 Windproof membrane 9 Solar collectors 	 1 Cables for wiring system 2 Controlled mechanical ventilation built into the box 3 Anchor plate 4 Main front upright 5 Intermediate front upright 6 Metal section, 50x100 mm 7 Metal section, 50x200 mm 8 Metal piece, 100x300 mm, with drip edge 9 Bracket 10 Bracket box 11 Metal rod, Ø30 mm 12 Water drainage channel 13 Bracket 14 Metal curtain 15 Metal box with substructure for stiffening and drip edge 16 Motorised roller blind 17 Flat hot galvanised steel section for supporting floor 18 Stainless steel drip tray section on ends of balconies X Sample to be made Y Parts to be joined together
Wall section	1 5-mm thick silicate finishing layer 2 Feldspar rockwool panels, 16 mm thick 3 Plaster 4 Adhesive 5 Partition made of hoolow bricks, 10 cm 6 6-cm air space 7 Inside plaster 	 1 Rockwool panels, 5 cm 2 Existing plastered reinforced concrete wall 3 Rockwool panels, 20 cm 4 Aluminium sheeting as coating

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	Europa-Novacella Quarter	Don Bosco Quarter
Energy consumption Before	220,78 kWh/m^{2}yr	211,93 kWh/m^{2}yr
Energy consumption After	61,00 kWh/m^{2}yr	61,34 kWh/m^{2}yr
Total Building Energy Use After included RES *	48,53 kWh/m^{2}yr	43,61 kWh/m^{2}yr
RES contribution	54%	58%
Global efficiency	15,91 kg CO_2/m^{2}yr	13,55 kg CO_2/m^{2}yr
* RES (Renewable Energy Sources)		

04 | Energy performances of the complexes before and after the activities

ergy coming from renewable sources leads to a drastic drop in the need for heat (Fig. 6). On the other hand, this led to critical issues when evaluating the effectiveness of the parallel urban-scale solutions aiming at increasing energy production (such as district heating, co-generation and other solutions), not needed by the designed building improvement.

In any case, the ex-post checking of the results, from May 2018 to May 2019 (so as to take all the seasonal factors into account) will place other data at disposal for further processing. To do this, sensors have been applied inside some of the sample flats (chosen at random but trying to distribute them in different parts of the building). These devices for monitoring the tempera-

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05 | Building works on the multipurpose façade in Via Brescia

ture, the moisture of the air, the ventilation performance and the opening of the windows, managing the data on a practically constant basis (data acquired every 5') by the system kept by IPES. Alperia, on the other hand, will take care of energy monitoring referred to the continuous consumption of both the buildings and the sample flats at a city level (therefore including the houses requalified by the Bolzano City Council) and also taking into account the data from the district heating network.

Conclusions

Everything described here, from the network among partners to the use of a multivariable method for defining and controlling the projects, from care for on-site organisation and safety to keeping inconvenience for inhabitants to a minimum, to the reduction of energy costs for users, of air pollution and of IPES's management costs (also with ex post checks), makes the IPES's experience a work method to tend towards, and the reliability of which can only inspire confidence on the part of other builders, whether public or private, that the effort made is worth the time it takes and the skills needed.

NOTES

[1] Sinfonia. Low Carbon Cities for Better Living (www.sinfonia-smartcities.eu).

[2] In 2011 the EUREGIO-GECT was founded, based on the Regulation No. 1082 of the European Parliament. The purpose of the EGTC is to foster and facilitate trans-border, trans-national and interregional cooperation between the Tyrol, South Tyrol-Alto Adige and Trentino (http://www.europa-region.info/en/egtc.asp).

[3] www.eurac.edu

[4] www.comune.bolzano.it

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06 | Building improvements: Via Brescia and Via Similaun

[5] www.ipes.bz.it

[6] www.alperia.eu

[7] www.agenziacasaclima.it

[8] www.tis.bz.it

[9] http://www.agenziacasaclima.it/it/certificazione-edifici/risanare-con-casa clima-1257.html

[10] *An integrated Research and Innovation Framework for Smart and Sustainable Cities intends to: · Better coordinate, streamline and focus the existing and future research and innovation activities and initiatives on urban issues across Horizon 2020 and future Framework Programmes. · Enable a sustainable and systemic approach to innovation, by fostering co-creation, codevelopment and co-implementation with different actors and citizens in cities across the Union and worldwide. · Develop new business and governance models, mobilise new partnerships and investments, and facilitate market uptake of visionary solutions and approaches needed to enhance urban resilience. · Provide the knowledge and evidence base to inform decision on investments in key infrastructure for cities and urban regions as well as to inform policy-making, planning and land use management. (European Commission, 2017).*

[11] Only about 5% of the flats were empty at the time of the works, a physiological percentage due to the rotation of tenants.

ACKNOWLEDGMENTS OF VALUE

Institut für den sozialen Wohnbau des Landes Südtirol
Social Housing Institute - Südtirol

We feel that it is useful to let the working method of IPES become known outside South Tyrol, because promoting cultural exchanges is fundamental in order to let the Institute's commitment in the field of social housing in which it is active grow constantly. In this respect, contact with the architect Michela Toni, professor at the Department of Architecture of Ferrara University, is of interest for us. Since 2006 she has been carrying out research in the field of constructions in South Tyrol, and during this period has written texts and organised study trips for the students attending her courses, creating a bridge with the university that, ever since it was first established, has repeatedly been found the leading Italian school of architecture (see "Valutazioni Censis, Centro Studi Investimenti Sociali").
We are currently particularly pleased that Michela Toni is carrying out research into the role of IPES in the framework of the experiments of the European Sinfonia Project, involving profitably in this activity also a colleague from her own Department, the architect Maddalena Coccagna. We therefore have a positive feeling that the opportunity of this international issue of TECHNE was grasped by the two university professors to summarise some of the results of their research activity on the Project under way, for the benefit of a public of experts.
We find the contribution of Professors Toni e Coccagna effective since:
- it makes it possible to understand how the evolution of Bolzano towards becoming a European "smart city" benefits specifically from the experience acquired over the years by IPES in the construction of buildings of high quality from the points of view of energy and maintenance, setting the goal of developing social relations among the inhabitants;
- it goes into the details of the holistic approach to technical and procedural solutions, of which IPES's leadership is confirmed;
- it puts forward some important initial critical thoughts about the deep-reaching meaning of a smart approach to the transformation of cities.

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