CONCERTO AL PIANO. SUSTAINABLE URBAN TRANSFORMATIONS

Concerto AL Piano

Sustainable Urban Transformations

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CONCERTO AL PIANO

Sustainable Urban Trasformations

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CONCERTO AL PIANO

Sustainable Urban Trasformations

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Introduction

Concerto AL Piano, in Alessandria at the NW of Italy, is one of the 58 integrated energy demonstration sites promoted by the European Commission within the 6th and 7th Framework Programme.
Concerto AL Piano is aimed at demonstrating the economic and social benefits in investing in energy saving and renewable energy in urban regeneration. The project includes a mix of interventions: the renovation of existing social housing, the construction of new eco-buildings and the provision of a cogeneration district heating, integrated in the urban environment.
The sustainability goals of Concerto AL Piano can be summarized as follows:

- high reduction of fossil fuel consumption in existing renovated buildings;
- integration of renewable energies at the urban village scale;
- district heating and co-generation as a network for the urban village;
- local team to promote the information campaign on the energy conservation scheme;
- municipal energy management and retrofit program.

The completion of urban voids, with the creation of the New Eco-Village, improves the perception and the endowment of the district that would be otherwise incomplete.

The project has upgraded the energy profile of a whole urban district through:

- renovation of 300 existing dwellings, up to 50% reduction of energy consumption;
- energy conservation scheme for 3,000 dwellings, and energy retrofitting over 48,000 m^2;
- 104 new dwellings and 50 apartments for elderly people reaching minimal space heating consumption.

Concerto AL Piano had a strong effect on the urban regeneration of the whole district. Such ambitious projects, managed by a partnership between local government, private companies and university research, served as a model for the urban regeneration process, which became a key action in the Strategic Energy Action Plan (SEAP) of Alessandria.
With regards to performance, what undoubtedly has undergone significant transformation is the energy balance of the neighborhood. The energy consumption of existing buildings was reduced by around 40% while the new settlement represents the next generation of buildings, aiming to reduce energy consumption even with unusual typological solutions, like a micro-climatic atrium.
Three main demonstration actions are developed in Concerto AL Piano:
RETROFIT _ Energy Retrofitting at the district level
The Energy Retrofit Programme aimed at providing the Concerto district with an energy conservation scheme for 3000 dwellings, based on announcements in local newspapers and letters addressed to the inhabitants. A 10% of the audited buildings (24,000 m^2) were retrofitted following the scheme. Over the global retrofit investment, inhabitants were asked to contribute up to the 65%

of the energy rehabilitation costs. This was organised through local community tenders that have increased the popularity and penetration of the Energy Retrofit Programme at the city level.

RENEW _ Energy Renovation of the existing village

The existing social housing village was needing an urgent energy retrofit, due to the lack of thermal insulation and a very degradated envelope. Then, a deep renovation of 300 dwellings took place, with the aim of reaching up to 50% reduction of the specific energy consumption. The complete refurbishment of 11 buildings belonging to the Social Housing Agency incorporated a wide range of measures: external insulation; air tight windows and ventilation control; greenhouses and glazed balconies; individual heat meters and thermostatic valves; district heating system with cogeneration.
A visible refurbishment involved the whole building envelopes, retrofitted using external fiber-wood insulation. Existing windows were replaced with new double glass, low emission and high performance windows. The south facades have been equipped with passive greenhouses to provide solar gains in winter, thus reducing energy consumption for space heating.

NEW _ New Construction of a low-energy village

The new low-energy village includes 104 dwellings and the elderly house for other 50 dwellings, adopting advanced space heating and DHW standards.
In addition these dwellings make use of renewable energy: 200 m^2 of water solar collectors; 50 kWp of photovoltaic systems. The design of four micro-climatic buildings is based on the atrium solution: two building blocks are linked together by a transparent atrium to determine an intermediate and more comfortable winter climate. The use of environmental friendly materials, the reduced fossil fuels consumption for space heating and sanitary hot water, and the implementation of a large set of measures to save and reuse water, recycle waste, limit the traffic speed, provide an improvement of the local environment. A newly built district heating network provides heating and electricity in co-generation. One of the demonstration issues consists of showing the inhabitants how a central power station can appropriately fit in a populated residential district. A plant remote control system drives the cogenerator to adapt its power output following the heat demand, granting the highest possible efficiency. A remote control room gets each day the production data, with 15 minutes scansion, as well as any eventual out of order signal.
At the end of the 8 years project cycle, from design to monitoring, the coordinating team of Concerto AL Piano could focus on the main achievements from this demonstration project to promote a smart urban community. The lessons learnt can be helpful for new projects and for a wide application of sustainable principles on an urban scale.

Governance PROCESS /
for Sustainable Urban Trasformations
by Roberto Pagani

a| METHOD
- Managing the change

b| APPLICATION
- Analysis of socio-economic indicators

c| RESULT
- Programme Organisation and Forum
- Creation of the Local Community Task Force
- From one acupuncture to multiple eco-punctures

1

Governance Process /

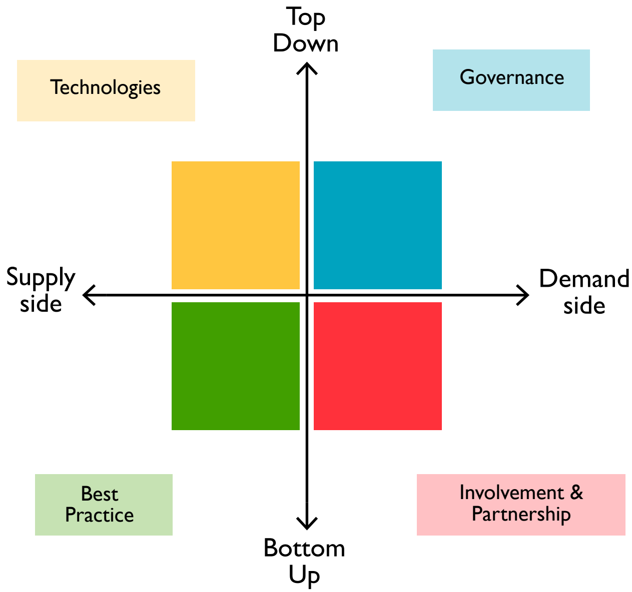
a| METHOD

Managing the change

Concerto AL Piano aims at providing the public decision makers, the developers, the professionals and citizens with a "Sustainable Urban Project":

- promotes an innovative regeneration of urban sites, with a mix of functions and with a mix of refurbishment and new construction, of residential and non-residential buildings, representing the complexity of our urban situations;
- acts where a revitalisation project is starting with new comprehensive rules and standards - housing, tertiary and commercial, institutional, recreational, etc;
- makes it visible enough to allow a strong impact on citizens, as well as on the decision making mechanisms.

Concerto AL Piano coordinators have developed in the recent years an interpretation diagram for describing urban policies and sustainable decision making that can be summarised into four fundamental approaches:



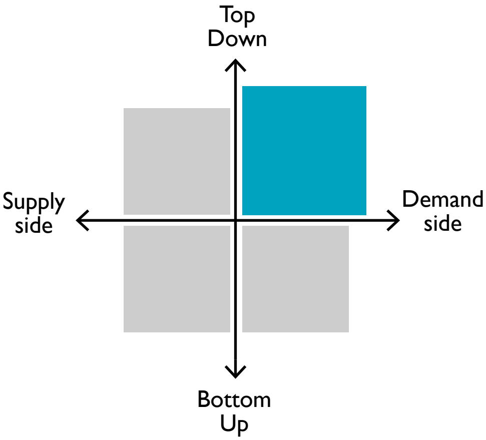
- *Top-down approach - Related mainly to the activity of governments and/or institutions when introducing new regulations, as well as when reducing regulatory and procedural impediments*
- *Bottom-up approach - Organising the needs of a community and preparing the policies which comply with these needs*
- *Demand-side approach - Concerning the end-uses of citizens and their needs: mobility, housing, quality of life, economic opportunities, healthy environment, and so on*
- *Supply-side approach - Refers to the capability of the market to organise the production of goods and technologies, which respond to consumers' need*

Scenario Workshop “Alessandria: villaggio integrato con l’ambiente”.

These four approaches create different urban policy consequences.
One approach is neither better nor worse than the other, but all can be equally significant and effective when pursuing objectives of a better urban quality.
In practice, the urban policies are not exclusively “top down” or “bottom up” or only “supply-side” or “demand-side”. Usually policies are a combination of the four approaches and can be placed in a Cartesian diagram, which refers to the supply - demand on the X axis and the top-down - bottom-up on the Y axis (see figure). This conceptual framework gives the innovative organisation of the project. The “urban strategies” diagram is:

- *The “Top-down – Demand side”. This is the city and institution area when planning or deciding, in the interests of the general public - the domain of “Governance”*
- *The “Bottom-up – Demand side” area is considered the domain of “Involvement and Partnership”, where citizens and users get involved and participate in decision making processes*
- *The “Bottom-up – Supply side” area is the domain of “Best Practice”, which supplies integrated responses and methodologies to urban problems with the involvement of professionals and educationalists*
- *The “Top down – Supply side” area is the domain of “Urban Technologies and Marketing”. This involves the supply of technical solutions and industrial products to the sustainable city concept*

This conceptual framework is the focus of the Concerto AL Piano methodology. Around this framework the various research and demonstration work-packages are organised and managed.



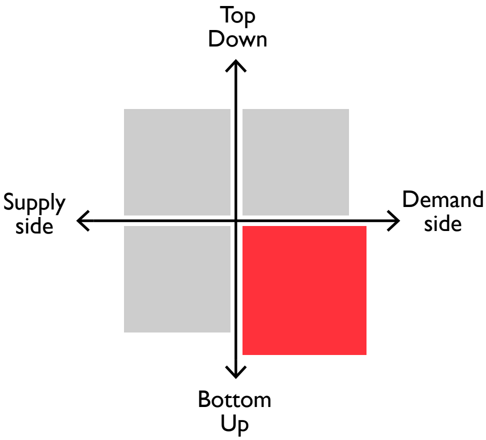
"GOVERNANCE"

Research Objectives:

- To develop a comprehensive set of community planning methods for sustainable urban regeneration, via:
  - a review of some of the existing options;
  - a testing in Concerto AL Piano.

  The general objective of the planning methods is to incorporate the needs, aspirations and interests of the local community in both the initial planning and long term work of regeneration.
- To test out the appropriate governance methods in the Concerto area and measuring their effectiveness

  The appropriate application of different methods is managed by the Concerto AL Piano "Central Unit", organising the application, testing and monitoring of results.



"INVOLVEMENT and PARTNERSHIP"

Research Objectives:

- To widely disseminate the results of the project, by making methods and techniques available to Concerto AL Piano "Users Group".
  - The methods and techniques adapted and tested in Concerto AL Piano are made available to planners and urban managers, by subscribing to the Concerto "Users Group". The objective is to provide practical support to urban regeneration managers in using the methods and thus expand their use.
- To provide necessary training
  - Training to city planners and urban managers is provided from the very beginning of the project by means of workshops and stakeholders participation in methods application. This training is made available in all stages of the project.

“BEST PRACTICE”

Research Objectives

To provide a revised and improved application scheme for the methods, combined with a specific context.

- The effectiveness of all methods during the application and testing phase is reviewed. Methods are improved to produce a final version ready for wider dissemination and use.

“TECHNOLOGY AND MARKETING”

Research Objectives

To review the application of a range of selected eco-technologies for building retrofitting and new construction

To test out the appropriate eco-technologies in the pilot area and measure their effectiveness.

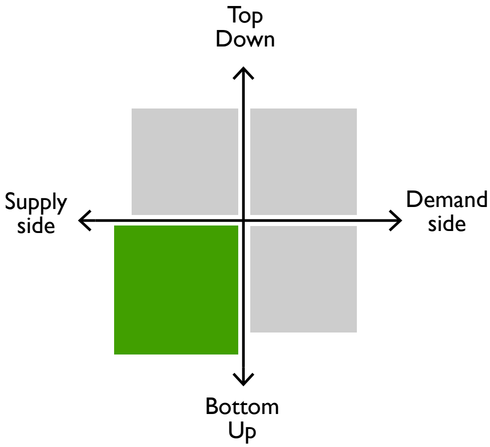
To demonstrate the cost effective, practical application of integrated technologies in urban regeneration and building refurbishment.

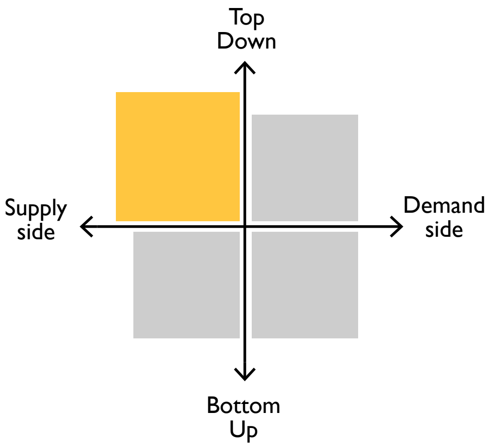
To provide a relevant reduction in energy demand compared to building regulation.

Concerto AL Piano contributes directly to many priorities and key action objectives:

Quality of life in urban communities.

- Concerto AL Piano improves the planning process of urban revitalisation and regeneration by involving the local community. It incorporates innovative energy technologies and contributes to the environmental quality of urban areas, but it also improves the quality of life, comfort, natural lighting, ventilation of indoor environments, since eco-buildings are better buildings for their occupants.





Scenario Workshop “Alessandria: villaggio integrato con l’ambiente”.

Promoting cross-fertilisation.

- Concerto AL Piano involves the participation of stakeholders and citizens in planning and decision making, and thus providing long lasting and more sustainable solutions to urban problems. Innovative methods are used to address economic, environmental and social issues, bringing in the local community. Cross-fertilisation of experience between municipal decision makers, professionals and consultants, developers and architects is a methodological strength of Concerto AL Piano.

Optimising capital cost.

- Concerto AL Piano shows that the operation and maintenance costs of eco-buildings, and energy efficiency measures in urban regeneration can be minimised by good design and project management
- Improving Building Regulation schemes.
- Concerto AL Piano helps local administrations to develop new building regulation schemes, contributing in the short-term to improve policy, legislative and regulatory measures for energy efficiency and renewable energy in buildings

CONCERTO AL PIANO

DG TREN07/FP6EN/S07.71241/038569

AIMS

THE URBAN VILLAGES OF ALESSANDRIA

The building costruction component of Concerto AL Piano won a Ministry of Housing and Infrastructure tender and got the basic financing for construction and infrastructure innovation (social and economical actions included). It can be regarded as an urban pilot project at the neighbourhood level.

The first design stage has been developed, while in 2006 the second design step is planned. Construction will start in 2007 and will be completed in 2009.

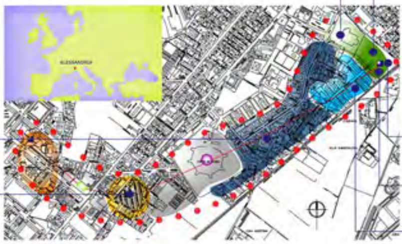
In the same district, the City of Alessandria has already built a Photovoltaic Village, just inaugurated, that won the 1st prize of the 2003 Sustainable Cities Award promoted by the Italian Ministry for Environment.

STEPS

The programme is divided into 17 Work-Packages listed below which have been identified targets, timing and expected results. The contents and the timing of each work pakage are:

1. Governing : Process	2007-2010
2. Implementing : Projects	2007-2010
3. Benchmarking : Products	2007-2010
4. Monitoring: Performance	2008-2011
5. Disseminating : 4P	2007-2011
6. Promotion with Associated Cities	2007-2011
7. RETROFIT: 48,000 m2 of dwellings	2007-2010
8. RENEW: 299 renovated dwellings	2007-2009
9. NEW Ecovillage: 104 new eco-dwellings	2007-2009
10. NEW Elderly: 50 new elderly dwellings	2007-2009
11. NEW Health Sport Centre: 4000 m2	2007-2009
12. NEW Kindergarden: 700 m2 eco-school	2008-2009
13. Biomass Trigeneration: 250 kWe 1250 kWt	2008-2009
14. Solar PV : 120 kWp	2008-2009
15. Solar Thermal: 585 m2 water/air collectors	2008-2009
16. Training AL Piano	2007-2010
17. Managing Concerto AL Piano	2007-2011

PLANNING



SWIMMING POOL

RETROFIT

1. Building Energy Auditing
   application over 240,000 m2 dwelling equivalent floor area
2. Energy Rehabilitation Programme of the Refugees Village
   up to 150 dwellings of equivalent floor area
3. Energy Rehabilitation Programme
   48,000 m2 of equivalent floor area

dwellings n	area (m2)	reduction % code2006
150	12000	48
450	36000	35

NEW ECO VILLAGE

1. Exemplar energy efficiency
2. Exemplar use of Renewable Energies (Solar thermal, PV and biomass)
3. Exemplar demonstration on wastes, water, vegetation, mobility

dwellings n	area (m2)	reduction % code2006
80	6400	46
24	1920	46

NEW SOCIAL ELDERLY

NEW KINDERGARDEN

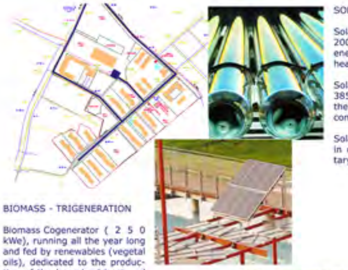
RENEW

Energy renewal of dwellings belonging to Alessandria Social Housing Association to provide well-being conditions of existing dwellings and improve their energy standards

dwellings n	area (m2)	reduction % code2006
299	23220	48

STRATEGIES

ENERGY TECNOLOGIES



SOLAR THERMAL

Solar water for eco-village: 200 m2 will provide peak energy for the sanitary water heating of the dwellings

Solar air for health centre: 385 m2 to provide warm air to the ventilation system for common spaces.

Solar water for kindergarden in order to provide hot sanitary water as needed.

BIOMASS - TRIGENERATION

Biomass Cogenerator (2 5 0 kWe), running all the year long and fed by renewables (vegetal oils), dedicated to the production of the base load heat and power demand (hot water and de-humidification).

Biomass burner (1250 kWt) to match the specific heat demand of the cold season

Absorption chiller fed by cogenerated heat, used for the de-humidification of the swimming pool

SOLAR Photovoltaic (PV)

PV – eco-village	50 kWp
PV – social, elderly building	20 kWp
electric bicycles	3 kWp
PV – swimming	37 kW
PV – kindergarden	10 kWp
PV - Concerto AL Piano	120 kWp
PV – existing PV Village	163 kWp
PV total in Concerto district	283 kWp

ENVIRONMENTAL MEASURES

1. Energy Efficiency
- walls' extra insulation, adopting 14 cm of fibre-paper insulation in cavity walls.
- air tight window frames and low emission glass for energy efficient windows (U= 1,6 W/m2K)
- passive greenhouses to be converted into balconies during summer, with control devices

2. Renewables
- Connection with the biomass driven District Heating system and CHP station;
- Water solar heating systems for hot water needs of dwellings;
- Building integrated - grid connected Photovoltaic systems

3. Lighting
- Indoor high efficiency lighting;
- Outdoor high efficiency lighting;
- Enhanced natural lighting;
- Dark-sky outdoor lights

4. Vegetation
- Greening on outdoor public spaces;
- Greening on outdoor parking

5. Waste
- Improved waste management at district level;
- Underground Waste Ecological Area

6. Water
- Individual metering; Toilet double flush system;
- Low flow shower heads; Rain water collection for irrigation;
- Grey water reuse

7. Mobility
- Bicycle lanes and parkings;
- Reorganising integrated public mobility

Concerto AL Piano, poster presented at UIA Turin 2008, 23rd Congress of the International Union of Architects (R. Pagani, C. Carbonaro, L. Savio)

b| APPLICATION

PROCESS
The programme has been governed through a large participatory process, started with a Scenario Workshop amongst the local community, in order to select the best possible strategy for developing the area.

PLAYERS
Project Coordinator is SOFTECH Total Environmental Action, Turin.
Partners in managing the Research and Innovation, as well as in evaluation, monitoring and dissemination are:
- Politecnico di Torino, Italy;
- Fundacao Gomes Teixeira da Universidade do PORTO, Portugal;
- GEONARDO, Hungary;
- Trecodome, the Netherlands.

The main local players for the implementation of the demonstration component of Concerto AL Piano are:
- City of Alessandria;
- ATC Social Housing Association of the Alessandria Province;
- Private partners: CIEPA and Consorzio Unione;
- Heat & Power, energy service company.

The Associated Cities that followed the design and implementation of Concerto AL Piano and took part in the dissemination activities are:
- the City of Porto - Câmara Municipal do Porto (PT);
- the Town of Tavira - Câmara Municipal de Tavira (PT);
- the Town of Moura - Câmara Municipal de Moura (PT).

COST
The business plan for Concerto AL Piano allocated the amount of 38.763.095,00 Euro for the design and construction activity promoted by the partnership: City of Alessandria, Social Housing Agency, building consortia and cooperatives.
Concerto AL Piano building programme won a Ministry of Housing and Infrastructure tender and got the basic financing for building construction and infrastructure innovation. It can be regarded as an urban pilot project at the neighbourhood level.
In the same district, the City of Alessandria has already built a Photovoltaic Village that won the 1st prize of the 2003 Sustainable Cities Award of the Italian Ministry for Environment.
The more comprehensive approach of Concerto AL Piano includes:
- eco-refurbishment of existing social housing (299 dwellings);
- new eco-village (104 dwgs);
- a new social-elderly house (50 dwgs)
- extended energy retrofit for the buildings of the district (plan to supply resources for energy/building retrofit of 48000 m2 equivalent dwellings);
- measures for green and infrastructures;
- measures for social re-vitalisation.

Eco-energy specific measures include:
- High standard of eco-building;
- Atrium and sunspace among building blocks;
- District heating in cogeneration;
- Micro-climatic housing with innovative design;
- Greenhouses and solar collectors on dwellings;
- Extensive adoption of PV modules for dwellings electricity need;
- Use of rainwater for irrigation, reduction of water flows;
- Waste management, on site compost production, and various other eco-settlement measures.

CONCERTO AL PIANO

Process

GOVERNANCE

comprehensive approach involving: administrators, planners, investors, users.

Project

IMPLEMENTATION

design ateliers to implement the energy network and the urban transformation.

Product

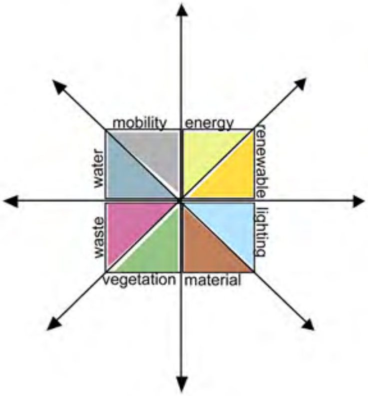
BENCHMARKING

zero fossil fuel district: all renewable trigeneration system (biomass), photovoltaic and solar thermal.

Performance

MONITORING

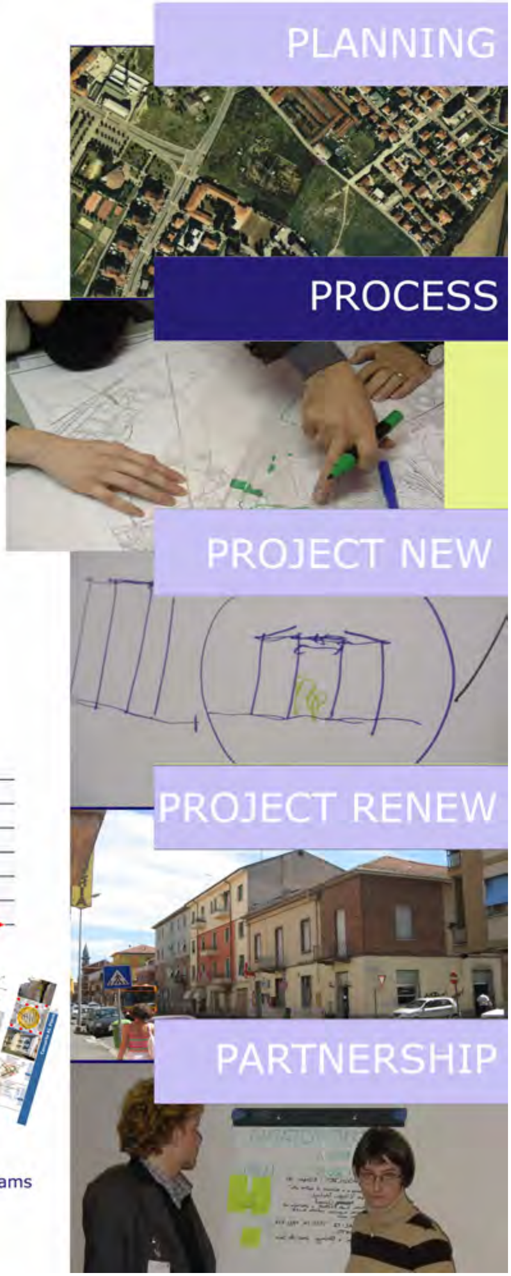
monitoring network to benchmark the urban transformation in terms of energy, environmental and quality assessment.



Promotion

DISSEMINATION

dissemination campaign and specific training programs for undergraduate, graduate and Phd students at Politecnico Torino, School of Architecture



Concerto AL Piano, poster presented at UIA Turin 2008, 23rd Congress of the International Union of Architects (R. Pagani, C. Carbonaro, L. Savio)

Analysis of socio-economic indicators

The City of Alessandria is a typical middle-size Italian city, industrial and agricultural based, in the north west of Italy.
The city has an area of 203.95 square km and is having a medium level elevation of 95 meters above sea level, with a minimum of 83 m and a maximum of 268 m above sea. This territory, almost totally flat apart from the hills to the north, includes a large urban centre - actually the City of Alessandria - and 13 suburbs.
The township shows that urbanization occurred mainly in the city that has developed along the south of the district while the suburbs have largely retained their predominantly rural character.

Currently Alessandria has settled a total population of about 90,000 inhabitants, of which about 75% in the city and about 25% in the suburbs, which plays such prevailing activities:

- Agriculture: 11%
- Mineral extractions, other companies: 0.70%
- Manufacturing: 11%
- Production and distribution of energy and water: 0.05%
- Buildings: 14%
- Wholesale and retail trade, repairs cars, motorcycles: 31%
- Hotels and restaurants: 5%
- Transport, storage and communication: 3.20%
- Financial intermediation: 3.55%
- Real estate, renting, research, IT, professional and business: 10%
- Other community, social and personal services: 6.50%

The main demonstration site of Concerto AL Piano is located in an area not too far from the centre of Alessandria.
Analysing the Concerto area (Quartiere Cristo) some essentials emerge, such as:

- Strong presence of Social Housing, from 1930s to 1980s, including the most recent (2000s) character of energy-environment construction (“Photovoltaic Village”);
- Presence of historical-artistic-environmental heritages, which turns out to be the “Forte Acqui”, in a state

		N. assisted families in the city	N. assisted families in district	N. families in the city	N. families in district	% in the city	% in district
1	Incidence of households assisted by social services of total households in the area, if this average is superior to that town (2004)	2238	436	38138	5592	5,87	7,80
2	Percentage of households who use the subsidy to the rent of the total households in the area, if this average is superior to that town (2004)	965	179	38138	5592	2,53	3,20
3		2206	1302	38138	5592	5,78	23,28

of under-utilization;

- Consolidated street crossing area (via Acqui) with two main axes;
- Aggregation of built substantially homogeneous, but disjointed, with breaks sometimes drastic urban “continuum”;
- Shortage of green areas and useful citizenship.

All these elements clearly prefigure an “urban decay”, at first historical context, then needing reconnections and revitalization as a whole. This action of upgrading and increasing the functionality of the urban context, with reconnections, interconnections of new construction, building renovation, new services to citizens, had to be planned and implemented.

The Concerto district is an area of composite and complex characteristics: a peculiar structure of the population, a diversified settlement system for quality and density, a socio economic transformation, all elements that constitute a framework marked by symptoms of the transition from an “industrial” condition to a “post-industrial”, as well as a transition from a “modern” socio-cultural in a “post-modern”.

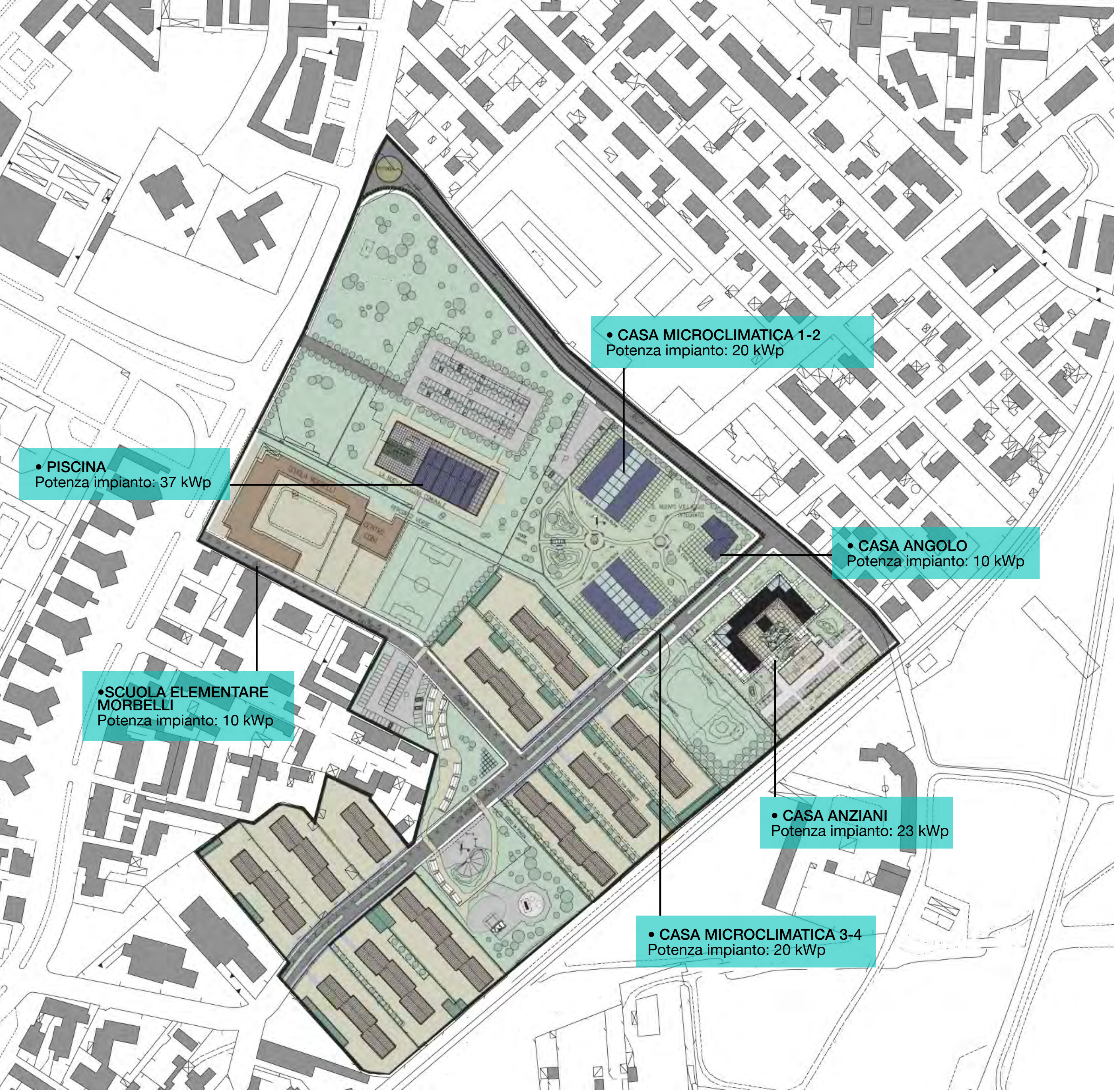
The neighbourhood is both socially and spatially fragmented, characterized by elements rooted in time, consisting of strong ties and constraints of the traditional type, in a continuous redefinition, subject to intermittent use by the population.

The relationships between individuals appear only partially characterized by individualistic attitude: anonymity is not the rule. Often, in everyday life, there is a special relationship with the place where the experiences, the symbols, the deepest values bind the individual to the community of origin.

All agree in defining this district as a “human scale” neighborhood, a place where life is good, where there are no frenetic rhythms and where, therefore, the problems of large urban areas are less pressing and present.

The Concerto district does not seem to register, in fact, particular problems or deficiencies. Services, infrastructure and public transport appear good and the commercial network meets the residents’ daily needs. The traditional forms of belonging persist and play an important and reassuring role of bonding personal recognition with the area. The research of local identity is manifested in an attempt to return to the past through the recovery of memories, celebrations, traditions of the past, and in the desire to have a viable community.

Belonging to the community is a source of local attachment even when this Northern Italian region is not the place of origin, but he area in which forming and maintaining social relationships becomes day-by-day satisfactory.



Concerto AL Piano, general plan of the project area.

c| RESULT

Programme Organisation and Forum

In Italy, the role of local authorities can facilitate the uptake of Concerto initiatives, when other key elements are included: specific political commitment, level of competence, risk acceptance.
In Concerto AL Piano, this mix of strong political commitment, level of competence and risk acceptance by all players was guaranteed from the very beginning.
As a financial characteristic, typical of Italy, we can mention the Urban District Contracts (Contratti di Quartiere), an instrument of the Italian Ministry of Infrastructures, devoted to urban rehabilitation, which includes measures for economic and social re-vitalization. This instrument was very important to provide the financial background to cities, builders, investors in our Concerto urban rehabilitation program.
The kick-off meeting of Concerto AL Piano took place on July 2-3, 2008 in occasion of the first, 'Partners Meeting' with the associated communities. The public part of this event and the press conference were also open to the citizens of Alessandria.
During the first day a short visit of the Concerto AL Piano district was carried out, followed by a sightseeing of the so-called “Photovoltaic Village”. In the evening there was a get together between major local and regional stakeholders and representatives of the associated communities.
As peculiarity of the second day, the meeting was held in a public place, namely a highly frequented square in the city centre of Alessandria. A further feature was the very high participation of the local public administration, including the Mayor and the Councillor for Economic Development and Urban Projects.
The meeting started with an opening speech of the Mayor Mr. Fabbio who pointed out that his city has great interest and ambition in becoming a leader for best practice and a reference for other cities. His speech was followed by presentations of the current activities of the Concerto AL Piano project in the demonstration site Alessandria and in the associated communities. The Project Coordinator highlighted the major characteristics of the project, its sustainability and its innovativeness, the partners from FGTUP Foundation of the University of Porto (PT) and of Trecodome (NL) stressed the technical monitoring aspects. Geonardo (HU) illustrated the dissemination strategy. These presentations were followed by the illustration of the activities in the communities of Moura (PT) and Tavira, where large PV and solar thermal projects have been carried out.
Concerto Plus, the EC coordinating office, held a general presentation and participated in the subsequent press conference. In the afternoon a site visit was organised to get a sightseeing of the project area.
The main goal of the initial project site visit was to start a productive collaboration with the project partners, to present the goals and describe the main research activities, to visit the local demonstration sites and to get an initial general overview of the planned activities and their state of advancement.
The goals of the afternoon session were to discuss the project management issues related to the project and to get a first overview on all project specific activities.

Concerto AL Piano, kick-off meeting on July 2-3, 2008.

Creation of the Local Community Task Force

Concerto AL Piano is characterised by a comprehensive approach involving administrators, planners, investors and users. It can be regarded as an urban pilot project at the neighbourhood level. In fact, during the planning phase, a number of consultations and workshops have been carried out.
Another highlight of Concerto AL Piano is the planned monitoring network to benchmark the urban transformation, not only in terms of energy, but also in terms of environmental and "quality of life" assessment.
The Local Community Task Force has been created for sharing and assessing Concerto AL Piano actions, at each stage of implementation.
This group is formalised as a Concerto AL Piano Task Force, for the analysis, discussion of implementation principles.
It is constituted by the following city managers, associations, experts, promoters and builders:

- Pierfranco Robotti (Local Coordinator);
- Giovanni A. Pesce (Consorzio Imprenditori Edili – CIEPA);
- Roberto Zeppa (UNI.C.A.P.I. Società Cooperativa Edilizia);
- Bruno Paradiso (Consorzio Edilizio Unione – CEU);
- C. Levi (Carlo Levi Cooperativa Edilizia);
- Andrea Tomaselli (Heat & Power s.r.l.);
- Riccardo Sansebastiano (Director ATC Alessandria);
- Franco Osenga (President Building Association);
- Luigi Tosi (Consulta Edilizia);
- Other members of the building companies and of the local community, including SOFTECH, in charge of organising and facilitating the programme and fora.

The new energy performance regulations did affect very much the perception of the involved local authorities and builders on the energy issues, a fundamental premise for the Concerto uptake.
In addition, the regulation that imposes at least the 60% of energy demand for sanitary hot water must be satisfied by solar thermal systems, both in new building construction and in rehabilitation, had a stimulating effect in convincing the local authority, builders, stakeholders belonging to this Task Force to do more than the requested performance by law.
The new building settlement of Concerto AL Piano won a tender of the Ministry of Housing and Infrastructure and received basic financing for construction and infrastructure innovation to carry out its activities. This "new eco-village" is characterised by an extensive adoption of PV modules for dwellings and public buildings, use of rainwater for irrigation, reduction

Mara Scagni, Mayor of Alessandria

Bruxelles, Award for Sustainable Communities 2008

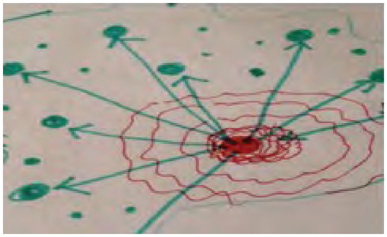
Piercarlo Fabbio, Mayor of Alessandria, and Roberto Pagani

of water flows, use of grey water, waste management, on site compost production and various other eco-settlement measures.
The settlement includes 104 dwellings, a number of services and an elderly housing (50 dwellings). High standards of eco-building insulation were applied together with a zero-fossil fuel strategy: The whole district operates with solar (PV and thermal) and co-generation. Other Concerto AL Piano measures include the eco-refurbishment of 300 existing social housing (around 12.000 m^2). These measures are flanked by activities for social and economic rehabilitation.
An additional wide spread energy retrofitting covers up to 48,000 m^2 of equivalent floor area of the district.

From one acupuncture to multiple eco-punctures

The “acupuncture” is a well known concept in urban planning. It provides the ground for the tactical action versus the strategical approach. When we started Concerto AL Piano it was very clear that our approach was not a strategical, but a tactical one: making a number of minimal acupunctures in the tissue of the urban grid to reverse, reconnect, and regenerate the area. Since the topic is the environmental regeneration of an urban area, we changed the expression acupuncture into eco-puncture that better symbolize the effort devoted to the environmental regeneration. We have learned that one eco-puncture is not enough to make the process visible and irreversible. Multiple eco-punctures were made, in various sectors and areas of the same districts to overcome the inertia and introduce innovation, in the existing social housing, in a new eco-village, in promoting and supporting energy retrofitting by private housing owners, in supporting the new cogeneration district heating, in taking-off the new elderly housing: many eco-punctures, many meaningful tactical steps to make the change happen.
Urban regeneration projects are, above all, long processes. These are slow enough to be, sometimes, counterproductive and to lose the original innovative outlook. Researchers have to fight againts the entropy of the trend, which is one of the most disruptive factor affecting the original ambitions and targets. An example in Concerto AL Piano consisted in the building energy efficiency performance. At the design stage, the selected levels were highly ambitious in comparison with the 2006 regulation levels. During the following years, stricter levels of energy consumption in buildings were in contradiction with the unchanged initial design requirements, and the lenght of the building process accentuated such discrepancy: projects get old, while regulations are progressing. Only a strong effort by project managers and coordinators was able to reset the initial targets, already reached by the improved regulation, to enlower energy consumption indexes, enlower U values, and to ameliorate the overall performances.
Three key recommendations can be proposed, based on lessons learnt:

- a scientific guide must support the local autority, or the public body, to strengthen the role and committment to targets;
- countinuous, simplified assessment of the process/project development at preliminary stages via basic tools, in addition to post-design evaluations and post-occupancy monitoring;
- social monitoring, in addition to environmental and energy monitoring, in order to reach a comprehensive assessment.


From one acupuncture to multiple eco-punctures

Implementing PLAN /
of Sustainable Urban Trasformations
by Roberto Pagani

a| METHOD
- Upgraded energy standards and renewable energies
- Effects on urban regeneration and environmental control

b| APPLICATION
- Retrofit Action
- Re-NewAction
- New Action

c| RESULT
- From single players to multiple stakeholders
- From strategic plans to tactical discontinuities

2

Implementing Plan /

a| METHOD



Concerto AL Piano, the design phase

The Urban Pilot Projects, as well as the European Integrated Projects (IP) put the focus on "sustainability" addressed on several levels: a new way, not exclusively technical, to deal with the inner multi-disciplinarity of projects. Urban Demonstration Projects, such as Concerto, are major tactical projects in the complexity of the city. The integrated management of these projects needs a huge team effort that should last up to ten years at very high intensity. The fertilization of experiences between local leaders, professionals, builders, industries, and not lastly citizens is a strong point of the integrated methodology that has been implemented in Concerto AL Piano. The planning goals of Concerto AL Piano can be summarised as follows:

- High reduction of fossil fuel consumption in existing renovated buildings;
- Integration of renewable energies at the urban village scale;
- District heating and co-generation as a network for the urban village;
- Local team to promote information campaign, energy conservation scheme;
- Municipal energy management and retrofit programme.

Upgraded energy standards and renewable energies

- Renovation of 299 residential dwellings that reaches up to 50% reduction of energy consumption;
- Energy conservation scheme for 3000 dwellings with announcements in local newspapers and letters addressed to the inhabitants;
- up to 20% of the audited buildings (48,000 m^2 of equivalent dwellings) to be retrofitted;
- 104 new dwellings adopting minimal space heating and SHW standards. In addition these dwellings make use of renewables to get a nearly zero energy balance;
- 200 m^2 of water solar collectors, integrated in the residential village for sanitary hot water needs;
- 50 kWp of photovoltaic systems for electric uses.

Effects on urban regeneration and environmental control

Concerto AL Piano has a strong effect on the urban regeneration of the whole district. Above others, it reduces the environmental impact through greening and absorption by green surfaces. The use of environmental friendly materials, the reduced fossil fuels consumption for space heating and sanitary hot water, the implementation of a large set of technologies and measures to save and reuse water, recycle waste, enlarge green surfaces and limit the speed of cars improve the micro-climate and environment.

CONCERTO AL PIANO AREA
The three main demonstration actions developed in Concerto AL Piano are:
a. RETROFIT _ *Energy Retrofitting at the district level*
b. RENEW _ *Energy Renovation of the existing village*
c. NEW _ *New Construction of a low-energy village*

b| APPLICATION

Retrofit Action

ACTION

Energy retrofitting at the district level to mobilise investments for energy conservation in conjunction with building renovation and maintenance Energy auditing on existing buildings Energy Retrofit on a subset of 20% of the audited building stock (9.600 m^2 over 48.000 m^2)

GOALS

- to upgrade the energy standards at the district level;
- to affect building rehabilitation and reconstruction;
- to facilitate the individual fitting of greenhouses when appropriately designed and integrated;
- to mobilise energy saving investments, in conjunction with building renovation;
- to facilitate the access to loans and funds for individual energy conservation projects.

IMPLEMENTATION

1. The "Planning Assistants' Team"

The Planning Assistants' Team was set-up in order to:

- Assess the potentiality of energy saving and comfort improvement on the district scale, by using energy checks, energy auditing and instrumental monitoring;
- Assist the implementation of energy technology measures at the district scale, by using appropriate tools and mechanisms of engagement with the local community: building sheets, potential energy savings, forecasted money savings, payback time;
- Implement the guidelines on the energy conservation policy, in conjunction with building

2. Energy Conservation Scheme for Concerto AL Piano

Dwellings [n]	Total area [m^2]	Reduction [%]
3000 equiv.	240.000	audit

rehabilitation and maintenance plan at the district level.

The energy conservation scheme aims at:

- Developing energy labelling and certification at the district level;
- Introducing individual energy consumption metering;
- Providing periodic emission control and check of building energy performances;
- Introducing new methods for financing and managing energy

3. Energy Rehabilitation Programme of ATC Village

Dwellings [n]	Total area [m^2]	Reduction vs actual [%]
150	12.000	48

conservation and substitution in the private and public housing stock.

The ATC (Social Housing Agency) Village needs urgent energy retrofit, due to the absence of thermal insulation and very degradated walls. The catalogue of measures is very extensive: external

4. Energy Retrofit Programme of diffused buildings

Dwellings [n]	Total area [m^2]	Reduction vs actual [%]
450 equiv.	36.000 equiv.	35

insulation, fixture replacements, replacement of burners and boilers are part of the guidelines for building recovery projects.

The Energy Retrofit Programme complements every future step of building renovation. The adoption of greenhouses in rehabilitated balconies and loggias affects the energy consumption, as well as the aesthetic of the district. Over the global retrofit investment, inhabitants are asked to contribute up to the 65% of their energy rehabilitation costs. This is organised through local community tenders that have increased the popularity and penetration of the Energy Retrofit Programme at the city level.

Re-NewAction

Energy renovation of 299 dwellings belonging to Alessandria Social Housing Agency .

GOALS

- to provide well-being conditions of existing dwellings and improve their energy standards;
- to equip the village with an integrated district heating network to represent an example of city innovation on a local scale;
- to promote the investment in the area by energy service companies, starting with the district heating and cogeneration system;
- to integrate energy supply and demand.

IMPLEMENTATION

1. Building Refurbishment

Dwellings [n]	Total area [m^2]	Reduction [%]
3000 equiv.	240.000	audit

A complete refurbishment of the 11 buildings belonging to the Social Housing Agency of Alessandria has been developed. This refurbishment includes:

- High levels of thermal insulation;
- Air tight windows (vent. control);
- Greenhouses and glazed balconies;
- Individual heat meters and thermostatic valves;
- District Heating Co-generation.

2. Greening the public space

An improvement of the external area is given by the green public square. The so-called “Green Square” is the new aggregation centre of the urban village and an important factor for its microclimatic control. The building outdoors are upgraded by introducing green measures and trees, creating a link between private and public green areas.

Parking boxes are improved by adopting fast growing plants, contributing both to aesthetic amelioration of outdoor climate.

3. Passive Facades

A visible refurbishment involves the building facades, which are retrofitted with external insulation (thermal coats). Existing windows are replaced with new double glass, low emission and high performance windows.

The south exposures of the 11 buildings are equipped with passive greenhouses to provide solar gains in winter, thus reducing energy consumptions for space heating.

New Action

Demonstration of a Low Carbon urban village:

- 104 new eco-dwellings built by private and public developers, based on low energy levels;
- 50 new eco-dwellings belonging to the Elderly House;
- District Energy Co-generation.

GOALS

- to represent a case-study, available as a testing facility, of a mix of energy conscious solutions at the district level;
- to demonstrate the economics of sustainable building technologies for developers;
- to reduce the use of fossil derived fuels through an extended application a complete set of energy conservation technologies: insulation, metering and control devices, greening, efficient lighting, CHP and district heating, solar thermal and photovoltaic;
- to design with regard to the life cycle of the building materials and components to minimise their environmental impact and maintenance costs.

1. **Micro-climatic buildings**

Dwellings [n]	Total area [m^2]	Reduction vs code [%]
104	8320	65

The micro-climatic buildings are based on the “atrium” solution: two building blocks are linked together by transparent technology to determine an intermediate climate in winter. In summer, the large openings at the ground level and upper level guarantee adequate shadow and natural ventilation.

The adopted solutions for the overall energy efficiency are:

- walls’ extra insulation with high thickness fibre paper
- air tight window frames and low emission glass
- passive greenhouses to be converted into balconies during summer
- district heating in cogeneration
- metering and control devices
- efficient lighting measures and appliances
- water flow restrictors and rain-water recovery
- garden and greening
- waste management

Photovoltaic modules are installed as flat roofing system of the microclimatic buildings and corner building to cover dwelling electricity needs: 50 kW provide the peak power for electricity use.

Solar water collectors cover sanitary water heating of the NEW Eco-Village dwellings. The 200 m^2 of collectors are hosted on the flat roofs of the new buildings.

2. Social-Elderly Buildings

Dwellings [n]	Total area [m^2]	Reduction vs code [%]
50	3750	46

The Elderly Housing is a 4 floors building, south oriented, with access on the main road. The building design gives privilege to a balance between indoors and outdoors adopting innovative residential solutions for aged people.
The space heating consumption of the new social-elderly-building provides a 45% reduction compared to the Italian code.

3. District Energy Generation

A newly built District Heating Network provides the heating and electricity in co-generation. One of the demonstration issues consists of showing the inhabitants how a central power/heating station could appropriately fit in a populated residential district.
A continuous power co-generator (250 kWe), running all the year long, is dedicated to the production of the base load heat and power demand.
Heat is produced by an exhaust-water heat exchanger, at a temperature of 85 C°, and delivered to the district heating pipeline. Power is delivered in parallel with the grid. The overall efficiency of the co-generator is above 70%.
A natural gas burner (1.250 kWt), running in winter, matches the specific heat demand of the cold season. A plant remote control system, running on a dedicated PLC, drives the co-generator to adapt its power output following the pipeline heat demand, granting the highest possible efficiency.
A remote control room gets each day the production data, with 15 minutes scansion, as well as any eventual out of order signal.

c| RESULT

From single players to multiple stakeholders

The need of a strong urban partnership is a well known concept in urban projects and it is a basic condition of all Concerto projects, from which the name itself originates. In Concerto AL Piano every step of the process has been a concertated step, from the very first ideas and applications to the very last reformulations and amendements. Concerto AL Piano has improved the process of urban revitalisation by involving the local community. The participation of stakeholders and citizens in planning and decision making has provided a longer lasting solution to urban problems. Innovative methods were used to address economic, environmental and social issues, while bringing in the local community.

From the very beginning, Concerto AL Piano aimed at providing the public decision makers, the developers, the professionals and citizens with a “Sustainable Urban Project” for Alessandria. A Scenario Workshop has been the basis for the selection of the regeneration topics, the technological solutions, and the urban action plan. The Scenario Workshop involved 40 among the city officers, professionals, builders, citizens’ representatives. It took place on a full day devoted to facilitate the discussion and selection of actions, within a number of possible futures for the Concerto district. Compared to more conventional methods, this Scenario Workshop allowed to identify and discuss the similarities and differences in the perception of problems and their possible solutions between the different role groups involved. It helped generating new ideas and guidelines for action and regeneration initiatives to be undertaken in the short and medium term. Based on the results of the Scenario Workshop, the urban proposal was shaped and the further steps were planned. We could retorically state that a perfect match was reached between public and private - the so called PPP - but our independent role gives us the opportunity to focus on the lessons learnt and on what was wrong, more than on what was right. A key lesson we have learnt suggests to make this public- private partnership flexible enough to make easy changes in the private coalition when problems occur (and they will occur) by easy decisions of the leading public body.

To exemplify, most of construction delays of Concerto AL Piano, due to the rising economic crisis, were essentially caused by the late engagement of the Alessandria private builders, concerned to start works without solid market guarantees on selling apartments once built. As a consequence, the urban demonstration was twofold: the public (city and social housing agency) completed its construction and rehabilitation works much earlier than the private development remained uncompleted for years, giving to the whole site and inhabitants a long and persistent low liveability. This could have been avoided through a more flexible engagement and substitution within the partnership, allowing internal bids and easy replacement of builders, that could take the place of those escaping risks.

Based on lessons learnt, three key recommendations can be proposed:

- the public-private partnership is essential;
- the public must lead;
- flexibility must be incorporated in consortium agreements and immediately implemented when problems occur.

From strategic plans to tactical discontinuities

A relevant step of Concerto AL Piano was its scaling-up from a limited, although visible, demonstration project (tactical) to a wide-spread strategic plan, the so called Sustainable Energy Action Plan (SEAP), initiated by the City of Alessandria few years after the project start. The SEAP initiative directly involves City Mayors, who commit to go beyond the EU target of reducing CO2 emissions of more than 20% by 2020. The initiative is having a considerable success all over Europe, but particularly in Italy, with more than 3000 signatory cities (about 52% of the total participants in Europe). In order to respect the commitments of the covenant and adopt an effective plan, the creation a Local Team was crucial. This team was able not only to involve all stakeholders in the SEAP, but also to integrate previous experiences, best practices, and on-going demonstration projects in the field of sustainable urban regeneration.

Here, the role of Concerto AL Piano was crucial. The involvement of Alessandria, who signed the Covenant among the first cities in Europe, started from the network of stakeholders shaped by Concerto AL Piano. The application of urban renovation methods, the collaborative design approach, the workshops based on scenarios from the building to neighborhood up to the city scale, were the essential methodologies for the SEAP elaboration. The research team of Politecnico di Torino supported the city of Alessandria in the integration between the european demonstrative project Concerto AL Piano and the adoption of the SEAP.

Three key recommendations can be formulated based on lessons learnt:

- tactical discontinuities are essential breakthroughs in the more-of-the-same urban experiences;
- scaling-up: move from local demonstration projects to strategic plans on a city scale;
- keeping the momentum of strategic plans, such SEAPs, in accordance with local demonstration projects, requires an extraordinary, rarely reached effort and commitment by all stakeholders.

Concerto AL Piano, General Meeting in March 2011, visit to the project area

Benchmarking PROJECT /

Products of Sustainable Urban Trasformations

by Eduardo de Oliveira Fernandes, Corrado Carbonaro

a| METHOD
- Introduction to Benchmarking
(By Eduardo de Oliveira Fernandes)
- Benchmarking method

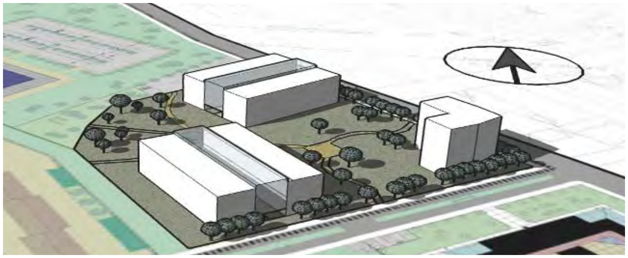
b| APPLICATION
- District level
- Building level: C.E.R. Method

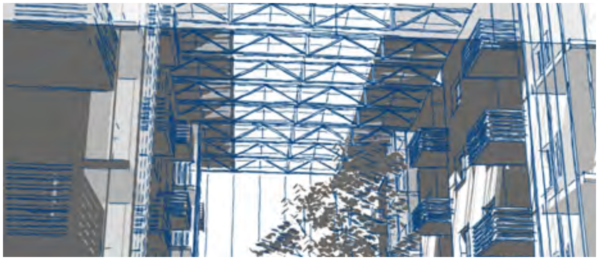
c| RESULT
- District level: results of settlement ecological footprint
- Building level: result of C.E.R. method

3

Benchmarking Project /

a| METHOD





Introduction to Benchmarking
(By Eduardo de Oliveira Fernandes)

Benchmarking is a basilar and essential approach to assessing quality and progress of complex operations. A permanent and sustained effort in such direction is always absolutely necessary when innovative emprises are promoted. That is the case of Concerto where innovation is brought into the city involving the buildings as energy systems themselves and the built environment in its duality: external, playing with the Sun and the space in general; and internal, creating comfortable and healthy spaces with reduced needs for exotic energies. And that for two reasons: to access the final result and to support the diffusion of its results.

Yet, in Concerto as in other similar EC sponsored activities, there is always a wide spectrum of circumstances, by its innovative specific character and by the novelty for society, that influence project actions in terms of the timing and timespan considered and or available for assessment. And in terms of changes of whatever nature, which temper the reporting, they require value judgments and introduce intangibles that make the undertaken actions eloquent in terms of novelty or scope but do not allow for a true assessment, much less benchmarking

Such considerations therefore do not refer specifically to this project but, instead, encapsulate the reflections entertained by some of us involved in Concerto – Alessandria who have been following EC projects for DG Research and DG Energy since the early 80s as applicants, experts and evaluators at the highest level and who, while contemplating some of the difficulties involved in this project, intend to open up the discussion of extended or alternative ways of assessment, not only strictly technical but also institutional and societal.

The considerations above are not intended as an apology for any perceived less successful accomplishments or shortcomings of this CONCERTO project, not at all. Instead intend to underline the risk that so varied circumstances of organizational, societal and political nature can trigger. The experience gained through this project, with its difficulties, - some that could have been expected and others totally unexpected - was indeed very enriching. There were very salient moments and relevant results accomplished within this project.

This, even, if some explicit results in terms of energy savings and correlated results, that could be reported, may not be as substantial as foreseen and promised.
This ambition put on this Concerto project might have been too high.
The experience from the past of the leaders involved might have provided the guarantee for what was proposed.
And the fact is this report transmits an outstanding image of what the team did and could have done, proud of its challenges and enthusiastic about the anticipated results and their impact for that local society, a small Italian city that already had some previous remarkable experiences on the urban social and security impact from a previous energy project on photovoltaics supported by the Italian government, which totally changed the social and urban character of a critical district making of it a visiting room for the city of Alessandria.

Benchmarking method

OBJECTIVES

- Placing Concerto AL Piano experience in a broader context overcoming the local, cultural and other specific characteristics to express its relevance in general or global terms;
- contributing to the identification and use of performance based indicators for the urban sustainability at the design and operation level;
- establishing a set of criteria and targets that allow the quality assessment in terms of environment, energy use, and quality of the indoor environment.

SUSTAINABILITY: SITE FOOTPRINT ASSESSMENT

Concerto AL Piano has developed an ecological footprint assessment on which the planning guidelines are drawn. The site footprint is based on a methodology, easy to work out and widely replicable. It estimates the level of performance for eight different indicators: energy, mobility, air, water, waste, soil, materials, bio-diversity. These indicators are classified into three different levels: current practice, good practice, exemplar practice.

BUILDING ENVIRONMENTAL ASSESSMENT

A dedicated assessment methodology has been applied for benchmarking the environmental quality of buildings, based on a list of relevant indicators, such as: design quality, dwelling flexibility, indoor comfort, environmental impact, health, and eco-friendly materials.

TECHNOLOGY CATALOGUE: CONCERTO AL PIANO ECO-TECHNOLOGIES

Concerto AL Piano includes significant number eco-technologies. The following factors have been considered and documented:

- predicted impact of technology with respect to energy use;
- level of innovation compared with current practice;
- replication potential.

Concerto AL Piano, kick-off meeting on July 2-3, 2008.

b| APPLICATION

District level

In order to be successful the transformation of a complex urban area must necessarily examine the original condition of a site and simulate the effects of the new intervention. Understanding the strengths and weaknesses of a comprehensive project is essential for dealing with the complexity of urban transformation that hosts a number of functions on the urban, district and building scale, closely related to each other. There are several methods for analysing the environmental impacts on a district and building scale. These methods evaluates the quality of a project, in relation with energy and environmental sustainability or with usability, health and comfort of indoor and outdoor environments.
The quality of a project must also be assessed in relation to the available resources , to the level of site upgrading, and to the opportunities developend. ,Scoring methods may not fully grasp the complexity of an urban transformation process, but, through their indicators, they can at least provide evidence of the impact of changes.

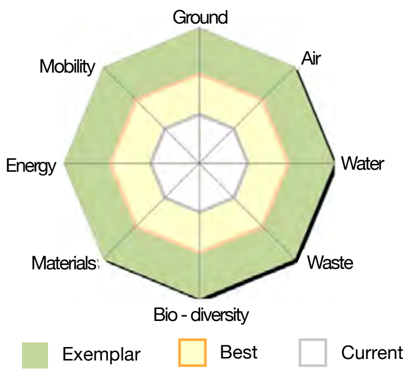
By means of an iterative process, these tools allow to progressively improve the result of each assessment issue (sustanaibility, healt, accessibility etc.). The Doggart-Pagani method on a district scale, and the CER method at building level were then adopted for Concerto AL Piano environmental quality assessments

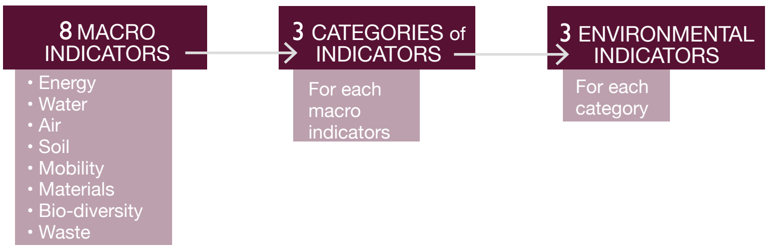
The method representing the sustainability indicators is known as “ecological settlement footprint”. It was developed in the framework of RESTART Project and subsequently applied for the design of the Olympic Village of Turin 2006 (J. Doggart, R. Pagani 2002). The system is based on a qualitative assessment of the energy, environmental sustainability. This method tests the potential of the plan, based on the impact on the environment. This allows designers to apply any design strategy regardless of the type of technology or building system. It allows to shape the design through highly experimental features, normally not provided by the current evaluation systems. It is a representation method based on a radial diagram organized into eight concentric axes and three levels, respectively:

- a level of current practice (inner circle);
- a level of good practice (middle circle);
- a level of exemplary practice (outer circle);

The values of the indicators are placed on different axes in relation to the

Ecological Footprint of area





assessments worked out through a specific project “checklist”.

1. GROUND

Preserving the permeability of the soil by draining surface water, whose flow is due to landslides of road surfaces, cracks in building structures and risks to the environment and safety

Contaminants / Protection

- Checking the phenomena of soil contamination through monitoring;
- Building in areas previously built or occupied;
- Protecting land by residual gases leaks (ex. radon).

Drainage / Protection

- Minimizing paved surfaces and design public areas surfaces to allow water penetration;
- Building in areas previously built or occupied.

Residues / Protection

- Participating in the management plan of the soil, with the guarantee that every cubic meter of earth excavated is deposited in a predetermined site;
- Re-usig in site the excavated soil for works completion;
- Equipping buildings with appropriate protections to prevent the penetration of gas (radon) from the ground to the underground rooms and basement.

2. AIR

To ensure good indoor air quality by controlling the spread of outdoor and indoor pollutants.

		Current	Best	Exemplar	Score
I. GROUND	0	0,33	0,66	1	0,77
I.1 Pollutant	0	0	1	0	
Absence of soil contamination detected by monitoring					
Alleged absence of phenomena of soil contamination					
Presence of soil pollution phenomena with medium or severe level					
I.2 Drainage	0	0	1	0	
Absence of paved surfaces and consequent maximum water drainage					
Limited presence of paved surfaces with reduced surface water drainage					
Prevalence of paved surfaces with poor drainage water					
I.3 Residue	0	0	1	0	
No leakage of residual gases from the soil detected by monitoring					
Alleged absence of residual gases leakage from the soil					
Leakage of residual gases from the soil with potential diffusion to built environments					

		Current	Best	Exemplar	Score
2 AIR	0	0,33	0,66	1	0,77
2.1 Local emissions	0	0	0	1	
Absence of localized gases emissions and pollutants detected by monitoring					
Alleged absence of localized gases emissions and pollutants					
Presence of of localized gases emissions and pollutants with medium or severe level					
2.2 Air currents and local wind	0	0	1	0	
Absence of local phenomena of wind and air currentss accelerated by the conformation of the urban fabric					
Alleged absence of local phenomena of wind and air currents accelerated by the conformation of the urban fabric					
Presence of local phenomena of wind and air movement accelerated by the conformation of the urban fabric with medium or high severity					
2.3 Monitoring of pollutants	0	0	0	1	
Presence of monitoring stations of gases and pollutants in the examined area					
Presence of monitoring stations of gases and pollutants in the urban neighbouring area (within 5 km)					
Absence of monitoring gases and pollutants emissions					

Emissions / Protection

- Controlling pollutant sources by minimizing pollutants' emission inside buildings;
- Reducing the level of air pollutants through vegetable adsorption.

Air movement / control design

- Controlling air flows, through a careful design of the openings, to dilute the indoor pollutants and to induce a natural summer cooling.

Pollutants / monitoring

- Monitoring air quality and energy consumption during the construction phase.

3. WATER

Controlling water pollution and reduce water consumption with appropriate technologies

Water distribution / Separation

- To design in an integrated systems of drinking water supply, its distribution, collection, storage, drainage and disposal of rain water;
- Protecting drinking water pipes from contamination by bacteria or chemical products of soil;

Rainwater / Recovery

- Protecting the storage of rainwater with suitable coating systems, to avoid algae due to exposure to solar radiation, and to prevent the penetration of animals that can contaminate water;
- Recovering rainwater for irrigation and for non drinking exploitation.

Controlled waters / monitoring

		Current	Best	Exemplar	Score
3 WATER	0	0,33	0,66	1	0,77
3.1 Water network systems	0	0	0	1	
Presence of integrated supply, distribution, collection and storage, drainage and water disposal in the examined area					
Presence of pipelines for the supply, distribution and disposal of water in the examined area					
Absence of systems of supply, distribution, collection of water					
3.2 Rainwater	0	0	1	0	
Presence of rainwater drainage systems to natural channels and reservoirs					
Natural drainage of the area with sufficient drainage of rainwater					
Poor natural drainage and absence of conveyor systems and ductwork, with medium-high risk of surface accumulation of rainwater					
3.3 Controlled water	0	1	0	0	
Presence of stations for monitoring the quality of surface water and / or groundwater in the area					
Presence of stations for monitoring the quality of groundwater in the urban neighbouring area (within 5 miles)					
Absence of station for monitoring qualioty of groundwater and/ or surface water					

		Current	Best	Exemplar	Score
4 WASTE	0	0,33	0,66	1	0,77
4.1 Local waste	0	0	1	0	
Absence of whatever waste in local area					
Minimum presence of non-hazardous waste, hidden in containers or in a small storages					
Presence of not-hazardous waste, not stored					
4.2 Waste managing	0	0	0	1	
Organized presence of pre-selection and separate collection of the different types of waste in the area					
Absence of waste on the site					
Absence of organized waste collection, even in the presence of various types of waste in the area					
4.3 Hazardous waste	0	0	1	0	
Absence of hazardous waste in the area in question verified by monitoring systems or campaign					
Alleged absence of hazardous waste in the area					
Presence of hazardous wastes with different levels of risk					

- Adopting technologies for the reduction of water flows from toilets, showers and other devices;
- Adopting accounting systems of water consumption per unit.

4. WASTE

Minimizing the production of waste and recycling it as much as possible. Disposal of not recyclable waste through appropriate technologies in a protected environment.

Local non-hazardous waste / Reuse

- Shortening the disposal cycle, locally re-using a share of organic waste;
- Providing mini-systems for the local production of compost as fertilizer for green areas.

Waste managed / Collection

- Providing appropriate technical and organizational tools for pre-selection and separate collection of different types of waste;
- Developing the interface between local collection processes and commonly adopted waste treatments, providing improvements and process innovations.

Hazardous / Inerting

- Transforming into inerted waste all residuals not otherwise disposed;
- Demonstrating that the soil excavation will be reused on site as part of the works completion.

5. BIO-DIVERSITY

Ensure green areas and high quality public spaces even in areas not traditionally green.

Vegetation / Variety

- Ensuring full integration of green areas with the prevailing vegetation system, introducing a variety of native plant species;
- Appropriate relationship between deciduous vegetation and leafy perennial vegetation;
- Appropriate mix of tall trees and low-lying vegetation.

Outdoor spaces / microclimate

- Reducing the outdoor overheating and air pollution during summer, due to re-radiation of surfaces of inert materials (asphalt, concrete, etc.) of parking lots and roofs, by vegetal absorption.
- Facilitating air movements to induce a natural cooling in summer, taking account of pressure differences in outdoor environment;

Preservation / Plan

- Transferring the residual waste not otherwise disposed to an inert transformation.

6. MATERIALS

The aim is to minimize energy consumption and environmental impact by using building materials that are recyclable and/or recycled, low emission of harmful substances to human health, easy to maintain and with long service life.

Usability / Demolition

- Using building materials from building demolition in the area;

		Current	Best	Exemplar	Score
5. BIO-DIVERSITY	0	0,33	0,66	1	0,77
5.1 Vegetable essences	0	0	1	0	
Presence of native plant to form green barriers and absorb pollutants					
Moderate presence of native plant to form green barriers and absorb pollutants			■		
Absence of native plant of medium sized and tall tree or with a poor diffusion in the area					
5.2 Outdoor spaces	0	0	0	1	
Outdoor areas with presence of considerable variety of plant species, to qualify the landscape				■	
Outdoor spaces with moderate presence of plants, but limited variety of species					
Outdoor spaces with poor or absence of plant					
5.3 Environmental conservation	0	0	1	0	
Absence of actions whit strong environmental impact					
Minimum presence of actions whit moderate environmental impact			■		
Actions with medium and strong environment impact					

- Reusing the existing built volumes limiting the construction of new volumes;
- Utilizing building materials from local construction and waste management
- Giving preference to materials with low energy content.

Atoxicity

- Avoid the use of products containing substances whose non-toxicity is not certified;
- Avoid using materials not resistant to abrasive actions or to washout as a coating of surfaces exposed to the human mechanical action or natural elements.

Availability / Recycling

- Using materials and components, easy to maintain, or to recycle in new products or components;
- Using secondary materials, whose eventual disposal avoids environmental risks.

7. ENERGY

To minimize the consumption of fossil fuels by using renewable energy sources, ensuring a high quality standard

CO_2 emissions / Reduction

- Reducing the consumption of fossil fuels for space heating, with a consequent reduction in CO_2 emissions and other pollutants and / or harmful substances in the environment, by limiting heat loss and/or introducing renewable energies

		Current	Best	Exemplar	Score
6. MATERIALS	0	0,33	0,66	1	0,77
6.1 Re-use of building materials	0	0	0	1	
Use of materials from excavation and demolition of any buildings in the area					
Use of materials from excavation in the area					
Not use of materials from excavation and demolition in the area					
6.2 Harmfulness	0	0	0	1	
Innocuousness of the materials present in the site verified by environmental monitoring					
Presumed innocuousness of the materials present on the site					
Alleged harmfulness of the materials and products on the site					
6.3 Natural materials	0	1	0	0	
Site without infrastructures with the presence of only natural materials					
Site with minimal infrastructure with traces of artifacts or secondary materials					
Presence of high quantities of secondary materials and products for medium / high density of infrastructure in the area					

		Current	Best	Exemplar	Score
7. ENERGY	0	0,33	0,66	1	0,77
7.1 CO_2 emissions	0	0	1	0	
Absence of CO2 emissions verified by monitoring actions					
Alleged absence of CO2 emissions due by lack of generations sources					
Presence of CO2 emissions and other pollutants with medium or strong impact					
7.2 Renewable energy	0	0	0	1	
High potential for renewable resources exploitable: eg. sun, biomass, water, wind					
Moderated potential for renewable resources exploitation					
Low potential for renewable sources exploitation					
7.3 Energy network	0	0	0	1	
Presence of a complete network of energy supply as well as infrastructure in the area (electricity, gas, water, district heating, disposal)					
Incomplete presence of a network of energy supply and a network of infrastruture					
Absence of a network of energy supply as well as infrastructure					

Renewable Energy / Integration

- Introducing passive solar energy systems;
- Integrating renewable energy technologies in architectural features to improve the indoor well-being and ensure energy differentiation

Conservation / Minimal impact

- Evaluating energy needs with LCA methods (Life Cycle Analysis);
- Reducing power consumption at the district level.

8. MOBILITY

To design easily accessible and affordable settlements, with efficient transport networks and urban cycling lanes, thus limiting the pollutant emissions.

Infrastructure / Integrated Project

- Providing an integrated design of private and public transportation;
- Minimizing parking areas, adopting a set of alternative measures, and providing the realisation of underground parking

Accessibility / Links

- Providing protected links between walking and cycling lanes inside and outside the area, with easy access to public transport networks.

Noise / Control

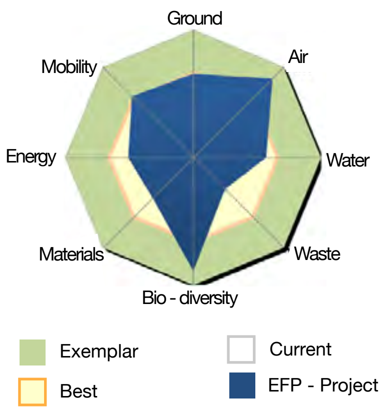
- Developing traffic noise control measures.

ECOLOGICAL FOOTPRINT DIAGRAM

The ecological footprint of the settlement is obtained by drawing a closed polygonal chain with vertex placed on the axes of the indicators. The representation has a shape of the below radial diagram.. The variation between 0 and 1 of radial diagram' axes indicates the ecological quality. The environmental sustainability of a site can be substantiate by a larger presence of results / points in the green belt of the diagram, corresponding to numeric values greater than 0.75. As a practical consequence, the best ecological footprint corresponds to the largest surface area of the polygon.

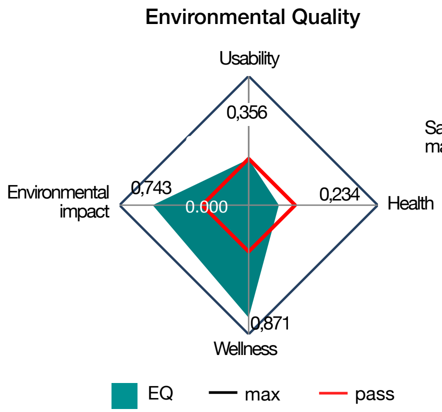
		Current	Best	Exemplar	Score
8. MOBILITY	0	0,33	0,66	1	0,77
8.1 Infrastructure	0	0	1	0	
Presence of an autonomous and integrated system of public and private transport in the area, with effective equipment for all types of transport					
Presence of an infrastructure for the public and private transport in the area, with equipment effective for the main typologies of transport			■		
Absence of an integrated system of public and private transport in the area, lack of infrastructure for the main types of transport					
8.2 Accessibility	0	0	0	1	
Excellent road system accessibility to the area with continous connections between internal and external system routes and with easy access to public transport				■	
Good road system accessibility to the area with easy access to public transport network (distances less than 500 m)					
Absent or poor road system accessibility to the area with lack of access to the public transport network (distances greater than 500 m)					
8.3 Noise	0	0	1	0	
Absence of traffic noise due by sound proofing made from curtains plant, despite the proximity of road infrastructures					
Absence of traffic noise due by the distance of road infrastructures			■		
Presence of noise with medium or high intensity due by the local or neighbouring circulation of traffic					

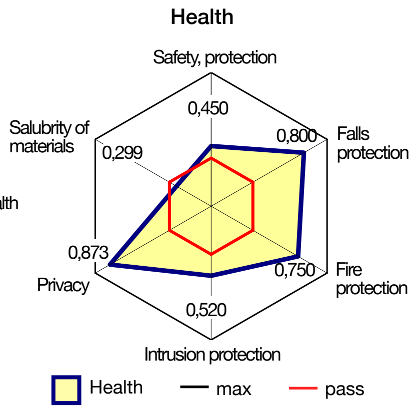
Ecological Footprint of Project



Building level: C.E.R. Method
(Residential Housing Committee)

The evaluation method CER (Housing Committee) is a voluntary instrument for measuring the environmental and architectural quality of building projects. The CER method, established in 1993 by Softech and published by the Italian Ministry of Public Works, was applied during the 2006 Winter Olympics held in Turin, for the environmental assessment of the Olympic Village, made by SOFTECH Total Environmental Action
The CER method analyzes four key categories of a building project: flexibility, health, comfort and environmental impact. The scope of this method consists of evaluating the quality achieved by the project, identifying strengths and weaknesses of each key factors. These are evaluated by assigning a score to each sub indicator, representing the degree of satisfaction of the specific design requirement. The method is applicable to housing, commercial and tertiary buildings. It is generally applied to one or more selected dwellings in a building. The analytical process returns the final results through a radial diagram applicable to any context.
One dwelling belonging to RENEW (ATC social housing), and one belonging to the NEW Eco-Village (Micro-climatic Building) were analysed, The procedure consists of the analytical check each





design requirement. The fulfilment of each of them allows to achieve a cumulative score that leads to the final assessment, established for each category of analysis.
The four categories are separately analysed, all having the same importance in the evaluation, without filtering through any weighing system. In fact, the fulfilment of each indicator is based on the key concept consist on “satisfaction / not satisfaction” without recurring to subjectively interpreted weights. Each criterium is composed of a series of requirements to be matched, each of which is assigned a score ranging from 0 to 1, depending on the degree of satisfaction. Indicatively, judgments assigned to each indicator can be classified according to the degree of satisfaction proposed:

- Insufficient - (score less than 0,36);
- Sufficient - (score between 0,36-0,48);
- Good - (score between 0,48-0,60);
- Very Good - (score between 0,60-0,80);
- Excellent - (score between 0,80-1,0).

The scores are represented by a radial graph of each category. The assessment allows to identify which parameters are lacking and in which others are well designed in the building.
The representation of the results is through the graphical method of radial diagram second four aces and three concentric levels, expressing respectively:

- level of normal practice (inner polygon);
- level of the test (current buiding);
- level of exemplary practice (outer polygon).

The value of each parameter is

distributed in the respective axes, based on the evaluations made through a dedicated check-list. Drawing a broken line, which combines the points on the axes, the profile of the environmental quality of the building is obtained.
As stated above, the four categories of analysis can be shortly described as follows:

BUILDING USABILITY
(29 design requirements)

- The usability is the set of conditions relating to the attitude of the building system to be properly used by tenants, in carrying out activities. This design factor is further subdivided into:
- SIZING - Relates the internal distribution,, the provision of auxiliary rooms.
- EASYNESS TO FURNISH - It is the possibility of multiple and adequate furnishing solutions.
- MAINTAINABILITY - concerns the possibility of non-invasive maintenance of the installations, and clean-ability.
- ACCESSIBILITY - sizing suitable for disabled access.
- FLEXIBILITY - concerns the ease of transformation of the interior and exterior spaces.

HEALTH (22 design requirements)
The building health parameter is referred to the presence, in the dwelling, of design of protections for the safety and privacy of occupants.

- PROTECTION SAFETY - concerns the protection of the user from fortuitous events in kitchens and electrical equipments.
- PROTECTION FALLS - taking safeguards with regard to accidental falls.
- FIRE PROTECTION - adopting preventive measures against possible fires, in particular in bathrooms and kitchens, and electrical and gas equipments.
- INTRUSION PROTECTION - adopting security measures against intrusions from outside.
- PRIVACY - adopting appropriate design features to limit introspection from outside.
- SALUBRITY - promoting the use of recycled, not harmful or certified materials.

COMFORT
(23 design requirements)
All conditions related to the building system to be properly used by users in carrying out activities.

- NATURAL LIGHTING - control average daylight factor.
- ARTIFICIAL LIGHTING - average space luminance control.
- AIR CONDITIONING - control of internal air temperature, mean radiant temperature, operating temperature and surface temperature of interiors.
- THERMOHYGROMETRY - dew-point temperature assessment, thermal inertia factor, and relative humidity.
- AIR VENTILATION - monitoring air exchanges and on indoor air quality.

ENVIRONMENTAL IMPACT
(87 design requirements)
All conditions related to maintenance and improvement of the equipment and building systems.

- ENERGY - measures taken to achieve good energy performances, use of renewable energy, eco-labelled appliances and equipments.
- MOBILITY - measures to promote public transport or biking, and reducing home-office commuting.
- POLLUTION - measures to reduce air pollution.
- MATERIALS - measures to promote the use of certified wood, recyclable and low environmental impact materials.
- WATER - measures to encourage reducing water consumption and using native floral species compatible with the climate.
- SOIL -measures to reduce the ecological footprint of buildings, thus increasing the ecological value of the site.

c| RESULT

District level: results of settlement ecological footprint

This method tests the design quality, based on its global impact on the environment.
The evaluation takes place by comparing the environmental impact of the area in its current state and once the intervention is completed. Eight macro-indicators are analysed: soil, air, water, waste, bio-diversity, materials, energy, mobility.
The macro-indicators assessment is derived from three sub-indicators related to possible conditions of the area.

The three sub-indicators are formulated to represent different degrees of fulfilment of the environmental requirements. Each category of indicators has different degrees of requirement satisfaction:

- requirement satisfied, to which the maximum score is assigned (1 point);
- requirement partially satisfied, corresponding to a score of 0.66;
- requirement not satisfied, to which a score from 0 to 0.33 is assigned.

The method allows an in-depth analysis of the site, establishing,ì for each indicator one of the three listed conditions and bring results in a table and radial diagram.

The area identified by this diagram is the carbon footprint of project.
The same procedure performed both before and after the intervention produces two comparable diagrams, that identify strengths and weaknesses of the project.

CONCERTO AL PIANO SITE FOOTPRINT: BEFORE



The analysis before developing Concerto AL Piano shows a typical level of urban suburbs built in the '70s of the last century. The results of each indicator category can be summarise as follows:

1. GROUND
soil looks not compromised by pollution sources, but since most of the existing settlement is not permeable the score of this parameter remains at the "current practice" level.

2. AIR
The final score of "Air" is slightly higher than the current practice for the following reasons: the district is affected by a limited vehicular traffic, with low pollution sources; the monitoring station for dust and contaminants control is 5 km far from the settlement.

3. WATER
The final score of "Water" before district renovation is slightly higher than the current practice. The new infrastructure collects rainwater and reuses it for irrigation purposes, but it does not provide for recovery or recycling systems.

4. WASTE
The final score of "Waste" before implementing Concerto AL Piano project was not high, due to a not organised waste management, without differentiated collection. This happened during Concerto AL Piano and better results are achieved. However, systems for composting and use of organic compost are not incorporated

5. BIO-DIVERSITY
The district is heavily urbanized, with small green areas. There are only tree lines of medium height in small green spaces of the courtyards of RENEW buildings.. Green space of the NEW Eco-Village consists of wild meadow waiting for the growing of new trees

6. MATERIALS
The area was built for its majority during the '70ies, while not presenting critical issues in terms of harmful materials, does not reach adequate levels in terms of eco-compatibility of materials.

7. ENERGY
The starting level of the "Energy" indicator is very low. Low efficient building technologies, production facilities with non-renewable sources, the absence of a district heating network and production from renewables, show a situation to be greatly improved.

Concerto AL Piano is an integrated project that mainly operates on three directions:

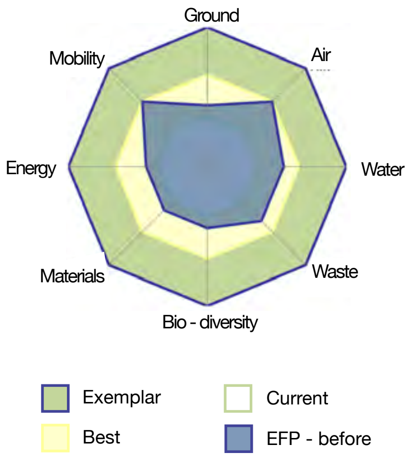
- the architectural and energy renovation of RENEW settlements (ATC via Gandolfi), reducing the energy consumption by 40% as a target;
- the completion of voids of the existing urban fabric with new residential buildings, with new infrastructures for local energy production from renewables (solar thermal, solar PV, and district heating with co-generation)
- the improvement of local mobility and the arrangement of green areas.

The analysis highlights the implementation of the energy and environmental solutions worked out by Concerto AL Piano.

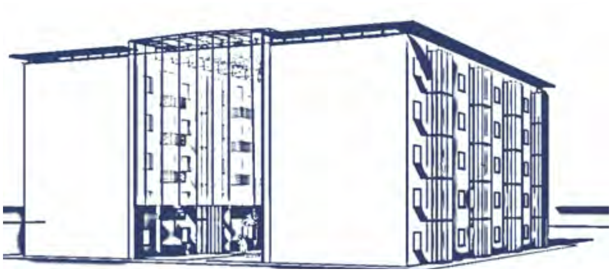
Site Footprint: before

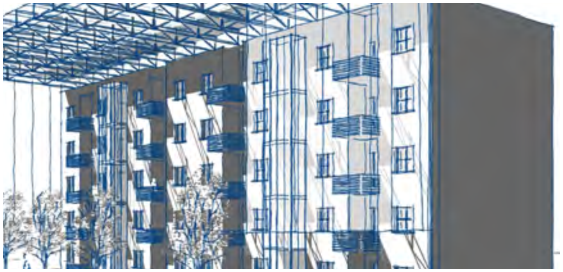
1. GROUND	**0**	**0,33**	**0,66**	**1**	**0,44**
1.1 Polluttrant			■		
1.2 Drarinage		■			
1.3 Residue			■		
2. AIR	**0**	**0,33**	**0,66**	**1**	**0,66**
2.1 Local emissions			■		
2.2 Air currents and local wind			■		
2.3 Controlo inquinanti			■		
3. WATER	**0**	**0,33**	**0,66**	**1**	**0,55**
3.1 Water network systems			■		
3.2 Rainwater			■		
3.3 Controlled water		■			
4. WASTE	**0**	**0,33**	**0,66**	**1**	**0,55**
4.1 Local waste		■	■		
4.2 Waste managing		■			
4.3 Hazardous waste		■	■		
5. BIO-DIVERSITY	**0**	**0,33**	**0,66**	**1**	**0,44**
5.1 Vegetable essences			■		
5.2 Outdoor spaces			■		
5.3 Environmental conservation		■			
6. MATERIALS	**0**	**0,33**	**0,66**	**1**	**0,44**
6.1 Building material re-use			■		
6.2 Harmfulness		■			
6.3 Natural materials		■			
7. ENERGY	**0**	**0,33**	**0,66**	**1**	**0,44**
7.1 CO_2 emissions			■		
7.2 Renewable energy	■				
7.3 Energy network			■		
8. MOBILITY	**0**	**0,33**	**0,66**	**1**	**0,66**
8.1 Infrastructure			■		
8.2 Accessibility			■		
8.3 Noise			■		

Ecological Footprint: Concerto AL Piano Project



CONCERTO AL PIANO SITE FOOTPRINT: AFTER



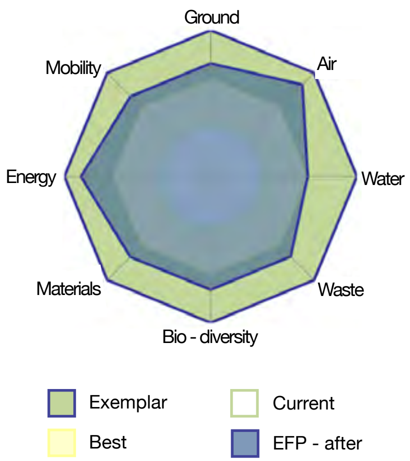


1. GROUND
It was considered necessary, where possible, to increase permeable areas, minimizing paved surfaces in new construction lots. The hydrogeological analysis performed on the New Eco Village and the New Social Elderly areas confirmed the absence of pollutants in the soil.
2. AIR
The air quality in the design phase was greatly enhanced by the measures to reduce energy consumption and by the local energy production from renewable sources and district heating.
3. WATER
The final score for “Water” is beyond the common practice. The attention paid to the recovery of rainwater improved the score with respect to the current state.
4. WASTE
The choice of the municipality to adopt the selective collection of waste, in specific ecological areas, has led to a substantial improvement of the area.
5. BIO-DIVERSITY
While providing for the transformation of unused green areas in built-up areas, an effort in improving landscape design has been made. In particular, in the area of the new eco-village, a garden with trees has been planned. Micro-climatic atria are provided with “winter gardens” to regulate temperature and humidity. In addition, along the properties borders medium size trees have been planted
6. MATERIALS
The attention to ecological materials has been carried out both on RENEW, and NEW Eco-village: materials based on wood cellulose and wood fiber were used as insulation and as wall components. All excavated material of the new settlements were reused on site.
7. ENERGY
The final score for “Energy” is very good. The district heating network powered by a cogeneration plant increases the overall efficiency of the urban district. In addition, the adoption of photovoltaic and solar thermal contributes to lowering the conventional fuel utilisation (gas). The good level of insulation in all building constructions helps to significantly improve the sustainability of the area.
8. MOBILITY
“Mobility” has particularly improved based on the extension and new connection of Via Gandolfi (previously dead-end blocked street), the upgrading of public transport systems in the district in order to transform the whole area into a slow traffic zone.

Site Footprint: after

1. GROUND	0	0,33	0,66	1	0,77
1.1 Polluttrant			■		
1.2 Drarinage			■		
1.3 Residue			■		
2. AIR	0	0,33	0,66	1	0,89
2.1 Local emissions				■	
2.2 Air currents and local wind			■		
2.3 Controlo inquinanti				■	
3. WATER	0	0,33	0,66	1	0,77
3.1 Water network systems				■	
3.2 Rainwater				■	
3.3 Controlled water			■		
4. WASTE	0	0,33	0,66	1	0,77
4.1 Local waste			■		
4.2 Waste managing				■	
4.3 Hazardous waste			■		
5. BIO-DIVERSITY	0	0,33	0,66	1	0,44
5.1 Vegetable essences				■	
5.2 Outdoor spaces				■	
5.3 Environmental conservation			■		
6. MATERIALS	0	0,33	0,66	1	0,78
6.1 Building material re-use			■		
6.2 Harmfulness				■	
6.3 Natural materials		■			
7. ENERGY	0	0,33	0,66	1	0,89
7.1 CO_2 emissions				■	
7.2 Renewable energy				■	
7.3 Energy network				■	
8. MOBILITY	0	0,33	0,66	1	0,77
8.1 Infrastructure				■	
8.2 Accessibility				■	
8.3 Noise			■		

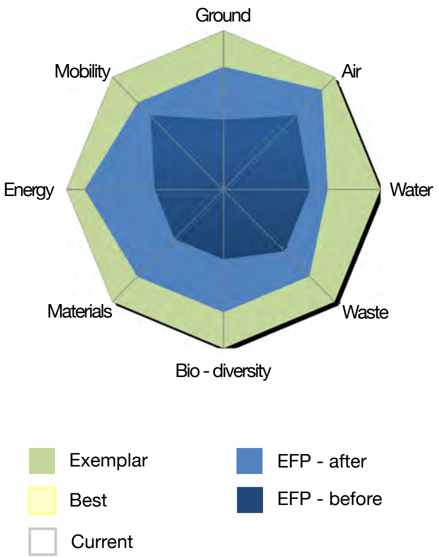
**Ecological Footprint:
Concerto AL Piano Project**



COMPARISON BETWEEN SITE FOOTPRINTS: BEFORE VS AFTER

The presence of a dense, low quality urban fabric has certainly affected the ability of Concerto AL Piano to maximize the scores. The result of the project produces a significantly positive impact on the urban surroundings, offering the opportunity to replicate content and process of Concerto AL Piano in other urban areas. In terms of avoided emissions, energy savings and social impacts it has been more effective to renovate the existing urban fabric, rather than get extraordinary results from isolated new demo-buildings.

Ecological Footprint: Concerto AL Piano Project



Building level: result of C.E.R. method

The CER method is applied on two different building types of Concerto AL Piano: the existing buildings (RENEW) and the new building (NEW Eco-Village) Concerning RENEW, the current state and refurbishment plan have been analysed on a dwelling belonging to ATC social housing. On the New Eco-Village, the analysis was carried out on a typical dwelling of microclimatic house.

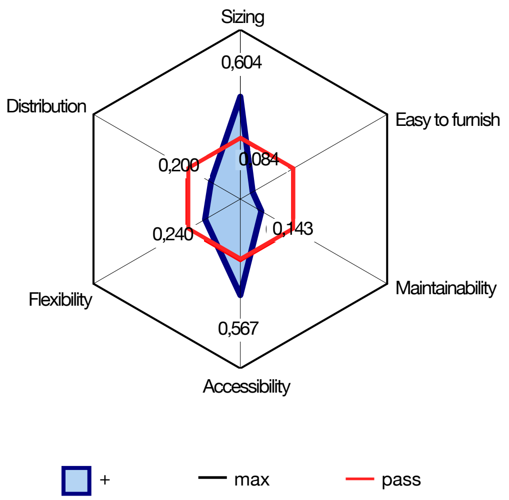
RENEW SETTLEMENT ANALYSIS

The dwelling analysed is located at the 3rd floor of the building Gandolfi 11. Three sides of it border with the outside. One side is contiguous to the unheated staircase. The apartment area is 80 m2 large, consisting of a kitchen, a bathroom, a living room, two bedrooms and a small storage closet. The lodge is situated on the south-western side, turned into passive solar greenhouse that helps to mitigate the winter thermal losses. The existing envelope has a cavity with 4 cm of glass wool insulation, and aluminum window frames with double-glazing. Concerto AL Piano improved the envelope with an external insulating coat made of wood fiber, and by replacing all windows with double low-emission glass and air-tight new windows, in order to increase insulation and enhance indoor comfort.

BUILDING USABILITY

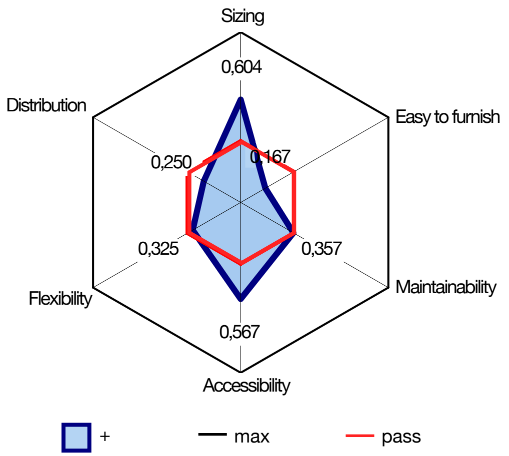
ATC Dwelling Before

Environmental Quality ATC DWELLING BEFORE	Max	Pass	EQ
SIZING	1,000	0,360	0,604
EASY TO FURNISH	1,000	0,360	0,084
MAINTAINABILITY	1,000	0,360	0,143
ACCESSIBILITY	1,000	0,360	0,567
FLEXIBILITY	1,000	0,360	0,240
DISTRIBUTION	1,000	0,360	0,200
BUILDING USABILITY	1,000	0,360	**0,306**



ATC Dwelling After

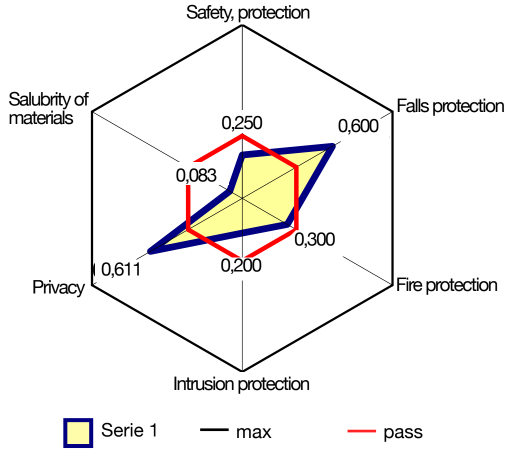
Environmental Quality ATC DWELLING AFTER	Max	Pass	EQ
SIZING	1,000	0,360	0,604
EASY TO FURNISH	1,000	0,360	0,167
MAINTAINABILITY	1,000	0,360	0,357
ACCESSIBILITY	1,000	0,360	0,567
FLEXIBILITY	1,000	0,360	0,325
DISTRIBUTION	1,000	0,360	0,250
BUILDING USABILITY	1,000	0,360	**0,378**



HEALTH

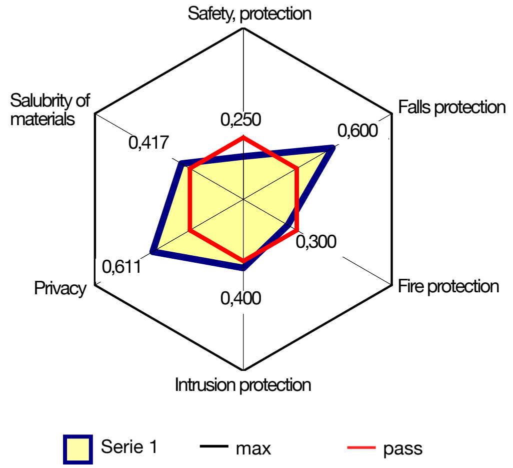
ATC Dwelling Before

Environmental Quality ATC DWELLING BEFORE	Max	Pass	EQ
SAFETY, PROTECTION	1,000	0,360	0,250
FALLS PROTECTION	1,000	0,360	0,600
FIRE PROTECTION	1,000	0,360	0,300
INTRUSION PROTECTION	1,000	0,360	0,200
PRIVACY	1,000	0,360	0,611
SALUBRITY OF MATERIALS	1,000	0,360	0,083
HEALTH	1,000	0,360	**0,341**



ATC Dwelling After

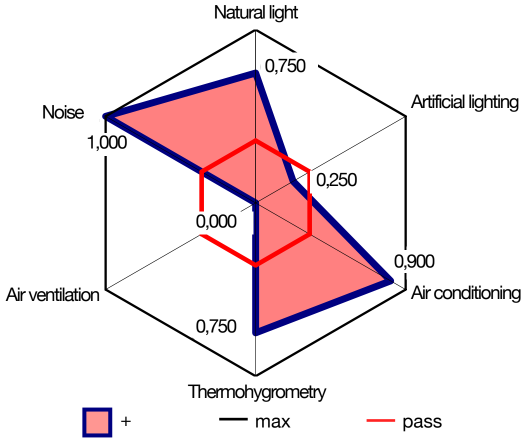
Environmental Quality ATC DWELLING AFTER	Max	Pass	EQ
SAFETY, PROTECTION	1,000	0,360	0,250
FALLS PROTECTION	1,000	0,360	0,600
FIRE PROTECTION	1,000	0,360	0,300
INTRUSION PROTECTION	1,000	0,360	0,400
PRIVACY	1,000	0,360	0,611
SALUBRITY OF MATERIALS	1,000	0,360	0,417
HEALTH	1,000	0,360	**0,430**



WELLNESS

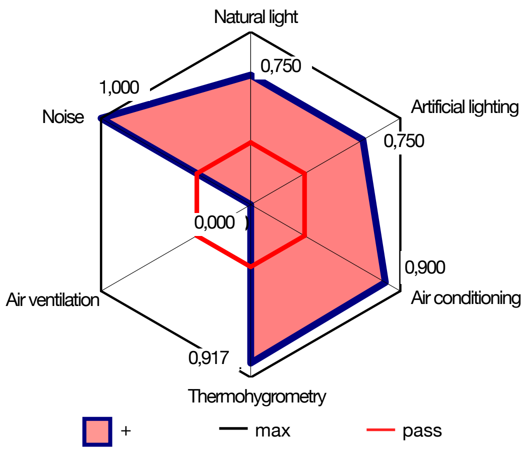
ATC Dwelling Befor

Environmental Quality ATC DWELLING BEFORE	Max	Pass	EQ
NATURAL LIGHT	1,000	0,360	0,750
ARTIFICIAL LIGHTING	1,000	0,360	0,250
AIR CONDITIONING	1,000	0,360	0,900
THERMOHYGROMETRY	1,000	0,360	0,750
AIR VENTILATION	1,000	0,360	0,000
NOISE	1,000	0,360	1,000
WELLNESS	1,000	0,360	**0,608**



ATC Dwelling After

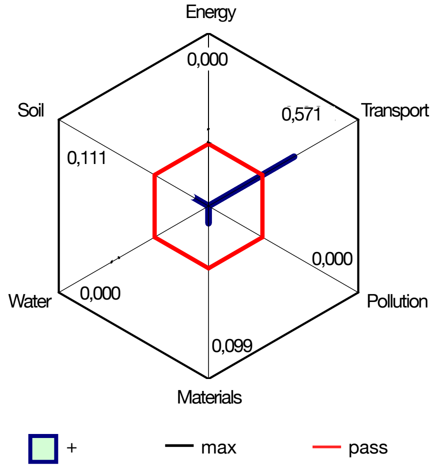
Environmental Quality ATC DWELLING AFTER	Max	Pass	EQ
NATURAL LIGHT	1,000	0,360	0,750
ARTIFICIAL LIGHTING	1,000	0,360	0,750
AIR CONDITIONING	1,000	0,360	0,900
THERMOHYGROMETRY	1,000	0,360	0,917
AIR VENTILATION	1,000	0,360	0,000
NOISE	1,000	0,360	1,000
WELLNESS	1,000	0,360	**0,720**



ENVIRONMENTAL IMPACT

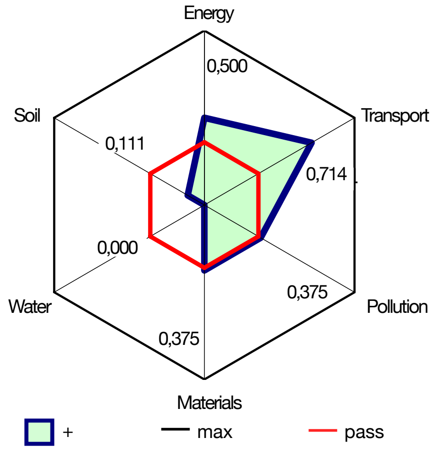
ATC Dwelling Before

Environmental Quality ATC DWELLING BEFORE	Max	Pass	EQ
ENERGY	1,000	0,360	0,000
TRANSPORT	1,000	0,360	0,571
POLLUTION	1,000	0,360	0,000
MATERIALS	1,000	0,360	0,099
WATER	1,000	0,360	0,000
SOIL	1,000	0,360	0,111
ENVIRONMENTAL IMPACT	1,000	0,360	**0,130**



ATC Dwelling After

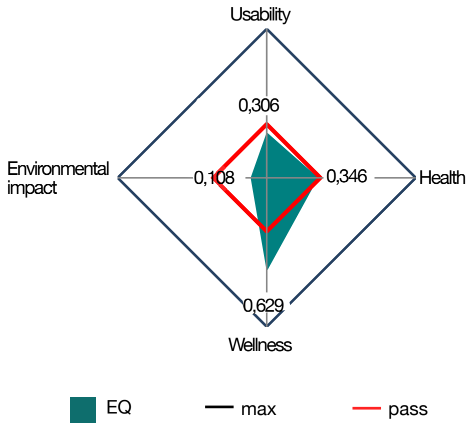
Environmental Quality ATC DWELLING AFTER	Max	Pass	EQ
ENERGY	1,000	0,360	0,500
TRANSPORT	1,000	0,360	0,714
POLLUTION	1,000	0,360	0,375
MATERIALS	1,000	0,360	0,375
WATER	1,000	0,360	0,000
SOIL	1,000	0,360	0,111
ENVIRONMENTAL IMPACT	1,000	0,360	**0,346**



ENVIRONMENTAL QUALITY

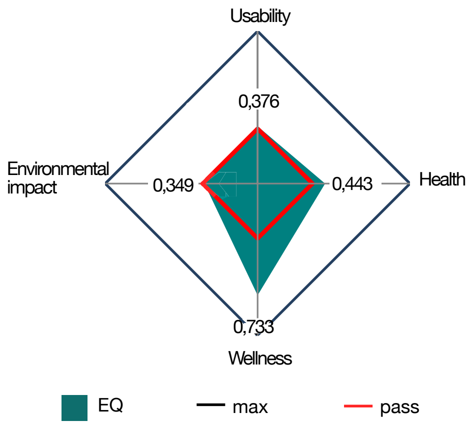
ATC Dwelling Before

Environmental Quality ATC DWELLING BEFORE	Max	Pass	EQ
USABILITY	1,000	0,360	0,306
HEALTH	1,000	0,360	0,346
WELLNESS	1,000	0,360	0,629
ENVIRONMENTAL IMPACT	1,000	0,360	0,108
ENVIRONMENTAL QUALITY	1,000	0,360	**0,347**



ATC Dwelling After

Environmental Quality ATC DWELLING AFTER	Max	Pass	EQ
USABILITY	1,000	0,360	0,376
HEALTH	1,000	0,360	0,443
WELLNESS	1,000	0,360	0,733
ENVIRONMENTAL IMPACT	1,000	0,360	0,349
ENVIRONMENTAL QUALITY	1,000	0,360	**0,475**



NEW ECO-VILLAGE SETTLEMENT ANALYSIS

The dwelling type of New Eco-village is located in the "Casa Micro-climatica 3-4" at the 3rd floor of block 4, in lot B. The apartment has an intermediate position, between two other dwellings. The other two sides of this dwelling,overlook the microclimatic atrium,and the outside courtyard respectively.

The net floor area is about 84 m^2, divided into 5 main rooms: a kitchen, a bathroom, two bedrooms, a large living room and an outdoor space (loggia)

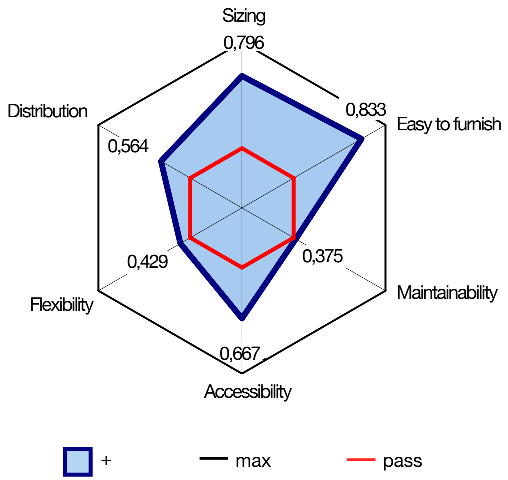
The envelope consists of a cavity wall with an insulation layer (14 cm) made of recycled paper.

The wall, made of brick clay blocks, provides a high frontal mass to ensure adequate thermal inertia for the hot season.

NEW - Microclimatic Houses

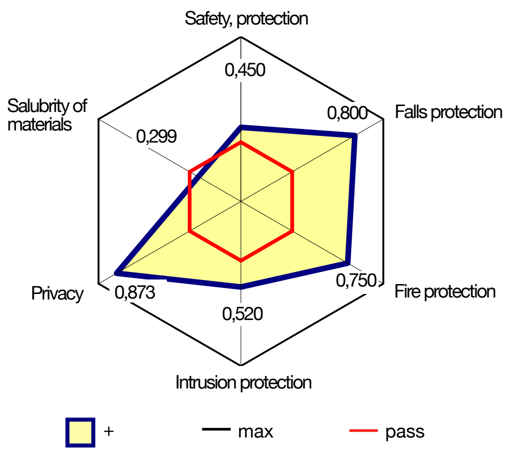
USABILITY

Environmental Quality MICROCLIMATIC HOUSE ACTUAL STATE	Max	Pass	EQ
SIZING	1,000	0,360	0,796
EASY TO FURNISH	1,000	0,360	0,833
MAINTAINABILITY	1,000	0,360	0,375
ACCESSIBILITY	1,000	0,360	0,667
FLEXIBILITY	1,000	0,360	0,429
DISTRIBUTION	1,000	0,360	0,564
USABILITY	1,000	0,360	**0,611**



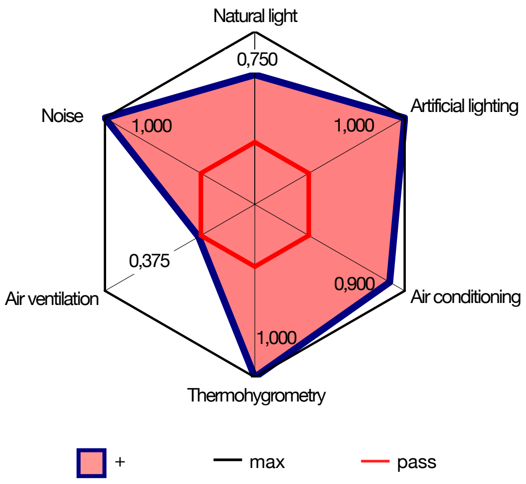
HEALTH

Environmental Quality MICROCLIMATIC HOUSE ACTUAL STATE	Max	Pass	EQ
SAFETY, PROTECTION	1,000	0,360	0,450
FALLS PROTECTION	1,000	0,360	0,800
FIRE PROTECTION	1,000	0,360	0,750
INTRUSION PROTECTION	1,000	0,360	0,520
PRIVACY	1,000	0,360	0,873
SALUBRITY OF MATERIALS	1,000	0,360	0,299
HEALTH	1,000	0,360	**0,615**



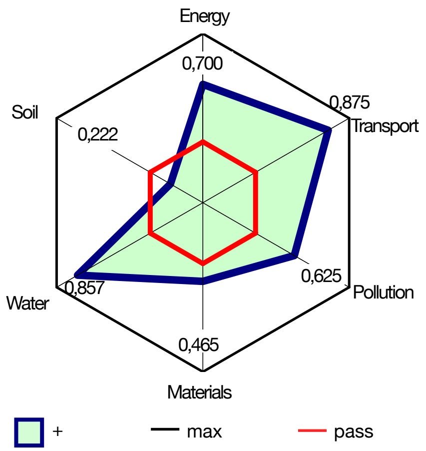
WELLNESS

Environmental Quality MICROCLIMATIC HOUSE ACTUAL STATE	Max	Pass	EQ
NATURAL LIGHT	1,000	0,360	0,750
ARTIFICIAL LIGHTING	1,000	0,360	1,000
AIR CONDITIONING	1,000	0,360	0,900
THERMOHYGROMETRY	1,000	0,360	1,000
AIR VENTILATION	1,000	0,360	0,375
NOISE	1,000	0,360	1,000
WELLNESS	1,000	0,360	**0,838**



ENVIRONMENTAL IMPACT

Environmental Quality MICROCLIMATIC HOUSE ACTUAL STATE	Max	Pass	EQ
ENERGY	1,000	0,360	0,700
TRANSPORT	1,000	0,360	0,857
POLLUTION	1,000	0,360	0,625
MATERIALS	1,000	0,360	0,465
WATER	1,000	0,360	0,857
SOIL	1,000	0,360	0,222
ENVIRONMENTAL IMPACT	1,000	0,360	**0,621**



Dissemination & PROMOTION /

With Associated Cities

by Roberto Pagani

a| METHOD

- Dissemination and Promotion of Concerto AL Piano

b| APPLICATION

- Dissemination Activity
- Dissemination with Associated Cities

c| RESULT

- From builders' involvement to communities' involvement
- Dissemination with Associated Cities
- The most effective dissemination
- Concerto AL Piano in the World

4

Dissemination & Promotion /

a| METHOD

Dissemination and Promotion of Concerto AL Piano

Citizens play a part in eco-construction. Urban pilot project is transforming micro-communities in the heart of Italy's Piedmont region.
Getting citizens involved in energy projects is proving to be the key to success for a region's effort to promote sustainable construction and energy-saving systems.
The Concerto AL Piano project in Alessandria has motivated many of the local residents to play a part in eco-construction an energy retrofit projects. Investors, city planners, builders and citizens of Alessandria worked together to develop a photovoltaic (PV) village. Thanks to the co-operation of the many players in this effort, as well as the support from the region, the project was an enormous success, and Alessandria became the largest PV village in Italy. This inspired leaders and citizens of Alessandria to further promote energy-saving concepts, including encouraging sustainable construction under the banner of Concerto AL Piano.
Concerto AL Piano project manager Roberto Pagani is a professor of Architecture Technology and Environmental Design at Politecnico Torino. Pagani explained "In a 'normal' city it's not easy to start a major programme to promote sustainable energy.
In Alessandria, because of the PV village success, we were fortunate to already have qualitative management in the city who were forward thinking and innovative." Thanks to the training programmes offered by the area universities and government, citizens can easily learn about options that exist for their energy retrofit projects. Advisors help them plan, build and rebuild high-efficiency housing and buildings. The training sessions involve many levels of participants. To improve the design quality of projects, architects and energy experts work side-by-side to counsel citizens. Training packs are provided for the various steps of construction projects.
"Trying to make things happen in a new way is possible only with the co-operation and involvement of the local community," Pagani explained. "Our goal is to create a zero-energy district, meaning that residents use all renewable energy. That is, no fossil fuels."
(MEDIA NEWSLETTER October 2007 _ Alerte_SEE_2007)

Concerto AL Piano, poster presented at UIA Turin 2008, 23rd Congress of the International Union of Architects (R. Pagani, C. Carbonaro, L. Savio)

b| APPLICATION

Dissemination Activity

The dissemination activity of Concerto AL Piano followed two main directions.

- a dissemination based on conventional communication tools
- a promotion towards Associated Cities: non demo-sites involved in Concerto AL Piano

EVENTS

All Project Teams participate in the CONCERTO AL PIANO Event Groups, at the half-a-year general meetings. Event Groups, designed and facilitated by the Coordination Team, equip participants to devise application strategies for their own situation. Preparatory work is made before each event to end-up with post-event releases and documents.

INTERNATIONAL DAY

Concerto AL Piano – International Day has been planned in a format to suit the specific context of Portugal, in conjunction with visit to the Associated Cities. The seminar focused on “how it works: organisation and methods for creating Sustainable Communities in Europe”, with detailed information for replicating the Concerto experience.

BROCHURE

A promotional CONCERTO AL PIANO Brochure has been designed and published in a number of copies to satisfy a wide European distribution. Special emphasis were placed in matching the information with the needs of a communication directed to city administrators and citizens.

EXHIBITION BOX

Design and realisation of an Exhibition Box portraying the relevant contents of the CONCERTO AL PIANO project. The Exhibition Box matches with the needs of exhibition both of CONCERTO AL PIANO city partners. It’s modular, flexible and easy disposal.

WEB SITE

Web site for the illustration of Concerto AL Piano. The Concerto AL Piano partners make links from their own sites and publicise the site address.

POSTERS

Series of CONCERTO AL PIANO Posters are designed and produced in order to comply with the exhibition needs both of the partners involved in the project and the Commission needs of dissemination

POWER POINT

This dissemination through PPT slides places special emphasis in matching the information with the needs of a communication directed to city administrators and citizens

Dissemination with Associated Cities

The dissemination with Associated Cities was aimed at creating a cooperation framework between Concerto AL Piano and the international partners, with special emphasis in exchanging experiences and application opportunities

Inter-services Working Group on Concerto AL Piano Demonstration Project

Three Associated Cities from Portugal are included in Concerto AL Piano: City of Porto (PT), Tavira (PT), Moura (PT). These cities take part as observers in the development of the project. Each associated city has organised an Inter-services Working Group at the city level. This can be considered a small group of carriers of the Concerto initiative.

Hosting a Concerto AL Piano event

The Associated Cities in Portugal have hosted the General Meeting of Concerto AL Piano, in the month of May 2009. The meeting lasted 3 days, starting from a visit in Porto and Moura and following with meetings among Institutions, management meeting of Concerto AL Piano and a Conference in Moura.

Participation in Concerto activities

The Associated Cities collected the relevant information on Concerto PLUS/ PREMIUM activities, in order to get the knowledge of the other Concerto Initiatives.

CONCERTO AL PIANO IN PORTUGAL

May 7	(night) – Arrival to Porto
May 8	Concerto AL Piano in Porto
9:30	Visit to the Historic Centre (Quarteirão das Cardosas, Morro da Sé)
11:30	Reception at City Hall
13:00	Lunch at 'O Comercial' (include visit to the Comercial Association of Porto)
15:00	Visit to Antas Social housing distric and to Casa da Música
18:30	Porto Wine at Museu do Vinho do Porto
20:00	Dinner at 'D. Tonho'

May 9	Concerto AL Piano in Moura
16:00	Work meeting of the 'Concerto AL Piano' partners
18:00	Visit to the May Exhibition
May 10	Concerto AL Piano Conference
9:00	Visit Amareleja PV central
14:30	Concerto AL Piano Conference
18:00	departure to Lisboa

Porto, Visit to the Historic Centre (Quarteirão das Cardosas, Morro da Sé).

c| RESULT

From builders’ involvement to communities’ involvement

Urban demonstration projects are long-term processes, that may last ten years, despite enormous efforts of involved teams, managing difficulties. They require an extraordinary commitment and team-work for cities. Concerto AL Piano, in its lifetime, has dealt with three City Mayors, four construction companies have withdrawn, and three different energy suppliers took responsibility for the co- generation district heating. In urban pilot projects, builders are still among the main players, having to make investments and test innovative solutions, but a durable political commitment, high competence and risk acceptance are essential components from the very beginning, in conjunction with a strong public awareness and community involvement.
To examplify the effectiveness of promotion initiatives among the community, the kick-off meeting of Concerto AL Piano can be summarised. It took place on July 2-3, 2008, in occasion of the first Partners Meeting with the associated communities.

During the first day a short visit of the Concerto AL Piano district was carried out, followed by a sightseeing of the so-called Photovoltaic Village. In the evening there was a get together between major local and regional stakeholders and representatives of the associated communities. The peculiarity of the second day was that the meeting was held in a public place, namely a highly populated square in the city centre of Alessandria. A further feature was the very high participation of the local public administration, including the Mayor. The meeting started with an opening speech of the Mayor, followed by presentations of the activities of the Concerto AL Piano project in the demonstration site Alessandria and in the associated communities.

Apart from the kick-off contents, the novelty was represented by the context: the public square where the conference was held and the attactiveness of this setting for the public. People around the square have been brought into the context of the urban pilot project through a truthful exposure to a conference that was not intended to be for the public, but intentionally within the public.
Based on the lessons learnt, three key recommendations on promotion issues can be proposed:

- do not ask people to come, but go to people: innovative city settings for promoting urban projects can enhance the perception and the awareness within the local community;

Concerto AL Piano kick-off, July 2-3, 2008

- involve associated cities in demo: having more communities involved in a local pilot project improves the partnership and sharing of the initiatives;
- when regeneration happens in a district, former inhabitants are happy to come back to live in their original neighborhood.

Dissemination with Associated Cities

A General Meeting of Concerto AL Piano was held in Porto and Moura. The Meeting focused on the activities already performed and to be started in the next period. Particular emphasis was given to the state of advancement of the collaboration with Associated Cities.
Minutes of the meetings have been made available to the partners.
The meeting dealt mainly with the objectives, deliverables and planning of works, and gave the opportunity to the Associated Cities in Portugal to show their activities and projects in the field of energy efficiency. In particular, the Moura PV project, which is the largest PV power plant in Europe, with its 46 MW of installed photovoltaic
The Municipality of Moura has organized the Concerto AL Piano Conference in occasion of the General Meeting in Portugal. The Conference was meant to represent an occasion of public debate in Moura, with an international team of experts, about the potential of energy efficiency for local authorities. The Mayor of Moura hosted the Deputy Mayor of Alessandria in occasion of the Annual Moura Celebration Day and Exhibition.


Reception at Porto City Hall


Reception at Moura City Hall


Visit to the PV park of Moura

The most effective dissemination

Concerto Al Piano was hosted by RAI Italian television in a programme having a very large audience share, in the evening of 29 March 2009:
3.642.000 contacts; share 13,88%

TV dialogues
"Alessandria wondered how much buildings consume, how much energy is thrown away? Too much...and if Europe says that for 2020 we all need to cut consumption, pollution and produce energy with renewable sources, all at 20%, in Alessandria they are sure to do more":
" 37% of energy saving"

"Yes, but how? A European project, a mayor who makes a deal directly with Europe..."

"This is an absolute novelty. The city directly deals with the European Government..."

"Buildings waste energy. First of all, one has to plug the holes, they thought in Alessandria. And they started from a neighbourhood, from social housing buildings."

"11 buildings with 300 apartments, about a thousand people...and then start putting the coats to the buildings..."

"This is the outer coat is made of wood fibre. Eight inches of coat that covers all the opaque walls of the buildings..."

"We started with an analysis of the buildings that have a consumption of 200 kWh per square meter per year, to decrease to around 100 kWh per square meter per year"

"Even when power plants are big and far they waste energy. Thus a small co-generator close to the district..."

"Because heat instead of being wasted, can be taken and recovered. Winter heating is done, the summer gets hot water, and cooling can be produced by one absorber for supplying air conditioning..."
"We currently waste 70% of the real demand of energy. Reducing holes and consumption of existing building from 220 to 100Kwh square meter per year, halving, and then introduce renewable sources, so that renewable resources are not wasted in buildings that are inefficient..."

"And then a photovoltaic village... They produce about 130 kW peak, housing an annual saving of about 700 euro per year per family."
"All this on a neighbourhood of 20 thousand people. If we scale-up to the whole Alessandria with 100 thousand people?"

"If the city of Alessandria consumes 150 thousand tons of oil equivalent, we could reduce the consumption by 56 thousand tons of oil equivalent per year."

Reference:
TV_RAI REPORT_29 March 2009
(https://www.youtube.com/watch?v=NjTff7oQlaQ&list=UUg-IKACUwcKtwb0pbwgw1qA&t=105)
Journalist and Interviewer: Michele Buono (RAI REPORT).

Concerto AL Piano in the World

The following is a list of the most relevant demonstrative activities of Concerto AL Piano in EU and in the rest of the world.

- Consensus Conference, Alessandria (Italy), City Awareness Conference in the Public Square of Alessandria, Oct 2008;
- UIA2008 World Congress of Architects, Torino (Italy). The presentation of Concerto AL Piano was an important step in the World Congress of Architects UIA 2008. A special session on “Concerto Vision” was held during the Congress. Concerto AL Piano contributed with an Exhibition Box to disseminate the concept of urban sustainability, Jul 2008;
- R. Pagani, Stockholm (Sweden), SET Plan Conference, a high level conference on the EU’s Strategic Energy Technology, 21-22 Oct 2009;
- R. Pagani, Torino (Italy), International Workshop “From Urban Communities to Sustainable Cities”, 27 Nov 2009;
- R. Pagani, Roma (Italy), Green-Up, Urban Vertical Farms, 12 January 2010;
- R. Pagani, Ferrara (Italy, Architettura Energia Laterizio, FAF Palazzo Tassoni, 8 Apr 2010;
- R. Pagani, Pescara (Italy), Designing Ecotown, International Conference, Facoltà di Architettura Pescara, 12-13 May 2010;
- R. Pagani, Sestriere (Italy), Global Change and Sustainability, ASP Spring School 2010 - 6th cycle, 18–21 May, 2010;
- C. Carbonaro, Aosta (Italy), Aosta (Italy), RIGENERGIA, 28 May 2010;
- R. Pagani, Porto (Portugal) ENERGY AND SOCIETY, Technological innovation - Energy Efficiency - Cities of the Future, 28 May 2010;
- R. Pagani, Dezhou (China), 4th ISCI Solar Cities Initative World Congress, 16-19 Sep 2010;
- R. Pagani, Lisbon (Portugal), Cascais Conference Series -Energy for Smart Cities, 16 nov 2010;
- R. Pagani, Perugia (Italy), Esperienze di Architettura Sostenibile, 26 November 2010;
- R. Pagani, Brussels (Belgium), CONCERTO in every city – forum for local decision makers and stakeholders, 6-7 Dec 2010;
- R. Pagani, Valencia (Spain), SMART CITIES, Universidad Politécnica Valencia, 10-16 dec 2010;
- R. Pagani, Sestriere (Italy), International Winter School Polycity, 10-12 Jan 2011;
- R. Pagani, Beijing (China), Concerto AL Piano, Training Seminar, 21 Jan 2011;
- R. Pagani, Alessandria (Italy), Edilizia Popolare in Alessandria, 18 March 2011;
- R. Pagani, C. Boonstra, E. de Oliveira Fernandes, Bardonecchia (Italy), Concerto AL Piano, SELECT Erasmus Mundus - Spring Seminar 2011, 21 March 2011;
- R. Pagani, Beijing (China), Global view of eco-cities: European and US concepts versus Chinese concepts, Beijing 7-8 June 2011;
- R. Pagani, Harbin (China) Smart Cities: the European Vision, Harbin China, 9 June 2011;
- R. Pagani, Reggio Calabria (Italy) Costruire sostenibile nel Mediterraneo, 27-29 June 2011;
- R. Pagani, Luoyang (China), Presentation of EU Demonstration Projects, 10 Jan 2012;
- R. Pagani, Torino (Italy), Smart Cities and Communities, 4 Apr 2012;
- R. Pagani, Urumqi (China), Demonstration Projects: the European experience, 17 May 2012;
- R. Pagani, Sustainable Architecture in Europe, Nanjing, October 2012;
- R. Pagani, Milano (Italy), Smart City Retrofit - Innovation Cloud, May 2013;
- C. Carbonaro, Torino (Italy), OAT Conference, Edifici intelligenti tecnologie per costruire il futuro, 5 dec 2013;
- R. Pagani, Roma (Italy), Concerto AL Piano, Smart Cities and Communities, 14 Feb 2014.
- R. Pagani, C. Carbonaro, L. Savio, Concerto AL Piano EUSEW, Bruxelles, May 2015.

District RETROFIT /

Energy retrofitting at the district level to mobilise the investments
for conserving energy in conjunction with building renovation and maintenance.
by Lorenzo Savio

a| METHOD
-The demonstrative project: a start up for the sustainable energy action plan

b| APPLICATION
- Energy Demand of Residential Building Stock
- Retrofit funding announcement

c| RESULT
- Retrofit Actions in Concerto AL-Piano area
- Energy Model for the SEAP (Sustainable Energy Action Plan)

5

District Retrofit /

a| METHOD

The demonstrative project: a start up for the sustainable energy action plan

Retrofit is a specific action of Concerto AL Piano, aiming at promoting the concept of the demonstrative project at the urban level, across the boundaries of the New and RE-new actions.
Thanks to Retrofit action, citizens and homeowners are directly involved in the demonstration project, implementing energy efficiency interventions on their dwellings, with the technical an financial support of Concerto AL Piano team.
The main objectives of Retrofit action are:

- to promote and to disseminate the concept and the issues of Concerto AL-Piano on an urban scale, through concrete interventions on buildings;
- to collect real data concerning the energy consumptions of residential buildings through energy check;
- to implement energy saving measures at urban scale, in conjunction with the ordinary building renovation process.

Two main activities were carried out in parallel. On the one hand, the launch of the public funding announcement called “Retrofit”, to promote the financing of energy audits and energy retrofit interventions on buildings of the the whole district. On the other hand, the study and the classification of the residential building-stock of the whole city in order to estimate of the energy demand of the residential building stock on the urban scale, using the chosen Retrofit interventions as a “test”. The association between the energy saving interventions promoted by the public funding announcement and the analysis of the whole residential building stock rapresents the first step towards the adoption of a sustainable energy action plan by the city of Alessandria.
The Italian residential building stock has, generally, low energy performances. In recent years national, regional and municipal regulations established minimum levels of buildings energy performance both for new and existing buildings. At the same time, citizens, who improve energy efficiency of their dwellings or integrate renewable energy sources, may be eligible for tax credits to offset a part of the costs. However, regulations and tax credits are not enough to make a real change in the urban energy consumption model. A more strategic approach should be adopted by the Municipality, as suggested by the EU initiative “Covenant of Mayors” (http://www.covenantofmayors.eu).
The analysis of the residential building stock promoted by the Retrofit action focuses the attention over the demonstrative project and supported the adoption of the Strategic Energy Action Plan (SEAP) for CO_2 emissions reduction. The comprehensive strategy of Concerto AL Piano (with the mix of new and retrofitted buildings, the reduction energy demand of buildings before the integration of renewable energy sources) may be replicated in other parts of the city, considering it as a “pilot” experience for a future urban strategy.

Alessandria, overview of the Cristo district with the social housing block builded in the 50s and later (suorce: “80 anni di IACP nella provincia di Alessandria”).

b| APPLICATION

Energy Demand of Residential Building Stock

The estimation of the residential energy demand is based on a methodology previously applied and tested for different case studies by the Concerto AL Piano research team. The methodology uses free data available from the national building census by ISTAT (national statistic institute), municipal annual statistic reports and annual energy reports by ENEA (Italian national energy agency).
In particular, the methodology is structured into the following steps:

- Classification of the residential building stock in homogeneous groups of buildings ("building code");
- Determination of an energy consumption "profile" for each "building code", considering the energy consumptions for different uses (expressed in kWh /m²);
- Estimation of the energy consumption of the whole residential building stock, associating the energy consumption indicators (kWh/m²) to the total residential floor area of each class of buildings (m²).

CLASSIFICATION OF THE BUILDING STOCK

The ISTAT census records a lot of data concerning residential buildings for each "census area", with informations about their age, number of floors, number of dwellings, proximity with other buildings etc..
All the informations and data by the ISTAT census and the municipal statisctics about residential buildings and dwellings of Alessandria were collected and analysed; the table of figure 5.2 shows a general overview for the year 2005, which wad took as a reference.
After the analysis of census data, 32 "profiles" of buildings (fig. 5.1; 5.5) were defined, combining variables concerning age, number of dwellings and building proximity, as shown in the table of figure 5.3. The 32 "building codes" are capable of representing the whole residential building stock of the city.
The residential building floor area attribuited to each building code was calculated; figure 5.4 shows the breackdown in the 32 building codes.

5.1 Sample buildings selected in the Concerto AL Piano area and classified, in the 32 building codes according to their characteristics

Building Code 111
Age: Before 1945
N° of dwellings: 1
Building Proximity: no

Building Code 321
Age: 1972 - 1991
N° of dwellings: 2
Building Proximity: no

Building Code 242
Age: 1945 - 1971
N° of dwellings: more than 10
Building Proximity: yes

City of Alessandria- year 2005 (data from census 2011 and municipal statistic report)	
Resident population	84'829,00
N° of Dwellings	40'795,00
total housing area (m^2)	3'821'346,00
Total rooms in all the dwellings	165'733,00
Average dwelling size (m^2)	93,67
Average inhabitants for dwelling	2,08
Average inhabitants for residential building	7,29
Average dwellings for residential building	3,51
Housing area for inhabitant (m^2)	45,05
Average room area (m^2)	23,06
% occupied dwellings with heating system	91,67%
% occupied dwellings with centralized heating system	50,52%
Residential buildings	11'631,00
Units (not only dwellings) in residential buildings	47'386,00
Total area of units (not only dwellings) in residential buildings (m^2)	4'430'413,75

5.2 Residential building stock of Alessandria (year 2005)

Age	
1	Before 1945
2	1945 - 1971
3	1972 - 1991
4	After 1991
N° of Dwellings	
1	1
2	2
3	3-10
4	More than 10
Building Proximity	
1	no
2	yes
4x4x2=32 building codes	

5.3 The 32 building codes, designed combining variables of Age, number of dwellings in a residential building and building proximity

5.4 Breakdown of the whole residential floor area in the 32 building codes

Afterwards, a virtual building geometry was designed and associated to each building code, due to its specific age, number of dwellings and building proximity. Those features, different for each code, influence the expected energy performance of buildings. For example the thermal trasmittance of building envelope, the percentage of windows area and the internal height of dwellings can be realted to the building age and to the different building technologies. Furthermore, the number of dwellings and building proximity influence the S/V ratio (surface area to building volume), which is an important parameter for the overall energy consumption of the building.
The reference building geometry associated to each building code was designed combining some real data collected from sample buildings of the Concerto AL Piano area (measured and classificated in the 32 codes) with some assumptions concerning (fig. 5.6; 5.7):

- the average internal dwelling height (related to the age);
- the average distance between windowed facades (related to age);
- the aero-illuminating ratio, used for calculating the window surface on the basis of the usable floor area;
- the ratio between the net and the gross buildings volume;
- the percentage of wall surface adjacent to other residential buildings (considered as adiabatic in energy ratings).

ENERGY CONSUMPTIONS

Each building code is representative of a part of the whole building stock. The energy ratings of standard buildings associated to each code, give the possibility to extend the estimated energy consumptions to the whole building stock with the same code.
The estimation methodology can be considered a basic approach to modelling the energy consumption of the whole urban building stock, since real energy consumption data are not available. Thanks to its simplification, the methodology can be replicated also in other Italian cities, acquiring the same kind of census data.
The energy consumption assessment associated to each building code refers to a virtual building, with a standard geometry and building technologies, associated to the age.
Different energy uses were considered: heating, electrical components, hot water and cooking; energy consumption for each use were expressed in kWh/m^2 per year (fig. 5.8; 5.9).
Energy consumption associated to each class of buildings have been calculated by reference to the National Guidelines for the Energy Certification, which

Building Code 111

Age: Before 1981-1991
N° of dwellings: 2
Building Proximity: yes

Building Code 321

Age: after 1991
N° of dwellings: more than 10
Building Proximity: no

Building Code 242

Age: before 1945
N° of dwellings: 1
Building Proximity: yes

5.5 Sample buildings selected in the Concerto AL Piano area and classified, in the 32 building codes according to their characteristics.

Age	Average height (m)	aero-illum. ratio
before 1945	3,5	1/8 of living area
between 1945 and 1981	3	1/6 of living area
after 1981	2,7	

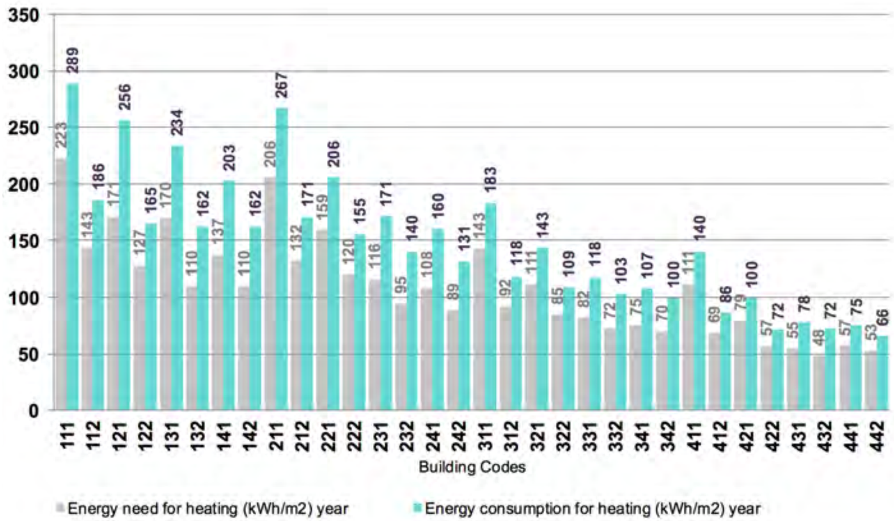
5.6 Assumptions for the average dwelling height and the aero-illuminating ratio related to different class of building age

Age	external wall	roof	basement	windows
	thermal trasmittance [W/m²k]	thermal trasmittance [W/m²k]	thermal trasmittance [W/m²k]	thermal trasmittance [W/m²k]
before 1945	1,14	1,30	1,13	5,00
1946-1971	1,04			
1971-1981	0,76	0,86	0,90	
1981-1991	0,76	0,9	0,80	
after 1991	0,59	0,76	0,73	3,3

5.7 Thermal trasmittance related to Age and different building elements

Alessandria - 2005			
Energy consumptions for different uses in Italy MWh/inhab (ENEA 2005)		Inhabitant – Alessandria 2005	Energy consumption (kWh/m² anno)
Domestic hot water	0,55	91'593	19,70
Cooking	0,30		9,50
Electricity	0,92		22,40

5.8 Energy consumptions for different uses



5.9 Energy need and energy consumption for heating (kWh/m² per year)

determines with a simplified method the average energy performance of a building (EPgl), as follows:
EPgl = EPi + EPacs + Epe + EPill
EPi = energy performance for heating
EPacs = energy performance for domestic hot water
Epe = energy performance for cooling
EPill = energy performance for lighting

The energy performance index for heating (EPI) was calculated through standardized energy assessments of buildings. Energy consumption for heating are about 70% of the total consumptions of residential sector at nationoal level and it is even more for Alessandria, which is in the climate area E, with 2559 degrees days.
The energy consumptions for the other uses are less dependent from the location, the annual temperatures and the building geometry, so they were calculated using average data at national level, expressed in kWh/m² per year, from ENEA annual report (2005).
Energy consumption for cooking, which are not considered in the National Guidelines, were also calculated.
The energy performance of standard buildings were calculated combining information from a variety of sources, such as:

- national regulations on energy performance of buildings and parameters, like ventilation ratio and window surface ratio;
- energy certification of the selected buildings of the Retrofit public funding anouncement;
- statistics concerning energy consumption of large building stocks at the provincial and regional level;
- direct surveys and evaluation of buildings included in Concerto Area.

RESIDENTIAL BUILDING STOCK ENERGY MODEL

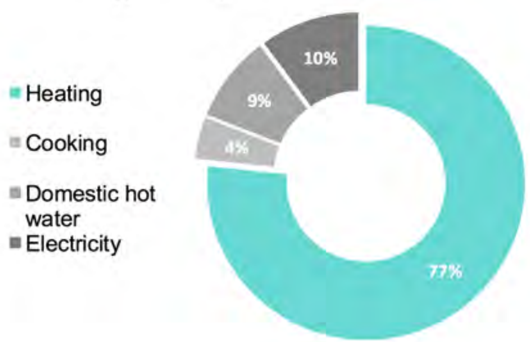
The energy consumptio of the whole building stock was estimated combining the energy performance indicators for different uses (kWh/m² year) with the floor area, of all building codes (fig. 5.12).
The main results of the final energy consumption estimation are shown in figure 5.10; 5.11; 5.12.

Final energy consumptions - year 2005 (2771 dd)	
Heating (2771 DD) kWh/m2	776'393,34
Cooking kWh/m²	38'929,50
Domestic hot water kWh/m²	80'727,49
Electricity (lighting and other uses) kWh/m²	91'791,66

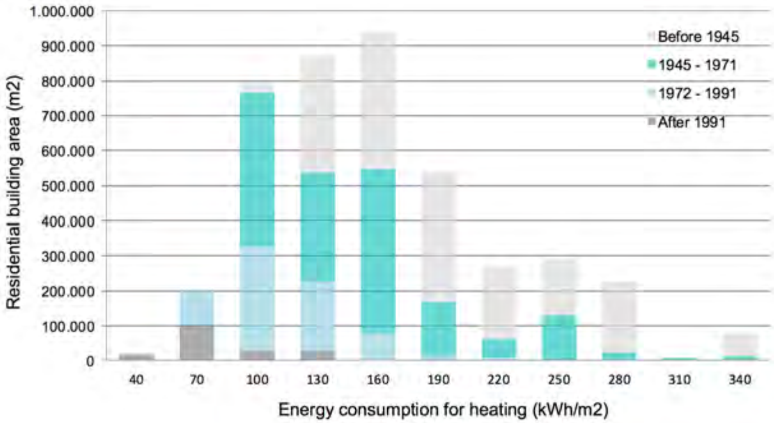
5.10 Final energy consumptions for different uses of the whole esidential building stock.

Average energy consumption (residential building stock)	
Heating (2559 DD) kWh/m²	163,98
Heating (year 2005 - 2771 DD) kWh/m2	182,42
Cooking kWh/m²	9,50
Domestic hot water kWh/m²	19,70
Electricity (lighting and other uses) kWh/m²	22,40

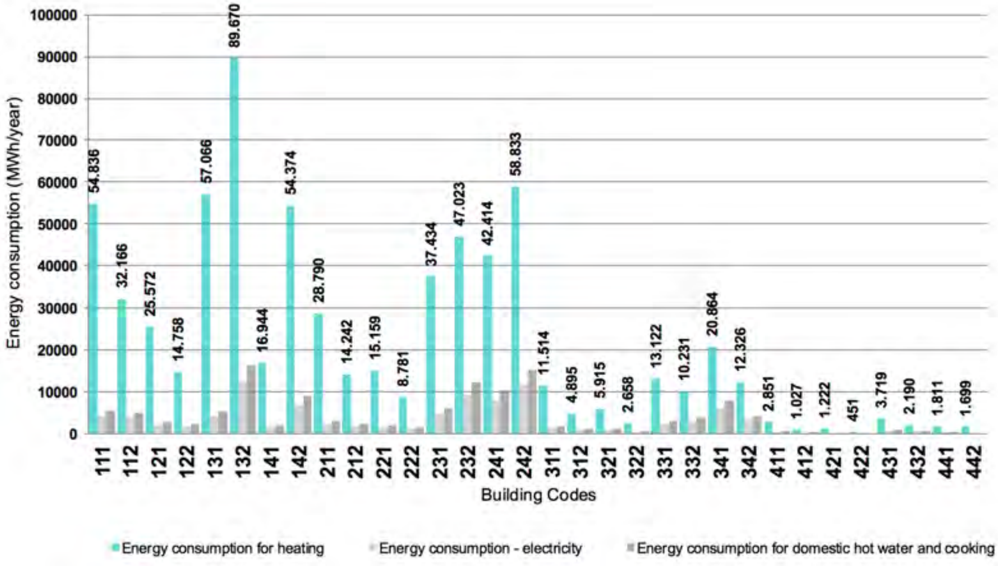
5.11 Final energy consumptions for different uses of the whole esidential building stock.



5.12 Final energy consumptions of the residential sector for different uses (Alessandria, year 2005)



5.12 Breakdown of the residential floor area in different class of energy consumption for heating



5.13 Energy Need and energy consumption for the 32 Building Codes

Retrofit funding announcement

The main purpose of Concerto AL-Piano/Retrofit is not to renew few buildings with drastically decreasing their energy consumptions, but to highlight the issue of energy saving in the routine building maintenance of many of the real estate assets. For this reason, the Funding Announcement (5.13) was structured in such a way that the maximum contribution for each dwelling or building is 16 euro per m^2, in order to have a large number of financed retrofit measures. Some estimates concerning the energy savings / investment (kWh / EUR) ratio in RE-new interventions show that for Retrofit measures (max 16 euro/m^2) it is difficult to have a strong decrease of energy consumption (fig. 5.14). For this reason, considering the level of the interventions, the submissions from private homeowners were not selected on the basis of a pay-back-time criteria but only considering the compatibility with the technical specifications of the Announcement.

The basic stages for the Call were:

- 28 September 2010 - Official Kick-off of Retrofit Funding Announcement at the second Concerto AL- Piano General Meeting. The presentation was held in the City Hall of Alessandria with a public press conference. The Funding Announcement was published in the Official Gazette and on the website of the City of Alessandria ;
- the City organised a series of meetings with citizens, professionals and operators in the sector. An important role was played by the dissemination activities carried out by the municipal authorities.
- February 28, 2011 - deadline for submission of applications for funding (Annex 1);
- April 30, 2011 - official publication of the list of approved funding and request for integration of technical information related to the projects.

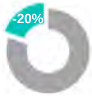
5.13 Retrofit public funding announcement

List of Retrofit Measures			
A - Light measure for Building envelope and heating system		B4	New boiler and/or generator
A1	Reflective screen behind radiators	B5	Heat recovery system
A2	Insulation and sealing of the external roller blinds box	B6	Heat valves with individual counters
A3	Installing seals to windows and doors	B7	Low-E glasses on existent windows
A4	Boiler insulation, check for fuel consumption and temperature	B8	New hi-efficient windows
B - Measure for Building envelope and heating system		B9	Solar thermal system (water or air)
B1	Cavity external wall insulation	B10	Greenhouses
B2	Roofs insulation	B11	Wall insulation (internal coat)
B3	Insulation of the basements	B12	Wall insulation (external coat)

5.14 Retrofit interventions

n°1 residential building

energy saving



retrofit measures B4; B6

retrofitted gross area (m^2) 1.678

n°2 dwelling

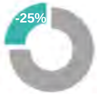
energy saving

retrofit measures B8

retrofitted gross area (m^2) 65

n°3 dwelling

energy saving

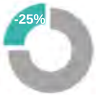


retrofit measures B2; B4

retrofitted gross area (m^2) 114

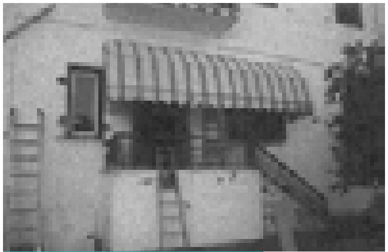
n°4 dwelling

energy saving



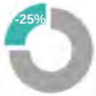
retrofit measures B8

retrofitted gross area (m^2) 190



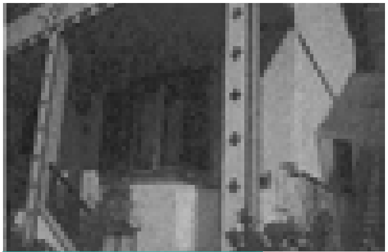
n°5 dwelling

energy saving



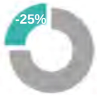
retrofit measures B8

retrofitted gross area (m^2) 305



n°6 dwelling

energy saving



retrofit measures B12

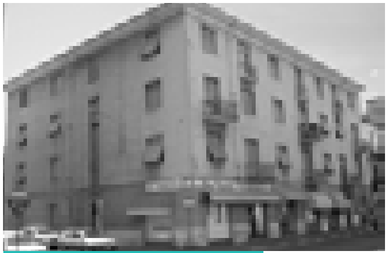
retrofitted gross area (m^2) 106

n°7 residential building

energy saving

retrofit measures B4;B6

retrofitted gross area (m^2) 639



n°8 residential building

energy saving

retrofit measures B4;B6

retrofitted gross area (m^2) 1277

n°9 dwelling

energy saving

retrofit measures B4;B6

retrofitted gross area (m^2) 79

n°10 dwelling

energy saving

retrofit measures B4; B6

retrofitted gross area (m^2) 106

n°11 residential building

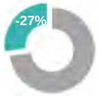
energy saving

retrofit measures B9

retrofitted gross area (m^2) 699

n°12 residential building

energy saving

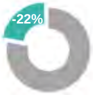


retrofit measures B8

retrofitted gross area (m^2) 264

n°13 dwelling

energy saving

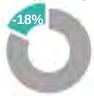


retrofit measures B4

retrofitted gross area (m^2) 102

n°14 residential building

energy saving

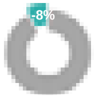


retrofit measures B2

retrofitted gross area (m^2) 2.606

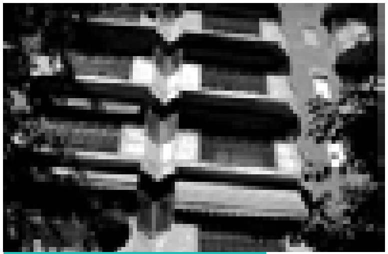
n°15 residential building

energy saving



retrofit measures B6

retrofitted gross area (m^2) 2.701



n°16 **dwelling**

energy saving

retrofit measures B4;B6

retrofitted gross area (m^2) 180

n°17 **dwelling**

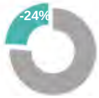
energy saving

retrofit measures B2

retrofitted gross area (m^2) 2.680

n°18 **dwelling**

energy saving

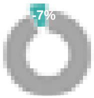


retrofit measures B8

retrofitted gross area (m^2) 110

n°19 **residential building**

energy saving

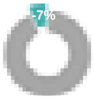


retrofit measures B6

retrofitted gross area (m^2) 1.335

n°20 **dwelling**

energy saving



retrofit measures B4; B6

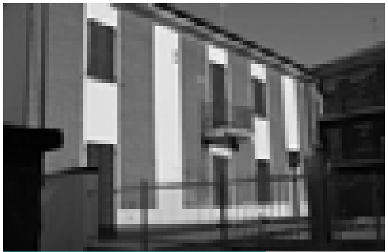
retrofitted gross area (m^2) 537

n°21 **dwelling**

energy saving

retrofit measures A1; B4

retrofitted gross area (m^2) 176



n°22 **residential building**

energy saving

retrofit measures B8

retrofitted gross area (m^2) 170

n°23 **dwelling**

energy saving

retrofit measures B4

retrofitted gross area (m^2) 88

n°24 **dwelling**

energy saving

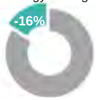
retrofit measures B8

retrofitted gross area (m^2) 100

n°25 dwelling

retrofit measures	B4
retrofitted gross area (m²)	140

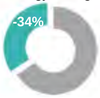
energy saving



n°26 dwelling

retrofit measures	B8
retrofitted gross area (m²)	95

energy saving



n°27 dwelling

retrofit measures	B8
retrofitted gross area (m²)	83

energy saving

n°28 residential building

retrofit measures	B1
retrofitted gross area (m²)	1.809

energy saving

n°29 residential building

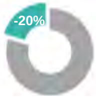
retrofit measures	B1
retrofitted gross area (m²)	1.809

energy saving

n°30 dwelling

retrofit measures	B8
retrofitted gross area (m²)	88

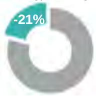
energy saving



n°31 dwelling

retrofit measures	B8
retrofitted gross area (m²)	200

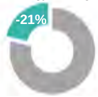
energy saving



n°32 dwelling

retrofit measures	B8
retrofitted gross area (m²)	75

energy saving



n°33 dwelling

retrofit measures	B8
retrofitted gross area (m²)	130

energy saving

n°34 dwelling

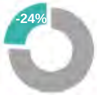
retrofit measures	B8
retrofitted gross area (m^2)	86

energy saving

n°35 dwelling

retrofit measures	B8
retrofitted gross area (m^2)	88

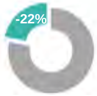
energy saving



n°36 dwelling

retrofit measures	B8
retrofitted gross area (m^2)	88

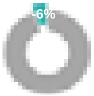
energy saving



n°37 dwelling

retrofit measures	A2; A3; B7
retrofitted gross area (m^2)	78

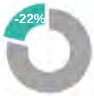
energy saving



n°39 dwelling

retrofit measures	A3; B7
retrofitted gross area (m^2)	115

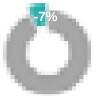
energy saving



n°40 dwelling

retrofit measures	B8
retrofitted gross area (m^2)	196

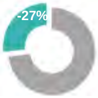
energy saving



n°41 dwelling

retrofit measures	B8
retrofitted gross area (m^2)	83

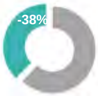
energy saving



n°42 dwelling

retrofit measures	B8
retrofitted gross area (m^2)	193

energy saving



5.15 Retrofit interventions with the public funding announcement. in total 42 applications were submitted by citizens of the district, 41 have been financed (number 38 was retired). Energy savings were calculated using data reported in the applications submitted by the building owners

c| RESULT

Retrofit Actions in Concerto AL-Piano area

Thanks to the public funding announcement “Retrofit”, 42 energy-retrofit interventions on residential buildings were funded, corresponding to 239 dwellings with an average area of 90 m². The total retrofitted surface was 2183 m², the total contribution disbursed amounted to EUR 269 760, with an average of 12.3 EUR / m².
For each building a form was completed, with the main information concerning age of building, area, number of dwellings, description of energy-retrofit interventions, photographs before and after refurbishment. An energy audit was also performed for each building, following the specific indication of national regulations for energy certification of buildings.

Energy Model for the SEAP

(Sustainable Energy Action plan)

The association to each building code of standard assessments of energy performance for heating, electrical components, hot water and cooking uses - expressed in kWh/m² per year - allows us to estimate the energy consumption of the whole residential building stock. The simplified descriptive model allows a variety of analyses concerning the energy consumption of buildings, providing the indicators of average consumption for specific portions of the building stock (in a particular neighbourhood or area) or the distribution of buildings for different classes of energy performance.
The energy performance indicators are calculated by assessing each code to a virtual building with standard characteristics that were established on the basis of a variety of sources, such as:
- national regulations concerning energy performance of buildings and hygiene parameters (ventilation ratio and window surface);
- energy certification of the buildings which were selected through the Retrofit Announcement;
- statistics and research concerning energy consumption of large building stocks (provincial and regional level);
- direct surveys and evaluation of buildings included in Concerto Area, supported by GIS maps.
By the correlation of energy performance indicators (kWh/m² year) with the surface data of each building code it is possible to obtain a descriptive model and a global energy consumption evaluation of a large building stock.

5.16 Examples of buildings analyzed and used as reference in the residential building stock energy model

Neighborhood Renew /
Concerto AL Piano Renew Programme
Energy upgrading and renewal of 299 dwellings belonging to Alessandria Social Housing Association
by Corrado Carbonaro

a| METHOD
- Elements of urban degradation of Concerto AL Piano District
- Design guidelines of RENEW settlement

b| APPLICATION
- Energy Efficiency of Envelope
- Glazed systems
- Passive solar systems
- Equipments
- Linving Comfort
- Synthesis of results in a data profile of RENEW settlement

c| RESULT
- Monitoring report, including post-occupancy evaluation of RENEW settlement
- Monitoring of an apartment on the first floor of the residential building in Via Gandolfi 15

6

Neighborhood Renew /

a| METHOD

Elements of urban degradation of Concerto AL Piano District

Located in the South-East part of the Concerto District, Via Gandolfi, extends for about 500 meters from Via M. Bensi. Twelve buildings for ATC Social Housing Agency residential property overlook the area, each with private garden and garage outside.
All common parts are in visible poor conditions.
The problem of social isolation is clear and the lack of means for integration in the neighborhood and social context of the city immediately follows. The main needs are pointed out:

- establishing the right balance between the existing building and the future new construction;
- enhancing urban maintenance;
- expanding services for the resident (post office, shops,common areas etc.);
- making residents aware that “good maintenance” of the common spaces is fundamental and involve the inhabitants in such operation;
- using colors to homogenize the facades.

Some stretches of property show chromatic differences probably due to the bad functioning of the window seals that favour the flow of rainwater along the masonry.
In all buildings the plaster shows slight breakings or detachments.
Even some plaster cornices have cracked revealing the steel armour underneath. Similarly all properties have showy detachments of plaster on the guardrails of the stairs leading to the boiler room.
The frames are made of different materials depending on the property, generally metal (in most cases). All are equipped with shutters, except for the windows of the stairwells.
Although each building is equipped with a main satellite TV dish, many apartments have been equipped with additional antenna placed outside the windows.
The worst conditions are found in fences, mostly missing, rusted and damaged and in the garage, made at random and leaning against the fences. Fences are not always made with the same materials: in almost all cases they are made of concrete, but sometimes also of prefabricated sheets.

Design guidelines of Renew settlement

The design method to renew followed the compositional process of integrated design, which had as its ultimate goal the energy savings of 30-40% of primary energy consumption for heating and indoor thermal comfort.
The design was carried out in collaboration between the technicians of ATC (Social Housing Agency), experts of Softech and Politecnico di Torino.
In the initial phase of the Workshop organized by Softech and ATC, a participatory approach with the residents of the entire complex was ensured.
The construction company was consulted in the analysis phase of the technology and construction, in order to get a valuable feedback on the application of technologies for the housing retrofit.
Seven steps have characterized the design process, construction and results analysis:

CONCERTO AL PIANO

DG TREN07/FP6EN/S07.71241/038569

RENEW

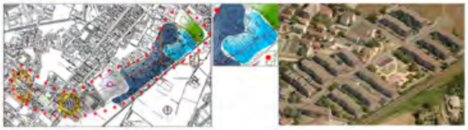
Dwelling n	area (m2)	% saving
299	23.920	48

GOALS

Building and energy renewal of 299 dwellings belonging to Alessandria Social Housing Association to provide well-being conditions of existing dwellings and improve their energy standards

Description of work

The space heating consumption of the existing stock will decrease from the current 247 kWh/m2y to 128 kWh/m2y, with a 48% reduction.



MEASURES

-external insulation in the building facade

-high thermal insulation levels

-greenhouses and glazed balconies

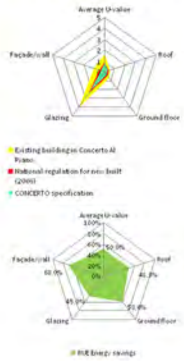
-efficient window systems

-individual heat meters

-thermostatic valves

-BEMS

PERFORMANCES



METHOD

RETROFIT

Dwelling n	area (m2)	% saving
150	12.000	48
450	36.000	35

GOALS

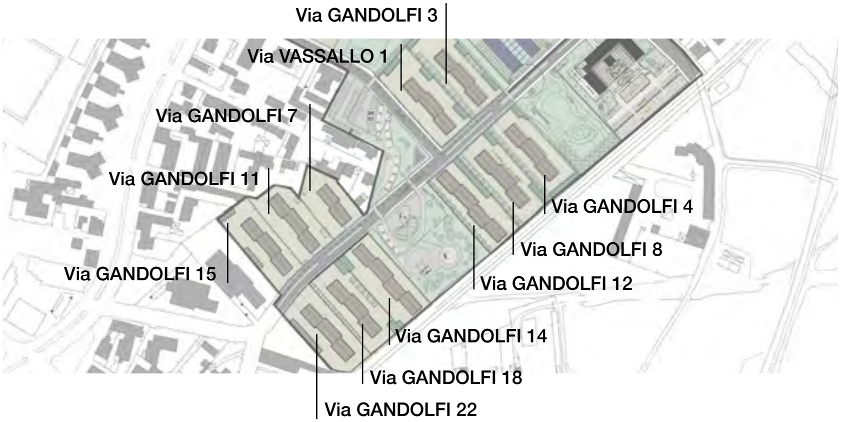
1. Building Energy Auditing (application over 240000 dwgs equivalent floor area)
2. Energy Rehabilitation Programme (48,000 m2 of equivalent floor area including 12000 of r.v.)
3. Energy Rehabilitation Programme of the Refugees Village (up to 150 dwellings or 12,000 m2 of equivalent floor area)

REFUGEES VILLAGE

The Refugees Village will be the first building stock to be retrofitted with energy conservation measures.

This operation will be made in conjunction with a renovation of building elements (facades, windows, roofs, external partitions) promoted by the City of Alessandria, together with the Housing Association of Alessandria and with local owners.

Concerto AL Piano, poster presented at UIA Turin 2008, 23rd Congress of the International Union of Architects (R. Pagani, C. Carbonaro, L. Savio)



1. Integrated design for Retrofitting ATC Complex;
2. Design Technology for building envelope;
3. Energy evaluation based on Italian regulamentation and energy building certification;
4. Living comfort analysis;
5. Summary of data analysis through Energy data sheets;
6. Monitoring of energy compsumtion of each buildings;
7. Monitoring of indoor comfort.

DESCRIPTION

HOUSING COMPLEX OF VIA GANDOLFI STREET

The ATC Gandolfi settlement is composed of 12 buildings of 4 floors each, characterized by a modular composition. There are 34 modules with 8 apartments for a total of 296 dwellings. The settlement was built between 1973 and 1978, all buildings have the same formal features, but there are differences in terms of the characteristics of the envelope:

- Type A, buildings in Vassallo street N° 1/3/5 and Gandolfi street N° 3/4 8 (Project year 1973), were constitued by exterior walls in air brick with cavity wall without insulation and aluminium windows with simple glass.
- Type B Buildings, buildings in Gandolfi street N° 7/11/15 and N° 12/14/18/22 (Project year 1975) have a similar statigraphy but with 4 cm of glass wool insulation in cavity wall and steel windows with double glazing (4-6-4 mm).

GEOMETRICAL DATA

- Type A – 12 modules with 8 dwellings each, n° floors: 4
  Gross heating volume: 29157,6 m^3
  Gross heating area: 8697,6 m^2
  n° dwellings: 96
  Average dwelling area: 90,6 m^2

- Type B – 22 modules with 8 dwellings each, n° floors: 4
  Gross heating volume: 53455,6 m^3
  Gross heating area: 15945,6 m^2
  n° dwellings: 176
  Average dwelling area: 90,6 m^2

b| APPLICATION

Energy efficiency of envelope

NEEDS

Reduce the energy consumption of winter heating.

STRATEGY

The energy recovery program of ATC housing complex in via Gandolfi was held in parallel with the process of building renovation. Various energy measures were planned:

- wood fiber coat insulation on the external walls
- windows substitution with airtight window frames and low emission glazing
- transformation of the balconies in passive solar greenhouses through the insertion of glazing systems
- Metering and control of individual consumption
- The buildings, initially equipped with centralized systems, will be connected to the network of district heating (heat exchangers in place of the existing boilers).

Individual homes were equipped with individual heat metering and sensors. Centralization will enable significant benefits in terms of:

- Effectiveness of maintenance
- Greater security
- Reduction of individual consumption
- Reduction of air pollutants.

Glazed systems

All windows of the buildings will be replaced with new galvanized steel frames with PVC roller blind and double glazed (consisting of two sheets of 4mm thick glass and a third cavity 12 mm).

U= 2,20 W/m^2K

Wall Layers and Trasmittance Value /
Building Type A

	External Wall	th. cond. W/(mK)	Thickness m
Original layers	Plaster	0,9	0,015
	Double Brick	0,36	0,12
	Lime Mortar	1,4	0,01
	Air Cavity Wall	0,19	0,05
	Airbrick with 4 Holes	0,36	0,08
	Gypsum Plaster	0,7	0,015
Addings	Wood Fiber Insulation Panel	0,042	0,08
	Plaster abd Fiberglass Plaster Net		
	R (mK)/W	3,29	
	U W/(mK)	0,304	

	Basement	th. cond. W/(mK)	Thickness m
Original layers	Tiled Floor	1,2	0,02
	Subfloor	0,9	0,08
	Insulating Concrete Screed with expanded clay	0,45	0,06
	Double Panels Covered with Resin	0,06	0,02
	Clay-Cement Mix Floor	0,8	0,26
	R (mK)/W	1,089	
	U W/(mK)	0,918	

	Upper floor ubder roof	th. cond. W/(mK)	Thickness m
Original layers	Insulating Concrete Screed with expanded clay	0,45	0,05
	Clay-Cement Mix Floor	0,8	0,26
	Gypsum Plaster	0,7	0,015
Addings	Wood Fiber Insulation Panel		
	R (mK)/W	3,208	
	U W/(mK)	0,312	

Passive solar systems

NEED

Reduce energy consumption for winter heating.

STRATEGY

In balconies on the front south / west of the buildings the greenhouses are realized. The existent lodges are closed by sliding windows to obtain the integration of passive heating in winter. The windows create an intermediate space (buffer space), very useful for the reduction of heat loss. The contribution of solar greenhouses calculated by the UNI EN ISO 832: UNI TS 11300 and the 2008 has an average value for each building of about 2.15 kWh/m^2 year.

Energy performance evaluation of passive solar greenhouse of eleven buildings in Gandolfi street

The energy renovation of eleven buildings owned by the ATC of Alexandria, was realized through external insulation of walls, replacement of windows with more efficient glazing and closure of the lodges facing South West with windows forming the greenhouses .

To close the existing lodges new frames were inserted with the following characteristics:

- aluminium windows;
- laminated safety glass according to UNI EN 12543.

The laminated glass of the windows of new greenhouses, necessary for security reasons especially on the lower floors, has been chosen to maximize the transmission of solar radiation, while the frame without thermal cut has been chosen to minimize the costs. The greenhouse, exposed to 47 degrees South West, consists of:

- a masonry parapet insulated with coat wood fiber to the outside;
- envelope walls between greenhouse and dwelling without thermal insulation;
- floor and ceiling not insulated as well;
- the geenhouse has a depth of 1.1 m and a width between 4.9 m and 4.64 m, with a net area ranging between 53.5 and 45.8 m^2. The height of the lodges is 3 m. The evaluation of the expected gains in energy has been developed according to the UNI EN 832: 2001, replaced in 2008 by UNI TS 11300, which does not essentially change the calculation method for greenhouses.

The calculation procedure is carried out according to three equations evaluated separately representing:

- the heat loss through greenhouses (Q_{ts});
- the gain due to the storage of heat energy from the walls delimiting the greenhouse, resulting from direct radiation ($Q_{SE,S}$);
- the direct gain in heated rooms($Q_{s,s}$);
- the total annual energy contribution of greenhuse is calculated by the following formula: $Q_{tot=} Q_{SE,S} + Q_{s,s} - Q_{ts.}$

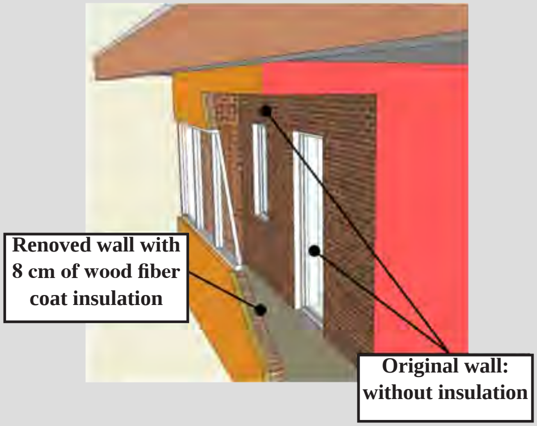
Evaluations were made for two types of greenhouses of Via Gandolfi buildings depending on the degree of insulation of the walls between the heated space and the sunspace: those with walls originally insulated and those with non-insulated walls.

The difference compared with the expected results is minimal. It mainly depends on the heat storage and the difference in heat lost through radiation.

Energy performances evaluation of passive solar greenhouse of buildings without insulation

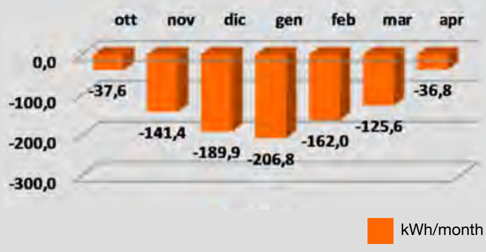
The ‘loggia’ of the 1973 buildings was characterized by an envelope without insulation determining relevant heat losses, but a high efficiency of thermal energy storage in the massive walls. These buildings are:

- Via Vassallo n°1
- Via Gandolfi n°3
- Via Gandolfi n°4
- Via Gandolfi n°8



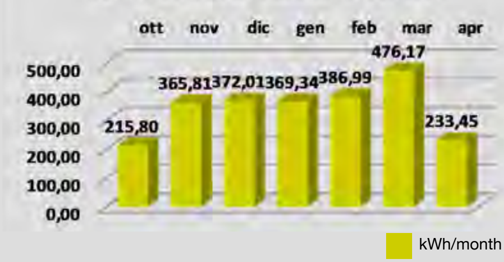
Qts: Evaluation of transmission losses through greenhouses
The analysis of the dispersions through the greenhouse was carried out according to the following formula linked to the local external temperatures.

Q_{ts}: Transmission losses through space sunny

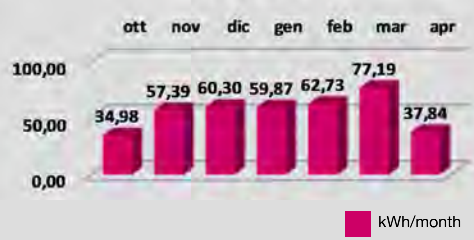


Energy performances evaluation of passive solar greenhouse of buildings without insulation

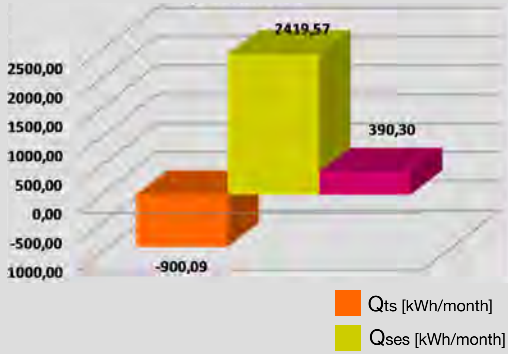
$Q_{SE,S}$: Free monthly energy due to the reduction of transmission losses



$Q_{S,S}$: Supply of heat due to direct solar radiation in the heated space



Total annual energy contributions of greenhouse



QSE,S : Assessment of the amount of solar energy due to greenhouse being adjacent to heated spaces

The free solar gain is mainly due to the storage capacity of the massive walls of the greenhouse and is calculated using the following formula.

Qs,s: Evaluation of the contribution of direct solar energy

The contribution of direct solar energy is due to solar radiation that enters directly into the heated space, after crossing the greenhouse. It is calculated using the following formula.

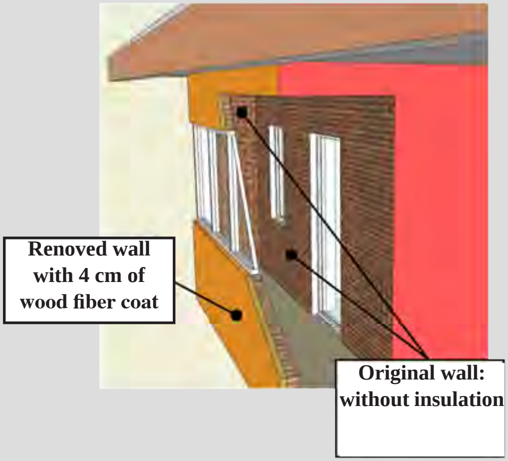
Total annual energy contribution of solar greenhouse

The energy production of a passive solar greenhouse, is then determined by the difference between solar gains (direct contributions and displayed storage temp of the masses) and dispersion.

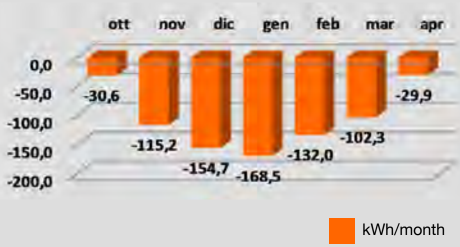
Evaluation of energy performances of passive solar greenhouse of building with 4 cm of insulation

The 'loggia' of the 1973 buildings was characterized by an envelope with 4 cm of insulation. These buildings are:

- Via Gandolfi n°11
- Via Gandolfi n°12
- Via Gandolfi n°14
- Via Gandolfi n°15
- Via Gandolfi n°18
- Via Gandolfi n°22

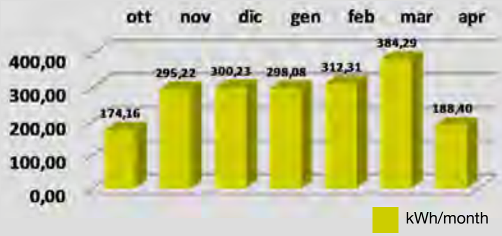


Q_{ts}: Transmission losses through space sunny

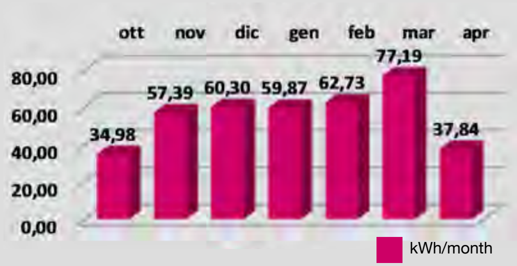


Evaluation of energy performances of passive solar greenhouse of building with 4 cm of insulation

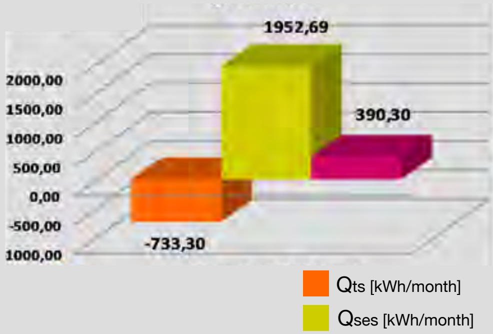
$Q_{SE,S}$: Free monthly energy due to the reduction of transmission losses



$Q_{S,S}$: Supply of heat due to direct solar radiation



Total annual energy contributions of greenhouse



Equipments

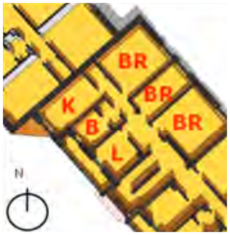
The heating systems final design equipment was characterized by:
Heat exchange stations connected to the district heating network

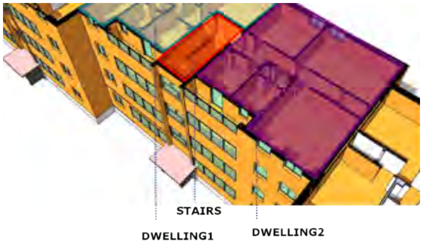
- Heat metering at building scale;
- Heat metering for each apartment;
- Water accounting for each apartment;

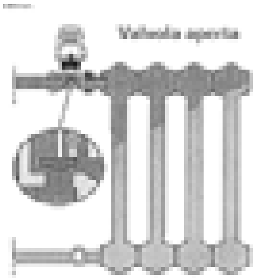
Thermostats in each apartment for regulation of the heat supplied
Subsequently, in agreement with the coordination team of Concerto AL Piano project, the ATC of Alexandria decided to improve the control systems and to increase the equipment for regulation of heat consumption with the adoption of:

- thermostatic valves;
- remote monitoring systems of the of thermal energy, electricity, hot and cold water data consumption, for each apartment.

These important regulation and control systems of thermal energy was applied in the ATC village during the winter







season of 2011.

Living comfort

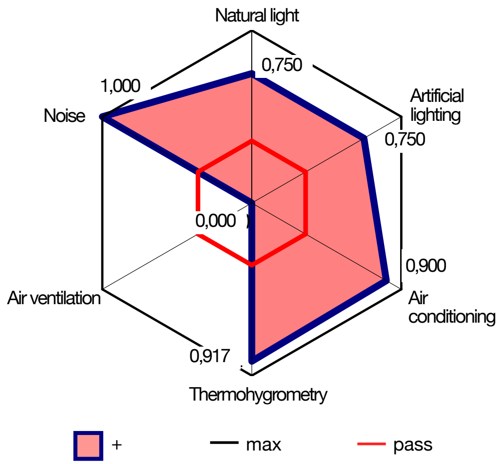
The sustainability of a building is not to be evaluated only in terms of energy, but also according to criteria of living comfort. Through the evaluation of the indicators below, a good performance of indoor environments in terms of lighting , acoustics, ventilation, temperature and humidity, both in winter and summer, was meant to be ensured
The method used was based on an evaluation of a standard dwelling, of medium size, with characteristics of exposure to solar radiation and heat loss that were neither favorable, nor unfavorable.

The project was studied also to ensure the quality of the following indoor comfort fields:

- THERMAL COMFORT: assessment of thermal comfort after the insulations of wall and windows substitution;
- THERMAL INERTIA: assessment of thermal comfort after the insulations of wall;
- NATURAL LIGHTING: assessment of natural lighting comfort in all the most important rooms;
- AIR CHANGE: assessment of air change rate in a all apartment rooms;
- SOUND PRESSURE LEVEL: assessment of the improvement of acoustic comfort.

Results of comfort indoor analysis

The Energy refurbishment of the Via Gandolfi complex improved the quality of residential comfort.
Compared to the standards of national regulamentation a significant increase in terms of climatisation and sound pressure has been registered.
The natural lighting and ventilation measures have not undergone substantial changes, since it is not possible to modify window systems.
The chart below shows the gain compared to the national regulation and the excellent practice.



Dwelling Results		Living Room	K	B. Room 1	B. Room 2	Allowable Range
Wall surface temperature (K)	Ts	verified	verified	verified	0	14<Ts<25
Radiant average temperature (K)	Tmr	19,17	19,25	19,17	19,16	17<Tmr<21
Operating temperature (K)	Top	19,58	19,63	19,59	19,58	18<Top<20
Hygrothermal verify (°C/°C)	Pa	0	0	0	0	no moisture
Thermal inertia factor (m^2/m^2)	i	0,73	1,97	0,74	2,69	$i > 0,5m^2/m^2$
Dailylight factor (%)	η_m	3,04%	2,76%	3,03%	2,69%	$\eta_m > 2\%$
Number of air change (m^3/m^3h)	n	0,55	0,52	0,60	0,70	$n > 0,5m^3/m^3h$
Sound pressure level (dB)	L	28,04	29,79	29,19	28,84	L < 45 dB

Synthesis of results in a data profile of renew settlement

The data collection is used to evaluate the Energy performances of each buildings. The analysis are presented in two data sheets:

1. The annual energy and geometric data sheet in which energy demand data are presented, broken down into current, expected energy saving and expected passive solar
2. The Building Energy Specifications Table, in which the expected data of energy demand are evaluated in comparison with the National regulations standards and the energy data before the retrofit process.

The annual energy and geometric data sheet: the graph of monthly energy demand shows the difference of energy saving between the buildings before retrofit activities (red), building with envelope technologies (blue) and building with envelope and passive measures (green).

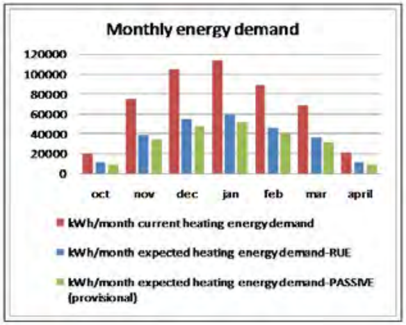
RENEW | via Vassallo 1

Location		Via Vassallo 1
Volume	m^3	29722
Total Area	m^2	2304
Number of dwellings		24
Average flat area	m^2	96
Walls area	m^2	1710
Roof area	m^2	646
Ground floor area	m^2	646
Windows area	m^2	s-w 84 n-e 108

ANNUAL ENERGY DEMAND	HEATING	DOMESTIC WATER HEATING
CURRENT [kWh/year]	493377	59689
EXPECTED-RUE [kWh/year]	257603	42416
EXPECTED-PASSIVE [kWh/year]		-
CURRENT [kWh/m2 year]	260	30
EXPECTED [kWh/m2 year]	128	21
EXPECTED-PASSIVE [kWh/m2year]		-

MONTHLY HEATING ENERGY DEMAND

MONTH	CURRENT kWh/month	EXPECTED RUE kWh/month	EXPECTED PASSIVE kWh/month
oct	20647	10835	9426
nov	75182	39453	34324
dec	104357	54764	47644
jan	113633	59631	51879
feb	89021	46716	40643
mar	68992	36205	31498
april	21545	11306	9836




April 2007


April 2010

Energy data sheet of Concerto AL Piano buildings

c| RESULT

Monitoring report, including post-occupancy evaluation of RENEW settlement

In 2009, following the end of the work of energy recovery and the modernisation of 11 residential buildings owned by the ATC of Alessandria, Politecnico di Torino began the campaign of monitoring in order to assess the actual effectiveness of buildings renovation. The specific objective was to quantify the reduction of consumption of thermal energy in the winter season.

The specific objective was to quantify the reduction of consumption of thermal energy in the winter season, cause have a lot of previous data on buildings energy consumption from energy bills. During all monitoring phase the applied energy measures were only those related to the building envelope: the district heating system will run starting from 2016. The building equipments in order to meter the thermal energy consumed and to regulate the internal temperature have been installed in the 2012. The monitoring was based on a comparison between the previous consumption and consumption after renovation, as follow:

- Natural Gas Consumption years 2006-2009 - through the data provided by the energy bills;
- Natural Gas Consumption years 2009-2011 - through the data recorded directly from the gas meter of each building;
- Natural Gas Consumption years 2011-2013 - through the data provided by the energy bills [1].

Analyzing the natural gas consumption per square meter in 2009-2010 (the first season after envelope retrofit) some buildings, thought to be less efficient than others, had in fact a lower gas consumption per square meter. In the table and the graph below it can be noticed that:

- The building of Via Gandolfi 12, 22 have the highest consumption for no apparent reason;
- The buildings of Via Gandolfi 4 and via Gandolfi 18 have the lower consumptions.

This trend is probably determined by particular inefficiencies of regulatory systems of thermal plants. The existing boilers are equipped with only a single external temperature probe, through which the curve of the control unit's thermal load of the heating system is determined. The buildings thus, at the time, while having a higher efficiency of envelope, due to the coat of wood fiber and new windows, continue to consume a lot, because the control system does not take account of the internal temperatures. We recorded in some dwellings indoor temperatures far from predicted values.

The latest figures of consumption indicate however a strong improvement (see tabs above) due to the inclusion of thermostatic valves and modification of the control units of the heating systems.

The difference between the primary energy value calculated with a specific software for energy certification, and the value based on the true consumption of Natural Gas, is shown in these two tables.

The results of Concerto AL Piano Measures in RENEW settlements, are clarified in the table below.

These results come from the differences between the monitoring campaign before (2006-2009) and after (2009-2010) retrofitting phase. The analysis is based on some estimated data:

1. Since heating systems were installed in the 80s, the ATC was waiting for the new district heating. The efficiency coefficient of the original heating systems is set at 0,7. While

the efficiency coefficient of new heating systems (district heating system based on cogeneration power plant and use of thermostatic valves) is set at 0,85.

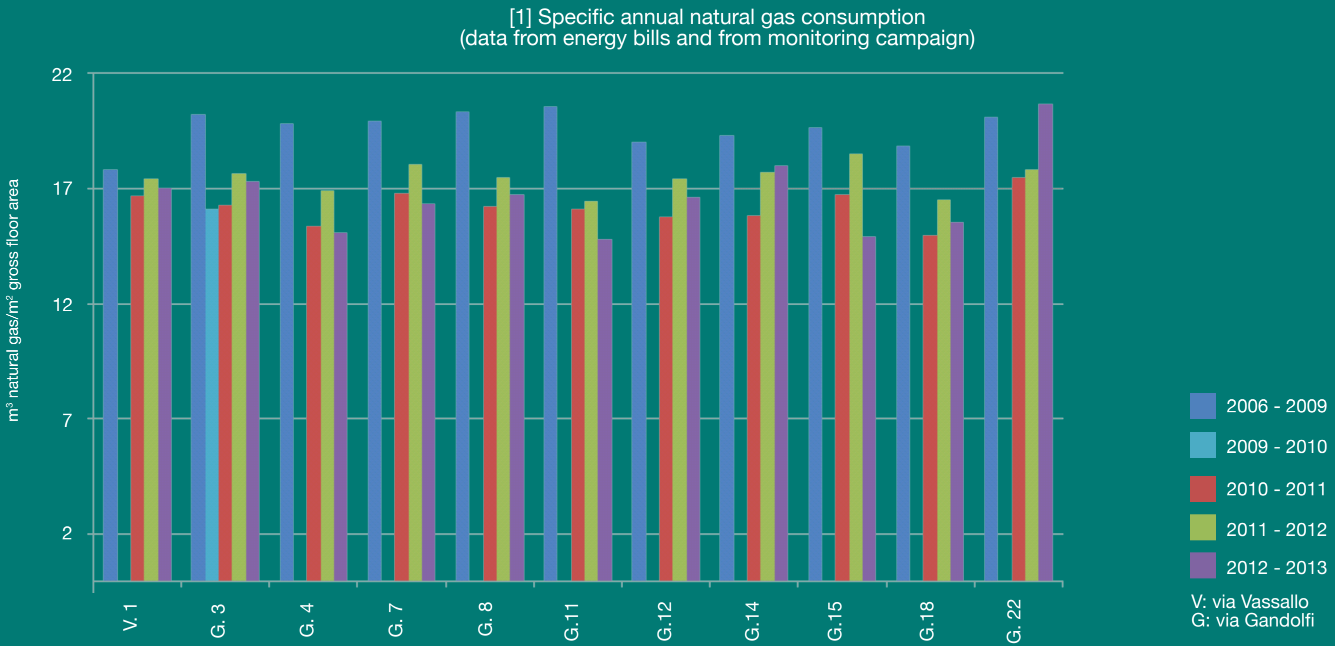
2. Since the monitored data are based on consumption of natural gas per square meters, including domestic hot water and cooking, we calculated 27,5 kWh/m^2 y for DHW (specific primary energy needs) with a specific software. For cooking a percentage of 7.1%, compared to the total energy consumption (ENEA data 2005 for Italian domestic consumption).

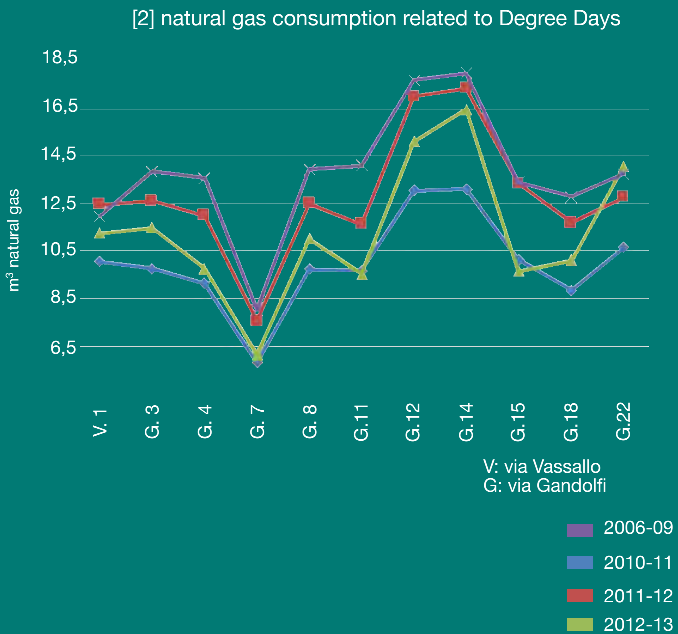
The results highlighted that there is a differences between the buildings of RENEW settlement, probably due to the different state of maintenance of buildings and to the starting situation of the envelope insulation, which in some case was absent, and in others case limited to 4 cm.
The average energy saving expected after the connection to the district heating of all the buildings is 32%, the maximum is 48% (Gandolfi street 8) and the minimum is 19% (Gandolfi street 12).

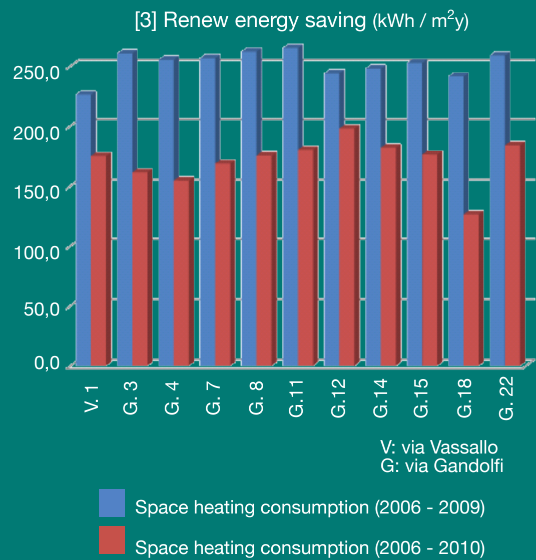








[1] Specific annual natural gas consumption
(data from energy bills and from monitoring campaign)
m³ natural gas/m² gross floor area
22
17
12
7
2
V. 1
G. 3
G. 4
G. 7
G. 8
G.11
G.12
G.14
G.15
G.18
G. 22
2006 - 2009
2009 - 2010
2010 - 2011
2011 - 2012
2012 - 2013
V: via Vassallo
G: via Gandolfi


[2] natural gas consumption related to Degree Days
m³ natural gas
18,5
16,5
14,5
12,5
10,5
8,5
6,5
V. 1
G. 3
G. 4
G. 7
G. 8
G.11
G.12
G.14
G.15
G.18
G.22
V: via Vassallo
G: via Gandolfi
2006-09
2010-11
2011-12
2012-13


[3] Renew energy saving (kWh / m²y)
250,0
200,0
150,0
100,0
50,0
0,0
V. 1
G. 3
G. 4
G. 7
G. 8
G.11
G.12
G.14
G.15
G.18
G. 22
V: via Vassallo
G: via Gandolfi
Space heating consumption (2006 - 2009)
Space heating consumption (2006 - 2010)

Monitoring of an apartment on the first floor of the residential building in Via Gandolfi 15

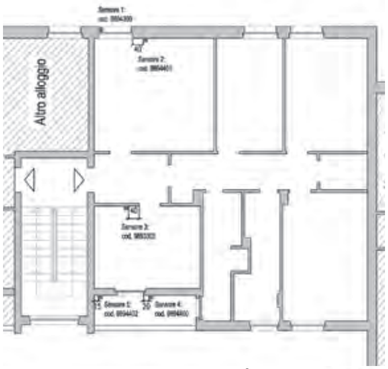
The instrumental monitoring under Concerto AL Piano, involved the recording of temperature, humidity and natural lighting in the environments of a dwelling on the first floor of the residential building located in Gandolfi street N° 15.
Based on some discomfort reported by the user immediately after the installation of insulation systems a monitoring campaign is started with the aim of:

- checking the thermal comfort and humidity in north and south exposures;
- verifying any issues related to the transformation of the open 'loggia' into solar greenhouses.

For this purpose four dataloggers have been used to survey and record the internal temperatures, relative humidity and brightness of the rooms and one datalogger that would record the same measures but outside the rooms.
The dataloggers, branded HOBO® of ONSET COMPANY, were chosen for their versatility and their characteristics of precision and accuracy (see Table A, the next page):

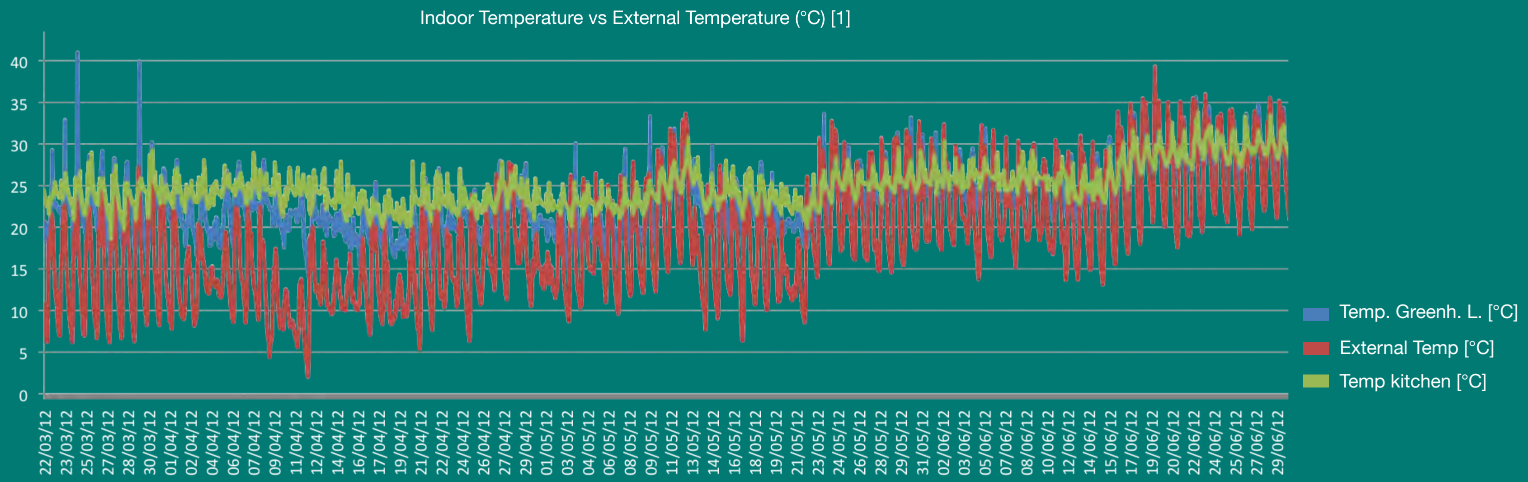
- temperature accuracy: ± 0.35 ° C from 0 ° to 50 ° C;
- accuracy R.H. : ± 2.5 from 10% to 90%;
- • Light Intensity accuracy. : 100% for a wavelength range between 550 and 600nm, between 60 and 80% for a wavelength range between 500 and 550 nm;
- Temperature Resolution: 0.03° C to 25°C;
- Resolution U.R.: 0.003%

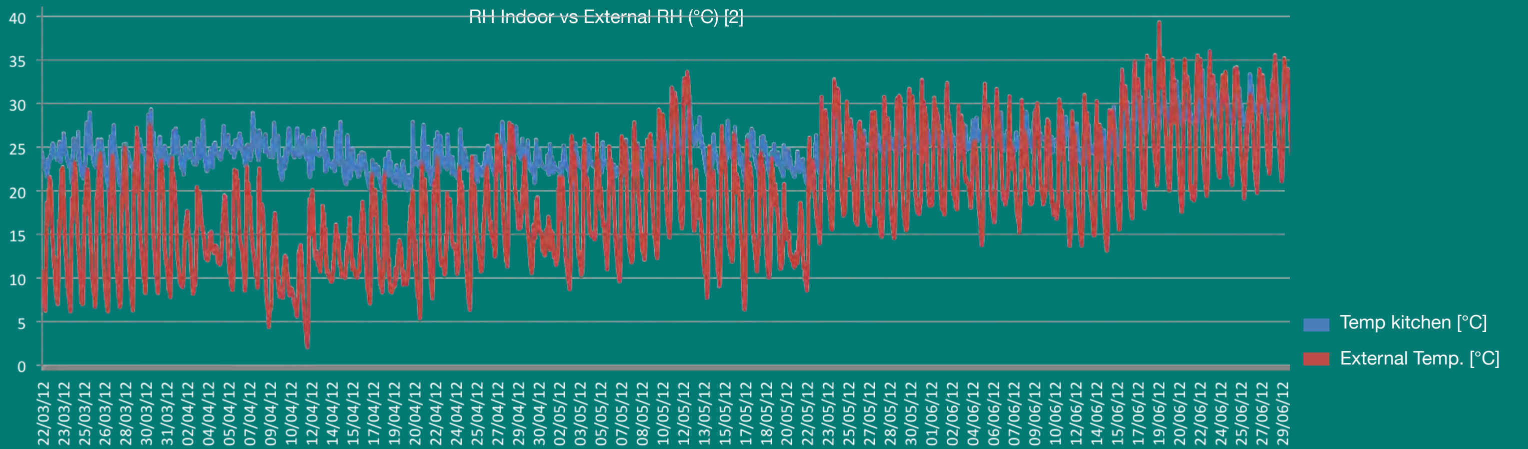
It was possible to record up from 22/03/2012 to 6/06/2012, in a first tranche of measurements, check the trend of dwelling in spring and summer. The measurements were subsequently suspended for difficulties in interfacing with the users, and resumed on 22/07/2013 to record the trend in summer and winter seasons.
The test dwelling has a net surface of 96.8 m^2 and consists of: a kitchen with adjoining greenhouse, a living room facing South-West, three bedrooms, two bathrooms.
The results show us a discomfort due to very high indoor temperatures, due to an excessive supply of thermal energy from the boiler.
The greenhouses monitoring return good data both in terms of temperature and moisture.
The seasonal graphs **[1]** identify a clear difference between the temperature of the greenhouse and the outside temperature during the heating phase (until April 15). The analysis of the temperatures in the next step shows an alignment between the two temperatures, probably determined by the tenants opening the greenhouse

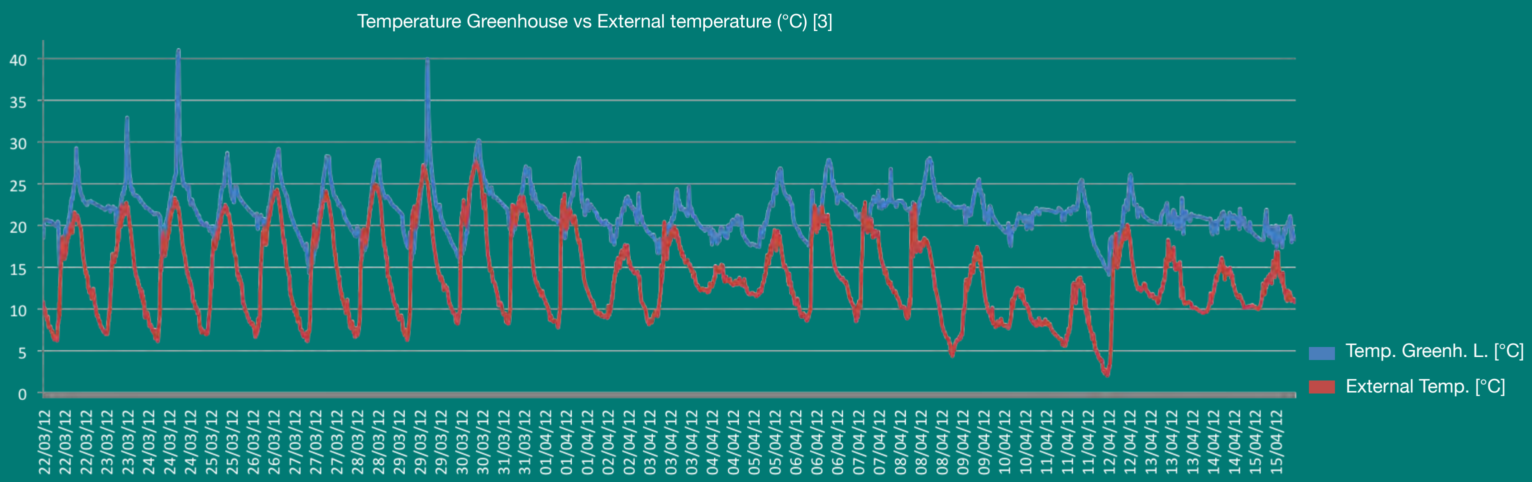


• Net area apartment: 96,8 m^2
• Net volume apartment: 290,4 m^3

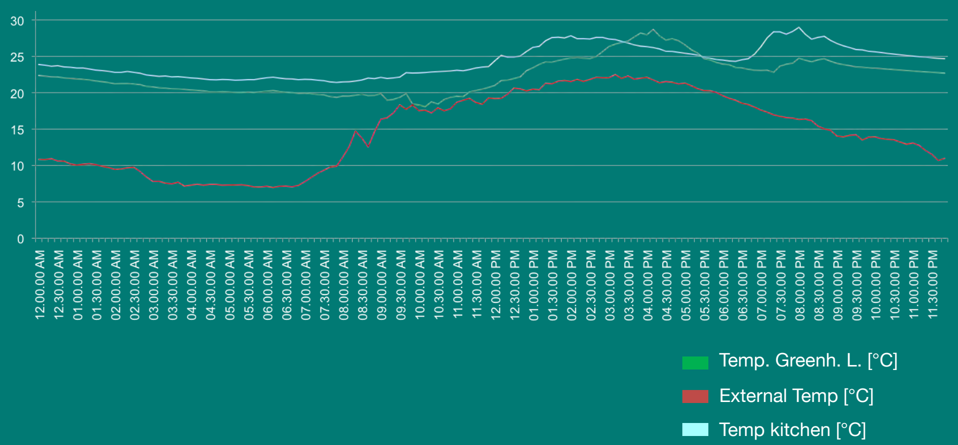
when the temperature is too hot.
In the heating season the trend lines in the graph **[3]**, point out a difference between the inside and outside temperatures of about 5-10 ° C, showing that the greenhouse is working properly and lead to real energy savings. The kitchen temperature is similar to the greenhouse: in winter it is quite high causing thermal discomfort in some moments of day (probably when the tenants are cooking).
By the analysis of these graph we can conclude that the greenhouse technology applied in a renovated dwelling gives good results
The comparison between the relative humidity values shows that in the greenhouse condensation is absent and the range of RH is also good in the kitchen **[2]**.


Indoor Temperature vs External Temperature (°C) [1]
Temp. Greenh. L. [°C]
External Temp [°C]
Temp kitchen [°C]

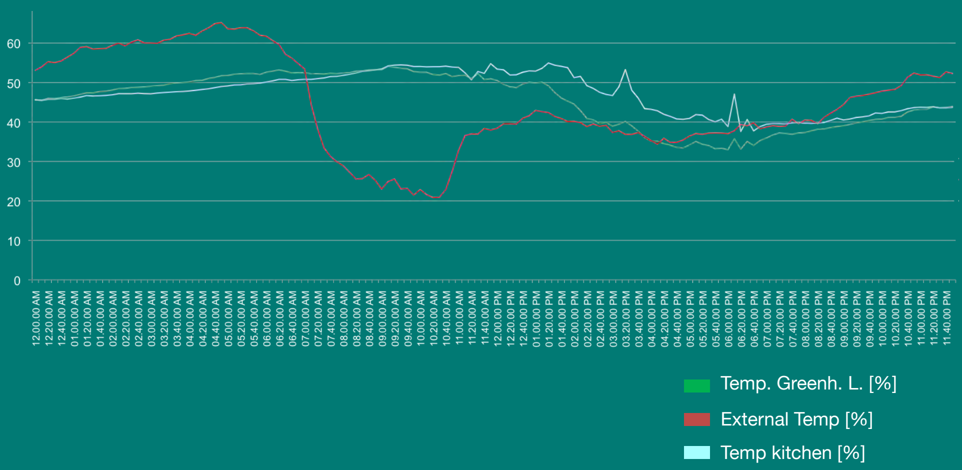

RH Indoor vs External RH (°C) [2]
Temp kitchen [°C]
External Temp. [°C]


Temperature Greenhouse vs External temperature (°C) [3]
Temp. Greenh. L. [°C]
External Temp. [°C]

Daily trend of Temperature - 25/03/2012 (°C)



Daily trend of RH - 29/06/2012



Very interesting is the daily temperature trend during cold and warm seasons:

• COLD SEASON: temperatures of kitchen and greenhouse are characterized by a clear regularity, leading to the reduction of outdoor temperatures effects, especially during the night. The indoor temperature still is very high, due mainly to a central heating system that has not been improved in conjunction with the envelope insulation system (the change takes place once connected to the district heating network).

• HOT SEASON: temperatures of kitchen and greenhouse are very close to the external temperatures, probably due to the simultaneous opening of the doors of the greenhouse and the kitchen by the tenants along the daytime.

Eco -Village & Elderly New /

AL Piano New Building Programme

by Corrado Carbonaro

a|1 METHOD_NEW Eco-Village
- Design guidelines of NEW Eco Village settlement
- Energy measures and environmental design

b|1 APPLICATION_NEW Eco-Village
- Micro-climatic houses
- Energy efficiency of envelope
- Passive solar systems
- Equipments
- Energy production from solar technology systems in the new eco-village
- Radiation analysis
- Design of photovoltaic system on the Microclimatic houses
- Solar thermal collectors

c|1 RESULT_NEW Eco-Village
- Energy verify and energetic contribution of technology measures
- Final energy demande of new eco-village
- Results of comfort indoor analysis

a|2 METHOD_NEW Social Elderly
- Design guidelines of NEW Social Elderly

b|2 APPLICATION_NEW Social Elderly
- Energy measures and environmental design
- Energy efficiency of envelope
- Energy production from solar technology systems in the social elderly
- Design of photovoltaic system on the New Social Elderly
- Solar thermal collectors

c|2 RESULT_NEW Social Elderly
- Energy verify and energetic contribution of technology measures

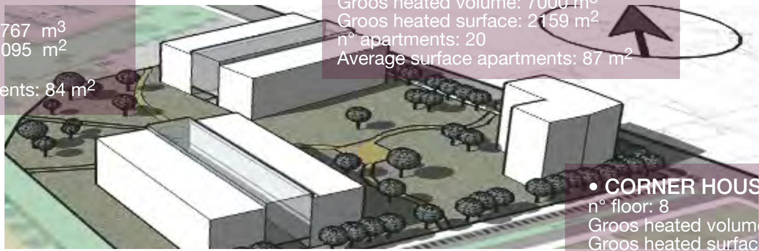
7

Eco -Village & Elderly New /

Concerto AL Piano, poster presented at UIA Turin 2008, 23rd Congress of the International Union of Architects (R. Pagani, C. Carbonaro, L. Savio)

The new buildings in Concerto AL Piano have to be divided according to the typology of the final user. The New Eco-Village is a residential settlement built by private builders, the New Elderly Homes, realized by the Social Housing Agency (ATC), are designed to host self-sufficient elderly people.

a| I METHOD



Design guidelines of NEW Eco Village settlement

The settlement of the new building called “New Eco-Village” is located on a free building lot, in the north area of Concerto AL Piano.
The construction of two different type of buidings was planned: the Corner House and the Micro-climatic Houses in 104 properties distributed as follows:

- Microclimatic houses 1-2: No. 40 dwellings;
- Microclimatic houses 3- 4: No. 40 dwellings;
- Corner house: 24 dwellings.

All buildings are characterized by high energy efficiency of the envelope and use of passive and active solar technologies. In terms of thermal transmittance the Concerto AL Piano project improves the U values of envelopes by 63% compared to the national legislation.

Energy measures and environmental design

The New Eco-Village is characterized by high energy and environmental sustainability obtained using the following design measures:

1. ENERGY EFFICIENCY

- Extra walls insulation using 14 cm of cellulose fibre insulation in the walls cavity;
- Airtight windows and low-emissivity glass (U = 1.6 W/m2K);
- Greenhouses which can be opened and converted into balconies during summer with control devices.

2. RENEWABLE ENERGY SOURCES

- Connection with the district heating system;
- Solar water collectors for domestic hot water needs of each dwelling;
- Integrated photovoltaic systems connected to the local power grid.

3. LIGHTING

- High efficiency lighting for indoor and outdoor resulting in an increase of lighting by 33% compared to the national regulation.

4. VEGETATION

- Green public spaces and integration of vegetation in parking areas.

5. WASTE

- New waste collection system for the whole district; underground ecological area for waste collection.

6. WATER

- Water metering devices, toilet double flush systems, low-flow shower heads, rain water collection for irrigation.

b|I APPLICATION NEW Eco-Village

7.MOBILITY

- Bicycle paths and new parking; Reorganization of integrated public mobility.

Micro-climatic houses

Micro-climatic buildings are based on the “atrium” solution: two building blocks are linked together by transparent technology to determine an intermediate climate in winter.
In summer the large openings at the ground level and upper level, in addition to operable screens, guarantee adequate shadow and natural ventilation. The atrium is equipped with side openings up to four meters high in order to allow adequate natural ventilation of the glazed environment.
Inside the atrium a winter garden with variety of plants is created. The heating energy consumption of the micro-climatic buildings is up to 45% lower than requested by the Italian regulation.

Energy efficiency of envelope

NEEDS:
Reduction of space heating energy consumption
STRATEGY:

- Extra wall insulation using 14 cm of cellulose fibre in the walls cavity. The extra insulation improves the comfort of inhabitants by increasing internal wall surface temperatures and radiant average temperatures.
- All windows are equipped with low-emissivity glazing allowing large transparent surfaces compatible with the requirements of internal lighting.) ($U= 1,6\ W/m^2K$)

The study of each technological node and of the envelope layers was the result of an integrated design process developed by architects, engineers of the building companies, and researchers of Politecnico Torino and Softech. During the technical sessions, experts evaluated each design proposal, verifying the related energy performances. This iterative method was applied for each building.
It’s very important to remark that Concerto AL Piano project started in 2005-2006, when in Italy sustainable energy of building sector was not yet a main goal. In fact initially the aims set seemed too high for the market.

Basement	λ [W/mK]	thickness [cm]
Cement plaster	1,4	1
Beams with predalles 5-20-5	0,24	25
Concrete with expanded clay	0,24	10
Polystyrene extruded panel	0,036	10
Polyethylene	0,02	0,35
Concrete screed	0,93	6
Tiled floor	1,0	2
$R_{si} + R_{se}$	R (mK)/W 4,76	
$U = 1 / (R_{si}+R_{t}+R_{e})$	U W/(mK) 0,21	

Greenhouse wall	λ [W/mK]	thickness [cm]
Gypsum and lime plaster	0,70	1
Poroton P700 block	0,17	25
Air cavity wall	0,55	1
Cellulose Fiber	0,058	8
Airbrick	0,50	12
$R_{si} + R_{se}$	R (mK)/W 3,28	
$U = 1 / (R_{si}+R_{t}+R_{e})$	U W/(mK) 0,305	

The builders, while feeling that the market sooner or later would have required a significant improvement in the sustainability of buildings, appeared undecided on the target value of energy consumption per square meter in winter to be 50 kWh/m^2 or 30 kWh/m^2. Between 2005 and 2010 in Italy there was a sudden alignment with the Northern European standards, first in terms of legislation, and later on the market.

For the building partners of Alessandria, Concerto AL Piano represented an opportunity to tackle innovation and, almost simultaneously with the legislative progress.

Nowadays the energy targets for new buildings are much stricter but, in the initial design phase, there was a lot of uncertainty about the new technologies, the way to install them and the way to calculate their performances (i.e. wood fiber insulation).

In the executive design of the New Eco-Village the thermal bridges are minimized thanks to the insulation layers being placed outside the wall and to load-bearing structures. The outer wall is finished with brick masonry, which protects the insulating layer.

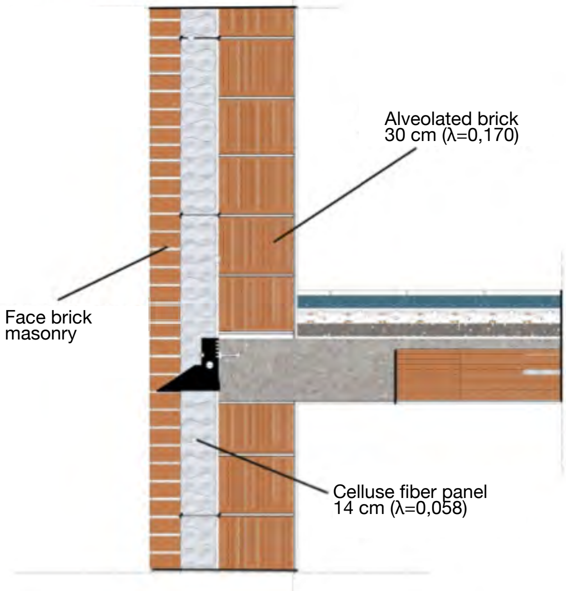
The non bearing masonry facing indoors, is made of hollow brick blocks

External Wall	λ [W/mK]	thickness [cm]
Gypsum and Lime Plaster	0,700	1
Alveolated clay block	0,170	30
$R_{si} + R_{se}$	R (mK)/W 4,55	
$U=1 / (R_{si}+R_t+R_e)$	U W/(mK) 0,22	

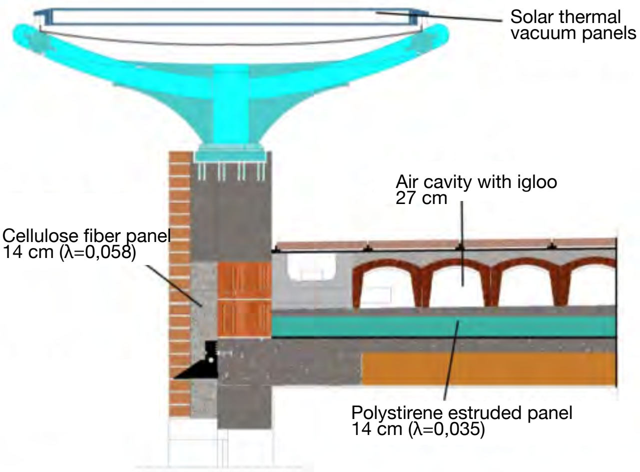
Roof	λ [W/mK]	thickness [cm]
Gypsum and lime plaster	0,70	1
Hollow Block	0,60	18
Concrete with sand and gravel	2,50	4
Polystyrene extruded panel	0,035	14
Concrete	1,28	6
Air cavity with igloo	1,05	27
Concrete with sand and gravel	1,31	4
Bituminous membrane	0,26	0,8
Air cavity	0,14	2
Floring tiles	1,40	4
Rsi + Rse	R (mK)/W 5	
$U= 1 / (R_{si}+R_t+R_e)$	U W/(mK) 0,20	

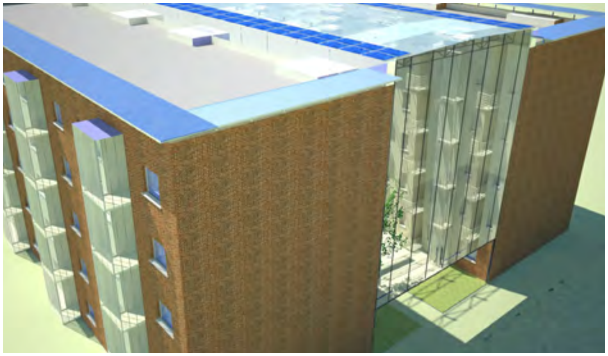
Wall staircase	λ [W/mK]	thickness [cm]
Gypsum and lime plaster	0,70	1
Airbrick	0,36	8
Insulation panel XPS	0,036	8
Alveolated clay block	0,17	20
Gypsum and lime plaster	0,7	1
$R_{si} + R_{se}$	R (mK)/W 0,26	
$U= 1 / (R_{si}+R_t+R_e)$	U W/(mK) 0,27	

External Wall Stratigraphy of microclimatic House



Roof Stratigraphy of microclimatic House





"Poroton", currently widely used by construction companies, but still quite a novelty in 2005.

Passive solar systems

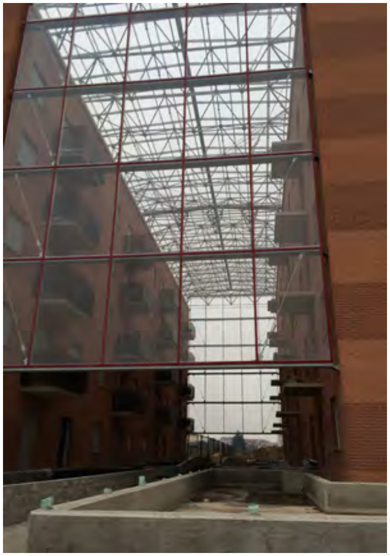
NEED:
reducing energy consumption for winter heating.

STRATEGY:
the greenhouses on S/W and N/E facades integrate the heating systems with passive solar gains. The greenhouses glass oriented to the N/E improve the thermal resistance of dwelling spaces (extra insulation effect). In S/W oriented greenhouses, the control and management systems require simultaneous control of temperature levels in the greenhouse and indoor environment with a thermostatic fan. The windows define an intermediate space (buffer space) reducing the heat loss. For this reason the efficiency of greenhouses remains good even in absence of direct solar radiation.
Laminated glass was chosen mainly to ensure the security of housing of the lower floors, and, concurrently maximizing the transmission of solar radiation.

GEOMETRIC CHARACTERISTICS OF SOLAR GREENHOUSES
Microclimatic house plots 1-2:
- N° 40 greenhouses;
- N° greenhouses S/W (oriented 47° South): 20;
- N° greenhouses N/E (oriented 129° South): 20;
- greenhouse area: 6.12 m^2;
- Storey height: 3.00 m;

Microclimatic house plots 3-4:
- N° 40 greenhouses;
- N° greenhouses S/E (oriented 51° South): 20;
- N° greenhouses N/W (oriented 133° South): 20;
- greenhouse area: 6.12 m^2;
- Storey height: 3.00 m.

In order to understand the energy intake of solar greenhouses the reduction of heat consumption for heating due to passive solar systems was evaluated .
The evaluation of the expected gains has been developed according to the Italian code (UNI EN 832: 2001, replaced in 2008 by UNI TS 11300) .



respectively applied to:

- Heat loss through greenhouse;
- Gain due to the heat storage from walls delimiting the greenhouse;
- Direct gain in heated rooms.

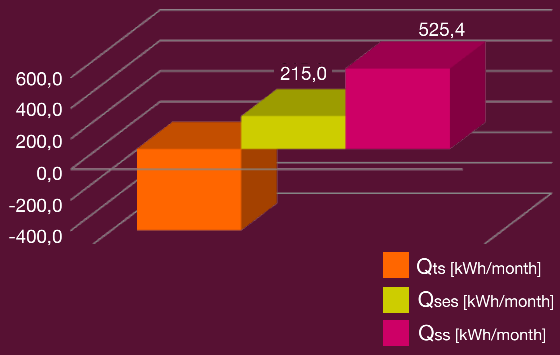
The calculation of the heat balance of solar greenhouses was made according to the following three equations:

1. Evaluation of transmission losses through greenhouse (Qt,s).
2. Assessment of the amount of solar gains from the greenhouse adjacent to the heated spaces (Qse,s). The solar gain is mainly due to the storage capacity of the building masses of the greenhouse.
3. Evaluation of direct gains (Qs,s). The contribution of direct solar gain is due to solar radiation that enters directly into the heated space, after crossing the greenhouse.

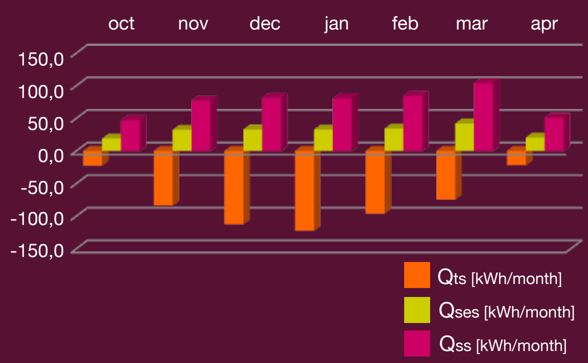
The thermal gain due to the greenhouse results from the last equation:

Qtot= QSE,S + QSE,S - QT,S

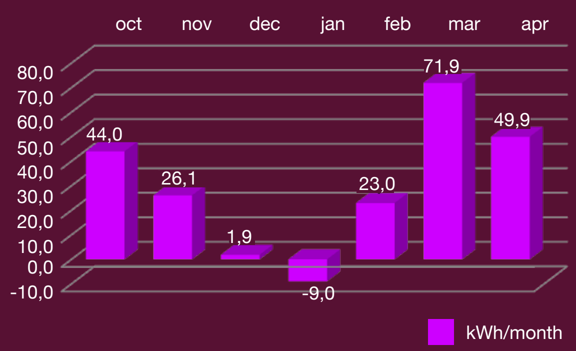
Total energy contribution of greenhouse



Annual thermal balance of greenhouse



Total heat gains in the cold season



Microclimatic House

Passive solar greenhouse, - plot 1

The production of a passive solar greenhouse is determined by the difference between solar gains (direct contributions and storage) and heat losses, as shown in the following chart:

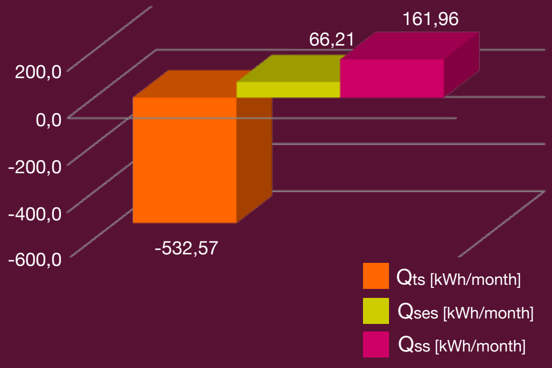
Energy Contribution of Greenhouse				
	Qts kWh/month	Qses kWh/month	Qss kWh/month	TOT monthly kWh/month
Oct	-22,23	19,17	47,09	44,03
Nov	-83,66	32,5	77,25	26,09
Dec	-112,38	33,05	81,18	1,85
Jan	-122,37	32,82	80,6	-8,96
Feb	-95,87	34,38	84,45	22,97
Mar	-74,3	42,31	103,91	71,92
Apr	-21,75	20,74	50,94	49,93
TOTAL	-532,57	214,98	525,43	**208**

Passive solar greenhouse, - plot 2

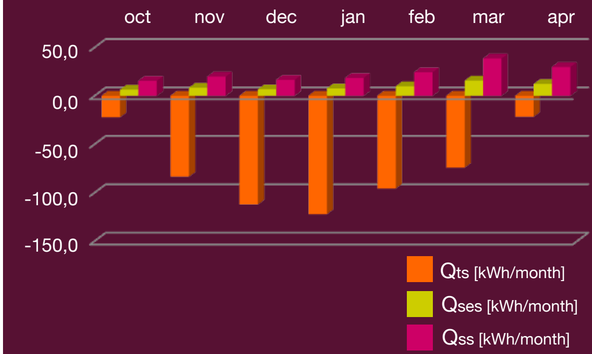
The production of a passive solar greenhouse of plot 2 facing North-East, is shown in the follow chart:

Energy Contribution of Greenhouse				
	Qts kWh/month	Qses kWh/month	Qss kWh/month	TOT monthly kWh/month
Oct	-22,23	6,27	15,41	-0,56
Nov	-83,66	8,28	19,69	-55,69
Dec	-112,38	6,66	16,36	-89,37
Jan	-122,37	7,49	18,4	-96,48
Feb	-95,87	9,81	24,1	-61,96
Mar	-74,3	15,61	38,33	-20,36
Apr	-21,75	12,09	29,68	20,02
TOTAL	-532,57	66,21	161,96	**-304**

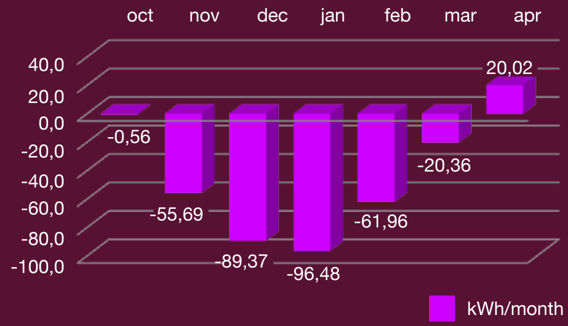
Total energy contribution of greenhouse



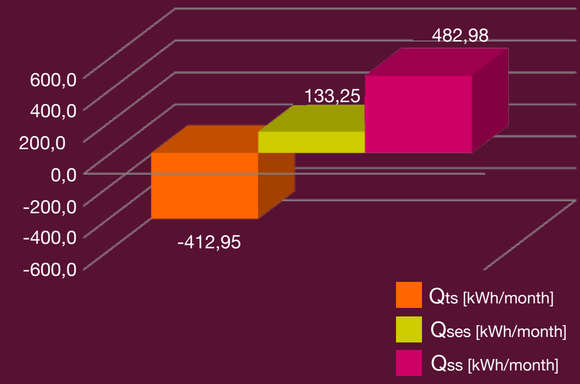
Annual thermal balance of greenhouse



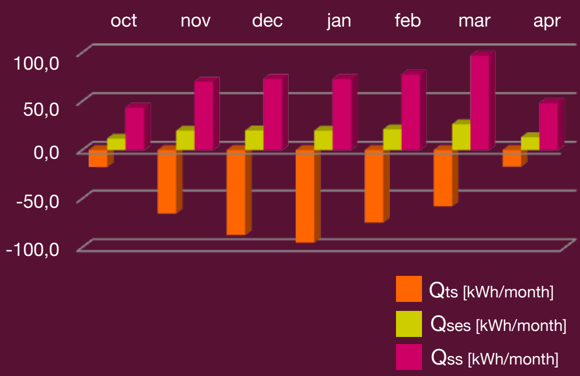
Total heat gains in the cold season



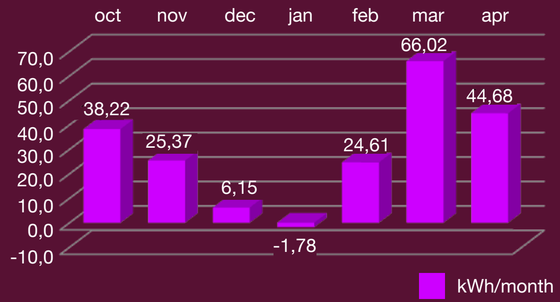
Total energy contribution of greenhouse



Annual thermal balance of greenhouse



Total heat gains in the cold season



Passive solar greenhouse,- plot 3

The production of a passive solar greenhouse of plot 3 facing South-East, is shown in the follow chart:

Energy Contribution of Greenhouse

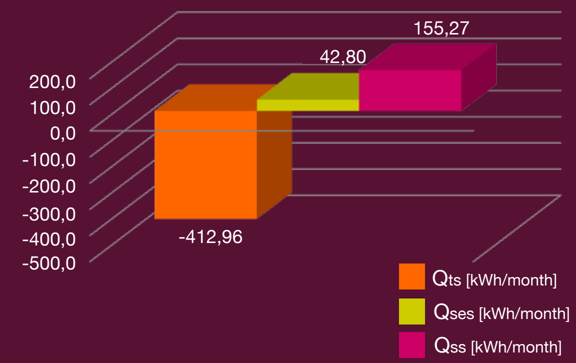
	Qts kWh/month	Qses kWh/month	Qss kWh/month	TOT monthly kWh/month
Oct	-17,24	11,95	43,52	43,52
Nov	-64,87	19,94	70,29	25,37
Dec	-87,14	20,1	73,2	6,15
Jan	-94,89	20,06	73,05	-1,78
Feb	-74,34	21,31	77,63	24,61
Mar	-57,61	26,63	97	66,02
Apr	-16,87	13,26	48,29	44,68
TOTAL	-412,96	133,25	482,98	**203**

Passive solar greenhouse,- plot 4

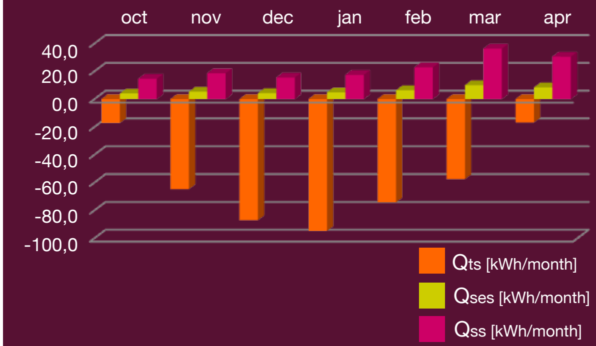
The production of a passive solar greenhouse of plot 3 facing North-West, is shown in the follow chart:

Energy Contribution of Greenhouse				
	Qts kWh/month	Qses kWh/month	Qss kWh/month	TOT monthly kWh/month
Oct	-17,24	3,99	14,54	1,29
Nov	-64,87	5,27	18,58	-41,03
Dec	-87,14	4,24	15,43	-67,47
Jan	-94,89	4,77	17,36	-72,76
Feb	-74,34	21,31	22,74	-45,35
Mar	-57,61	6,24	36,17	-11,51
Apr	-16,87	9,93	30,44	21,94
TOTAL	-412,96	42,8	155,27	**-215**

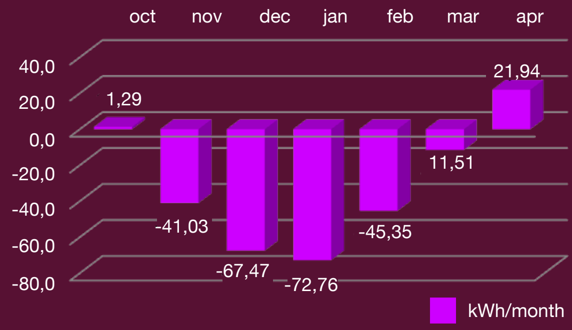
Total energy contribution of greenhouse



Annual thermal balance of greenhouse



Total heat gains in the cold season



MICROCLIMATIC HOUSES: THE ANNUAL ENERGY PRODUCTION OF GREENHOUSES

The analyses previously presented are related to only one greenhouse for each block. In reality each buildings has 20 greenhouses with same orientation. The table below represents a calculation of the energy annually generated by all greenhouses for each building block.
The influence of the greenhouse contribution on expected final energy balance is shown in the below table.

Name of Block	Orientation	N° of Greenhouse	Annual thermal balance for each greenhouse [kWh]	Annual contribution for 1 grennhose without heat losses [kWh/ y]	Net floor area of each building block [m^2]	Annual gain for each block [kWh/ y]	Annual gain for unit surface [kWh/ m^2 y]
Microclimatic h. 1	S-O	20	208	704,41	1687	14808,2	8,8
Microclimatic h. 2	N-E	20	-304	228,17	1687	4563,4	2,7
Microclimatic h. 3	S-E	20	203	616,23	1738	12324,6	7,1
Microclimatic h. 4	N-O	20	-214,9	198,07	1738	3961,4	2,3

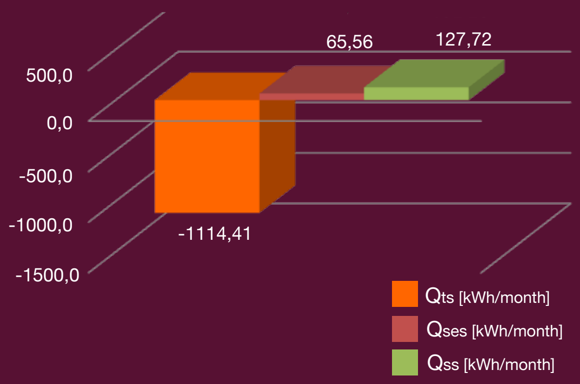
Corner House

PASSIVE SOLAR GREENHOUSE, - CORNER BUILDING

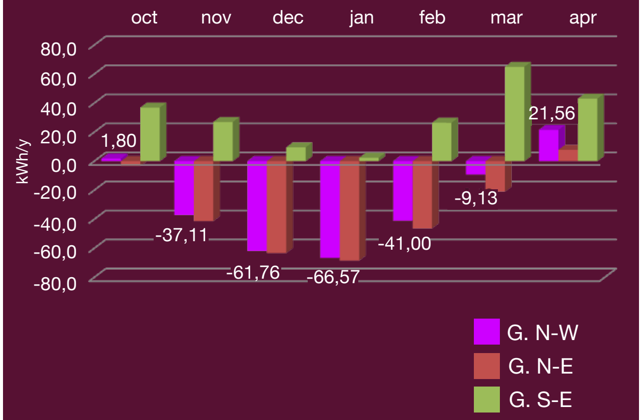
The Corner Building has three type of greenhouse according to orientation and dimension.
The results of the total energy balance of the Corner house greenhouses is shown in the above graph.

Energy Contribution of Three Greenhouse				
	Qts kWh/month	Qses kWh/month	Qss kWh/month	TOT monthly kWh/month
Oct	-46,5	24,2	57,8	35,5
Nov	-175,1	5,7	9,4	-160,0
Dec	-235,2	4,6	7,8	-222,8
Jan	-200,6	5,2	8,8	-242,1
Feb	-155,5	6,8	11,5	-182,3
Mar	-45,5	10,8	18,3	-126,4
Apr	-16,87	8,3	14,2	-23,0
TOTAL	-1114,4	65,6	127,7	**-921**

Global balance related to the three greenhouses



Comparison between energy balances of greenhouses



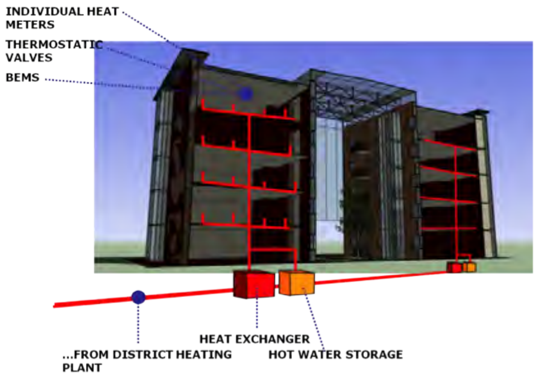
CORNER BUILDING: THE ANNUAL ENERGY PRODUCTION OF GREENHOUSES

The analyses are related to one greenhouse for each orientation. As described, the Corner Building has 24 greenhouses, 8 for each orientation. (S/E, N/E, N/W).
The table below represents a calculation of the annual energy generated by all greenhouses.

Name of Block	Orientation	N° of Greenhouse	Annual thermal balance for each greenhouse [kWh]	Annual contribution for 1 grennhose without heat losses [kWh/ y]	Net floor area of each building block [m^2]	Annual gain for each block [kWh/ y]	Annual gain for unitsurface [kWh/ m^2 y]
Corner house	N-E	8	-235,4	122,9		983,5	0,6
Corner house	S-E	8	-210,4	584,5	1777	4675,9	2,6
Corner house	N-O	8	-192,2	189,8		1518,0	0,9
Total Corner house	-	24	-217,2	897,2	-	7177,5	4,0

The influence of the greenhose contribution on expected final energy consumption is shown in the table below.

	WITHOUT contribute of greenhouses			WITH contribute of greenhouses			
Building Name	Simulation of envelop heat losses [kWh/ m^{2}y]	Simulation of DHW consumption [kWh/ m^{2}y]	Final heat energy consumption expected (with DHW) [kWh/ m^{2}y]	Annual gain for unitsurface [kWh/ m^2 y]	Simulation of envelop heat losses [kWh/ m^{2}y]	Final heat energy consumption expected (with DHW) [kWh/ m2 y]	Percentage of greenhouses contribution on the total [kWh/ m^2 y]
Corner house	49,69	21,25	83,88	4,04	45,65	78,84	5 %



Equipments

The buildings of the New Eco-Village are equipped with systems to ensure:

- Consumption metering;
- Energy saving, for high energy performance;
- Resource saving through heat and rainwater recovery.

The systems are also connected to the district heating network through the heat exchanger in the basement of the buildings. Consumption monitoring is ensured by one counter for each apartment and one placed on the heat

Type of equipment	Equipment description
Power plant of heat generation	District heating network, generated by a biomass cogeneration plant.
Heat metering	Each apartment will be equipped with consumption counter of hot water, cold water, thermal energy for heating. It will also present a counter centralized, necessary to quantify the global consumption of the building.
The heat distribution and regulation system	The heating system in the service of individual units will consist of radiant floor. The heating and domestic hot water systems for space heating will be centralized. The heat distribution and regulation system will be managed with climate control unit (on the two areas to service the heating housing), with adjustment of the flow temperature as a function of the outside temperature.
Hot Water production system	The hot water will be produced by 2 accumulators powered by solar heating and boiler. Each block of ten dwellings will be equipped with a double accumulator constituted by a first accumulator powered by solar thermal and a second accumulator fed by boiler of bake-up.
Power ventilation system	Will be installed controlled ventilation systems with heat recovery air extractors to put in the environments treated. The systems of artificial ventilation will ensure a air flow rate equal to 0.3 / 0.5 vol / h for every dwelling. Thermal efficiency of the heat recovery equipment is 50%.
Devices for heat management	Each room is also equipped with control box of radiant floor complete with three-way valve with climate management of the flow temperature to the radiant floor, control system supply of WC radiator, thermostat with weekly programmability and management of two temperature range levels (day-night). The areas with different exposure will be equipped with thermostatic valves on the radiant floor circuit. Remote control system of the heating system with data transmission, pump failure alarm, hours of operation management, , reading and transmitting accounting, management indoor climate controller.

Electricity production from photovoltaics systems

Unit of Measure	Power of PV plants [kWp]	Electricity production [MWh/ y]	Net area of PV panels [m²]	CO_2 saved * [Ton/ y]
Microclimatic house 1-2	20	21,2	142	13,78
Microclimatic house 3-4	20	21,2	142	13,78
Corner house	10	11,5	71	7,475

* Calculation method: each kWh produced by the photovoltaic system avoids the emission of 0.65 kg of carbon dioxide.

exchanger.

Solar systems in the New Eco-Village

The project at the neighborhood level foresees the achievement of a high degree of energy sustainability by reducing emissions of greenhouse gases.

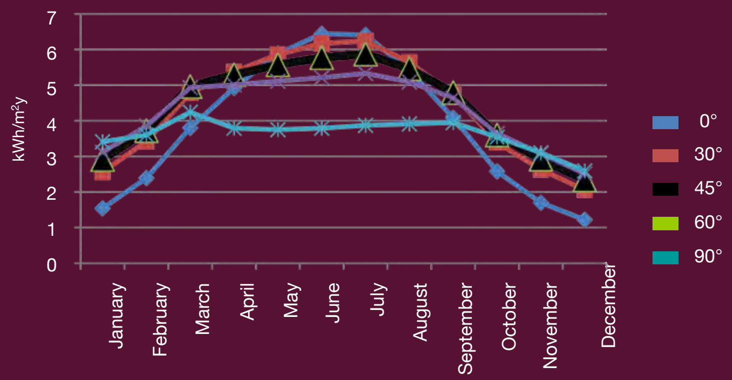
Radiation analysis

Analyses were directed to determine which was the best inclination of solar panels according to an orientation change between 0 ° (South) and 45 ° (East). The results of radiation according to the orientation and tilt of the panels are here presented.
In particular, radiation losses were evaluated and tilt guidelines were given:

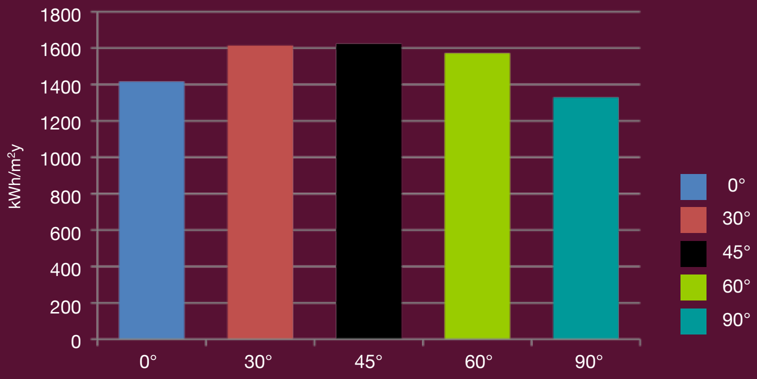
- Maximum radiation (45 ° South);
- Maximum integration with architectural structure shed (45° East);
- Maximum architectural integration

Month	Solar radiation of south orientation [kWh/ m² y]					Percentage of losses (with respect to 45°south) [kWh/ m² y]			
	0°	30°	45°	60°	90°	0°	30° South	60° South	90° South
January	1,54	2,56	2,91	3,11	3,41	47	12	-7	-17
February	2,39	3,42	3,72	3,85	3,6	36	8	-3	3
March	3,8	4,78	4,96	4,93	4,24	23	4	1	15
April	4,92	5,37	5,29	5,01	3,79	7	-2	5	28
May	5,88	5,86	5,57	5,11	3,75	-6	-5	8	33
June	6,44	6,17	5,77	5,21	3,79	-12	-7	10	34
July	6,41	6,24	5,87	5,33	3,87	-9	-6	9	34
August	5,41	5,64	5,46	5,09	3,91	1	-3	7	28
September	4,08	4,74	4,79	4,64	3,95	15	1	3	18
October	2,58	3,39	3,6	3,64	3,54	28	6	-1	2
November	1,7	2,63	2,92	3,08	3,1	42	10	-5	-6
December	1,22	2,06	2,34	2,51	2,59	48	12	-7	-11
Annual	1614	1614	1624	1572	1329	13	1	3	18

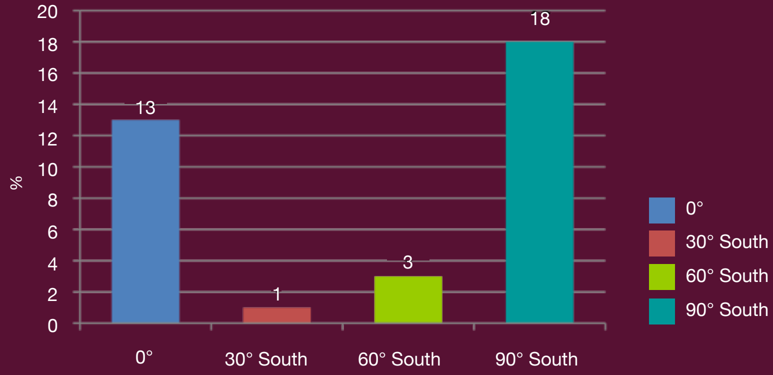
Average Monthly Solar Radiation

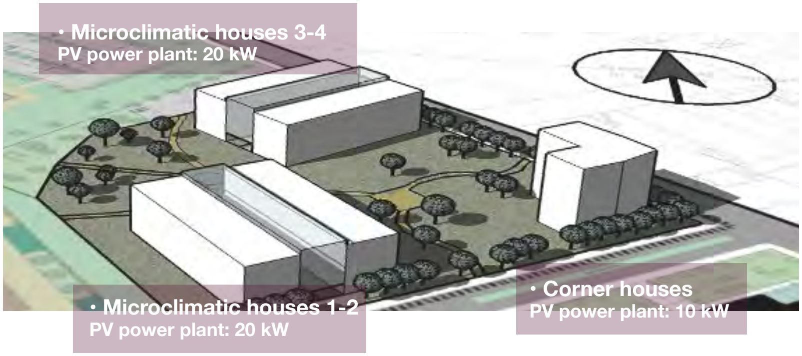


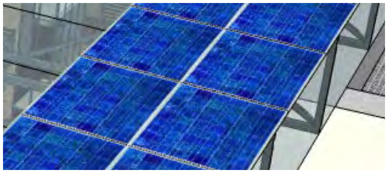
Annual Solar Radiation in Alessandria



Annual Percentage Losses in
Comparison to 45° South Irradiation







with horizontal structure (0°).

Photovoltaic system in the Microclimatic Houses

In order to integrate photovoltaic technology into the buildings structure. a comparison between solar radiation values at various slopes was done. This, highlights how the choice of a maximum integration of photovoltaic technology (0 ° South) leads to a performance loss of 13% compared to the best exposure. For the Corner Building the design choice has priviledges a tilt angle of 10° for photolvotaics panels, compromising between the best architectural integration and a better angle for photovoltaic effectiveness.
The microclimatic buildings, being characterized by the presence of a microclimate atrium connecting two residential blocks, will host the modules on the roof in conjunction with the transparent polycarbonate panels.
The support structure is continuous and integrated with the shape of the building, allowing a minimization of costs of manufacture and assembly.
Not having to separate the photovoltaic strings in function of their mutual shading allows an optimization of space.

COMPONENTS OF PHOTOVOLTAIC PLANT

The plant consists of polycrystalline silicon panels connected to the distribution network owned by the National Electric Company , which through a dedicated counter, measures the amount of electricity flowing into the grid. The equipment for the system operation is characterized by the components listed below.

Photovoltaics modules

Structure: Anodized Aluminium and
Coating: Tempered Glass
Certification: IEC 61215, TÜV Safety Class II, CE.
Panels desciption:

- Type solar cell 125 * 125;
- Maximum power (W) 170;
- Maximum voltage (V) 35.2;
- Open circuit voltage (V) 43.8;
- Circuit current (A) 5:14;
- Maximum power current (A) 4.83;
- Size (mm) 1580 * 808 * 35;
- Weight (kg) 15.5.

Solar thermal collectors

The water solar collectors provide peak energy for water heating of homes of the New Eco-Village and the New Social Elderly Housing. These systems are architecturally integrated on the roofs of new buildings.

NEW ECO-VILLAGE

The total surface of solar thermal collectors for the New Eco-Village amounted to 200 m², with 2 m² of collectors per dwelling and with a coverage of 65% of the domestic water heating needs, which would ensure the achievement of the results shown below.

Each installation is composed of the following devices:

- N° 5 pairs of solar vacuum tube of the collecting surface equal to 2,13 m², with set for flat roof installation;
- N° 1 solar control and management station, circulator glycol, asameter, valves, flow meter;
- N° 10 immersion probes for solar circuit management, Ethernet module for communication of breakdowns and production data;
- N° 2 1500 liters solar storage units stratified type with instantaneous production of sanitary hot water;
- No. 6 copper high contact surface heat exchangers.

The domestic cold water enters through the parallel connection of 12 copper exchanger immersed in the solar storage units. Hot water is also stored from district heating in a 800 liters tank. In case the tap water temperature does not reach the prescribed value the 800 liters tank will supplement the solar production. The control unit of the mixing valve located downstream of the traditional boiler manages the flow temperature of the water units.

DHW production from solar thermal systems

Measure unit	Energy production [MWh/ y]	Net area of S.Th panels [m2]	CO_2 saved* [Ton / y]
Microclimatic House 1-2	47,1	30,6	13,728
Microclimatic House 3-4	47,1	30,6	13,728
Corner House	22,7	14,7	6,432
New Eco-Village	116,8	75,9	33,888

* Calculation method: each kWh produced by the photovoltaic system avoids the emission of 0.65 kg of carbon dioxide.

c|I RESULT

Energy contribution of technology measures

The analysis of energy demand of each building of New Eco-Village shows how the different technologies affect the energy performance of the new buildings.
In the following paragraphs some tables indicating the energy needs of buildings are shown, according to the incremental technology integration on the New Eco-Village.

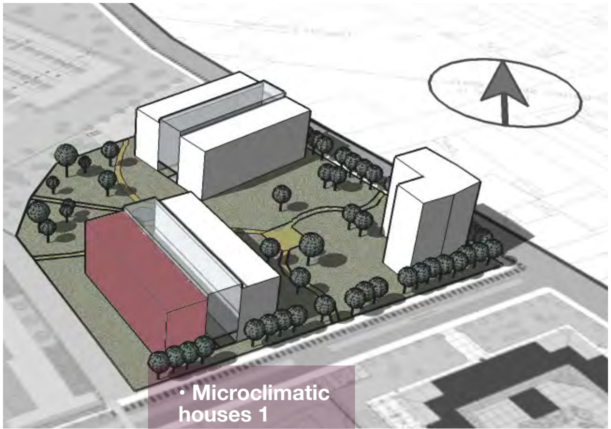
MICROCLIMATIC HOUSES

Energy saving from envelope measure

Current (national regulation 2009) [kWh/ m2y]	Heat losses through the envelope [kWh/ m2y]	% Energy Saving [kWh/ m2y]
74	39	47

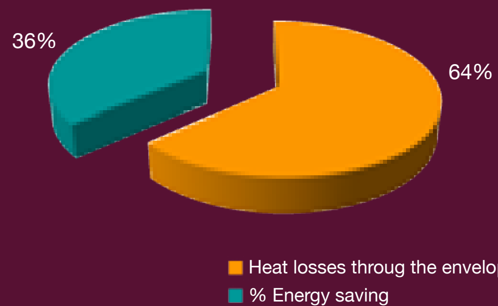
Energy saving (final energy demand)

Current (national regulation 2009) [kWh/ m2y]	Final Energy demand for space heating [kWh/ m2y]	Final Energy demand for DHW [kWh/ m2y]	% Energy Saving [kWh/ m2y]
115	53	23	34

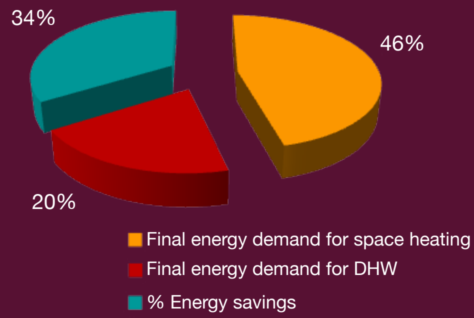


• Microclimatic houses 1

Percentage of reduction of energy losses in comparison to the national regulation limit

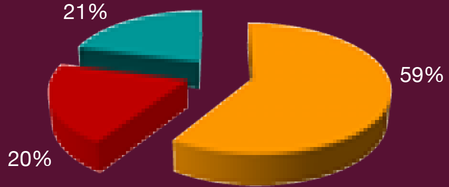


Percentage of final energy saving in comparison to the national regulation limit



Percentage of reduction of energy losses in comparison to the national regulation limit

Percentage of final energy saving in comparison to the national regulation limit



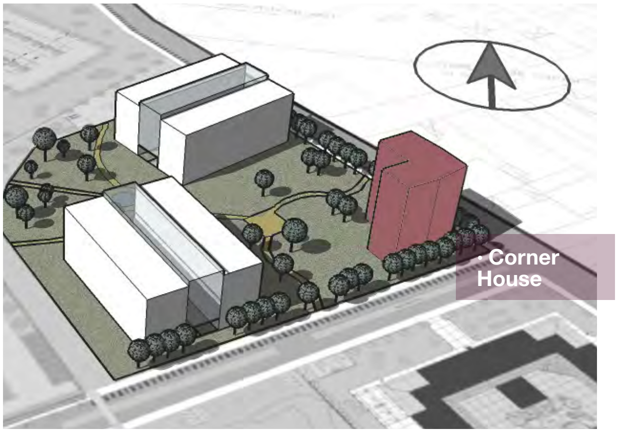
CORNER HOUSE

Energy saving from envelope measure

Current (national regulation 2009) [kWh/ m2y]	Heat losses through the envelope [kWh/ m2y]	% Energy Saving [kWh/ m2y]
72	43	40

Energy saving (final energy demand)

Current (national regulation 2009) [kWh/ m2y]	Final Energy demand for space heating [kWh/ m2y]	Final Energy demand for DHW [kWh/ m2y]	% Energy Saving [kWh/ m2y]
106	63	21	21



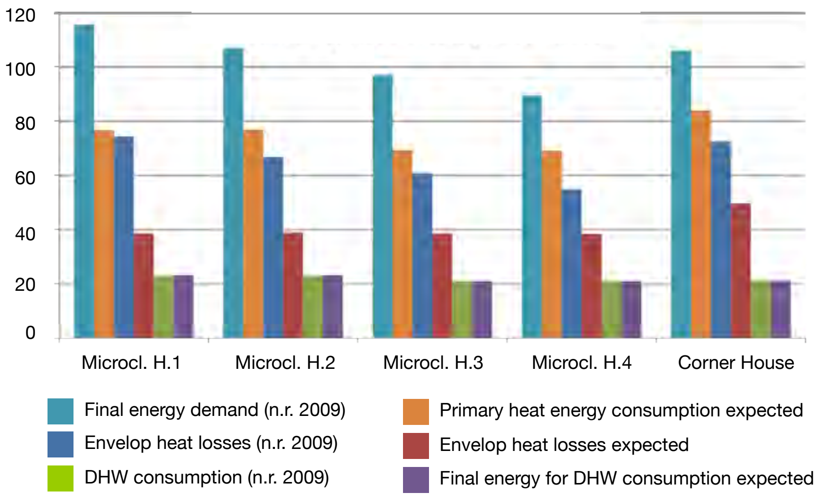
Final energy demand of New Eco-Village

New Eco-Village		National Regulation 2009 (2)			Executive Project iwth Atrium Contributions*			
Building Name	Net heating area [m2]	Envelope heat losses [kWh/ m2y]	DHW Consuption [kWh/ m2y]	Final energy demand [kWh/ m2y]	Envelop heat losses [kWh/m2 y]	Final heat demand for space heat [kWh/ m2y]	Final energy for DHW consumption expected [kWh/ m2y]	final heat demand for space heat and DHW [kWh/ m2y]
Microclimatic h. 1	1687	74,33	23,02	115,7	38,7	53,42	23,25	76,67
Microclimatic h. 2	1687	66,76	23,02	107	38,94	53,74	23,25	76,99
Microclimatic h. 3	1738	60,9	21,05	96,98	38,7	48,25	21,05	69,3
Microclimatic h. 4	1738	54,88	21,05	89,47	36,19	45,12	21,05	66,17
Corner House	1777	72,49	21,25	106,07	49,69	62,63	21,25	83,88

* In the Corner House there is not the Atrium System, so in the energy consumption assessment don't take into account of its contribution.

Like reported in the previous paragraphs the the evaluation of the expected gains has been developed according to the Italian code (UNI EN 832: 2001, replaced in 2008 by UNI TS 11300) . In the proposal of Concerto LA Piano. The energy contribution of the atrium was calculated considering the atrium like a non-heated space, with a winter simulation temperature of 6 °C instead of -8°C (UNI EN 12831). in the proposal Concerto AL Piano was chosen to use as reference values the maximum levels of thermal energy consumption allowed by national legislation in 2006. But the national legislation in terms of reducing energy consumption for

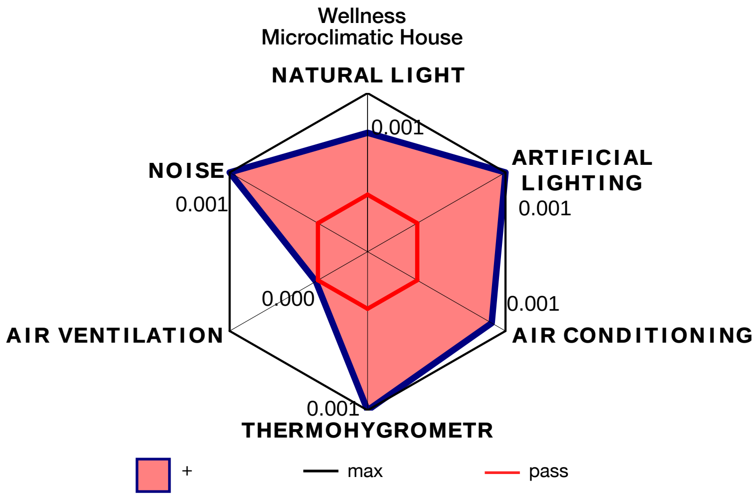
Heat Energy Comsuption in New Eco-Village: National Regulation vs expected values



buildings has evolved enormously in ‘ span of a decade. To give the most current references was chosen to refer to the standard for energy efficiency in buildings in 2009 (D.M. 26/06/2009), which is already much more similar to the current one, while remaining temporally closer to the stages of the building design.
Compared to actual values applied in the market of new buildings, the results obtained are definitely not excellent. These results, however, when compared to the normal practice in use until 2009, appearing certainly more ambitious: the values of energy saved in comparison to the limit values ranges among the 21% e to the 34%. the microclimatic house 3 and 4 have the lowest consumption because in compare to the others they benefit from better orientation.

Results of indoor comfort analysis

The design of the New Eco-village, is not pointed only on having a good energy efficiency, but also a good residential comfort.
Through the evaluation of the indicators below, a good performance of indoors is predicted in terms of lighting , acoustics, ventilation temperature and humidity both in winter and summer.
The assessment method is applied on a standard dwelling, of medium size, with characteristics of exposure to solar radiation and heat loss that were neither favorable nor disadvantaged.
As reported in Chapter 3, comfort is assessed through the Doggart-Pagani method. The graph and table below summarize the results.

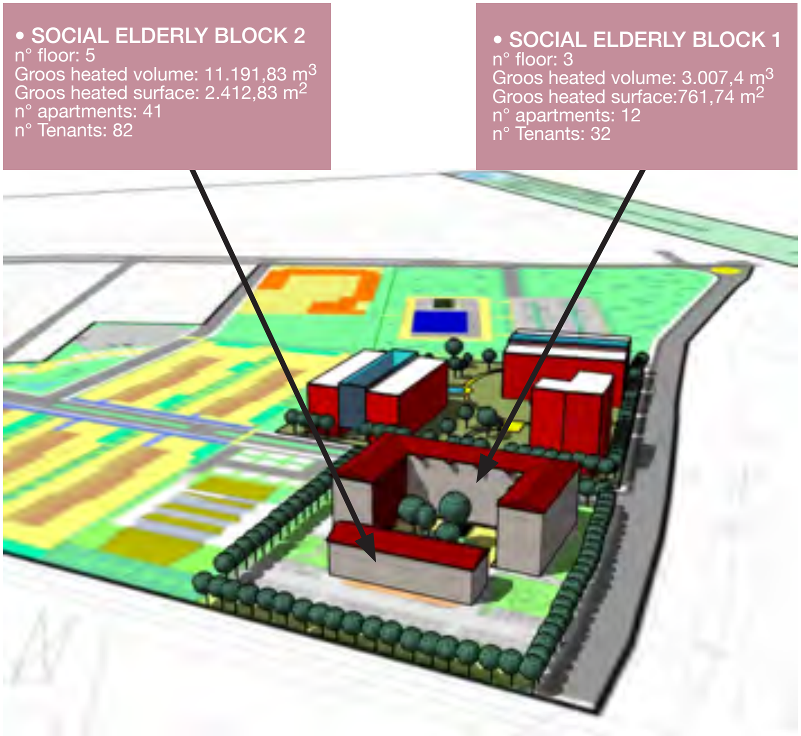


Dwelling Results		Living Room	K	B. Room 1	B. Room 2	Allowable Range
Wall surface temperatures (K)	Ts	verified	verified	verified	0	14<Ts<25
Radiant average temperatures (K)	Tmr	19,25	19,79	19,8	19,17	17<Tmr<21
Operating temperature (K)	Top	19,63	19,9	19,9	19,59	18<Top<20
Hygrothermal verify (°C/°C)	Pa	0	0	0	0	no cond.
Thermal inertia factor (m^2/m^2)	i	4,83	5,52	6,79	3,89	i > 0,5m^2/m^2
Dailylight factor (%)	nm	2,32%	1,92%	1,78%	2,13%	nm > 2%
Number of air change (m^3/m^3h)	n	0,5	0,5	0,5	0,5	n > 0,5m^3/m^3
Sound pressure level (dB)	L	27,83	25,34	25,21	28,69	L < 45 dB

a|2 METHOD

Design guidelines of NEW Social Elderly Housing

The Elderly Housing is a 4 floor building, south oriented, with access on the main road. The solution privileges the exteriors and outdoor environment, adopting a bioclimatic approach and innovative residential solutions for aged people.The heating consumption of the new social-elderly-building are 57% lower than current Italian regulation.
The settlement of New Social Elderly is located on a free building lot, in the north area of Concerto AL Piano district.
Two types of buildings are developed :
• Social Elderly housing Block A: n°41 dwellings
• Social Elderly housing Block B: n°10 dwellings
Both buildings are characterized by good energy efficiency of the envelope and the use of solar thermal technologies. A solar thermal system allows a 62,3% energy saving for hot domestic water.



b|2 APPLICATION

Energy measures and environmental design

The new Social Elderly Housing is characterized by high energy and environmental sustainability through the following design measures:

1. ENERGY EFFICIENCY

- Walls made with blocks of cement bonded wood fiber with thickness of 33 cm and 8 cm in graphite (U=3.1 W/m^{2}K)
- Average U value of 0,49 W/m^{2}K
- Airtight windows and low-emissivity glass (range U = 1,98 /2.3 W/m^{2}K);
- Building structure made of bearing floors and walls with formworks filled with reinforced concrete to reach a good level of thermal inertia (time lag of heat wave = 17 hour).

2. RENEWABLE ENERGY SOURCES

- Solar water collectors supplying 62% of domestic hot water needs;
- Connection with district heating network.

3. LIGHTING

- Design according to summer shading and glazing systems (shading reduction factor in conditions of maximum shielding=0,151).

4. WASTE

- New waste collection system for the whole district; ecological area for waste collection.

5. WATER

- maximization of the ground filtering of natural water flow (ratio between the area of the permeable surfaces and the total area of surfaces pertinent to the building=88,1%);
- Water metering devices and systems for the reduction of liquid waste, such as: single-lever faucets, taps with aerator, dual flush toilets.

Energy efficiency of envelope

NEEDS:
Reduce energy consumption for space heating.
STRATEGY:
Insulation system of building envelope. The walls will be made of blocks of cement bonded wood fiber with thickness of 33 cm and 8 cm in graphite.
The inner side of the wall is plastered with gypsum plaster thickness 1 cm, while the outer one, in plaster of lime and sand thickness 1 cm. The overall thickness of the wall is equal to 35 cm.
WINDOW SISTEMS
All windows will be equipped with low-emissivity double glass to allow large glazed surfaces, compatible with the requirements of internal illumination.
Range U= 1,94 W/m²K - 2,38 W/m²K

Greenhouse wall	λ [W/mK]	thickness [cm]
Gypsum plaster	0,4	1
wood-cement block	0,112	33
Sand and lime plaster	0,8	1
Rsi + Rse	R (mK)/W 4,55	
U= 1 / (Rsi+Rt+Re)	U W/(mK) 0,314	

Upper floor, under roof	λ [W/mK]	thickness [cm]
Insulation based on feldspar	0,038	10
Cement screed	1,49	4
Brick slab thickness. 16 - Distance 50	0,61	16
Gypsum plaster	0,4	1
Rsi + Rse	R (mK)/W 5	
U= 1 / (Rsi+Rt+Re)	U W/(mK) 0,318	

Basement	λ [W/mK]	thickness [cm]
Gres tiles	1	2
Concrete bed	0,7	4
Vapor barrier foil	220	0,08
Polystyrene extruded panel	0,035	10
Concrete bed	0,7	5
Concrete screed	1,49	5
Polyvinyl chloride foil	0,17	0,1
Rsi + Rse	R (mK)/W 3,291	
U= 1 / (Rsi+Rt+Re)	U W/(mK) 0,304	

Solar systems in New Social Elderly

In the realisation of the New Social Elderly housing the Block n° 2 is equipped with photovoltaic modules. The PV area is , enough to cover 17% of the expected energy demand of the building . The expected production and savings of CO_2 given in the following table.

Photovoltaic system

The photovoltaic modules made of polycrystalline silicon are installed on the roof of the building. The total area is 24 m^2 (1 module about 1 m^2). The modules are mounted on a structure made of metal bars in aluminum and stainless steel. The strings are connected to the solar inverter. Between the inverter and the modules electrical protections of overcurrent and overvoltage are inserted (lightning arresters).
The photovoltaic system covers about 17% of the electricity needs of the building which, added to the 16% of the share of national electricity produced from renewable sources (hydro, geothermal, wind, biogas, biomass, solar), reaches a total of 33% of primary energy demand for electricity.

Solar thermal system

Solar thermal water collectors are integrated on the roof of both buildings. The tilt of the panels follows the roof slope (20°) with a South orientation. The surface covered by the panels is:

- **BLOCK A**: 86 m^2, the energy production is 46,76 MWh/year, covering the 62% of the total requirement of thermal energy for domestic hot water. The energy needs for domestic hot water is 73,1 MWh/year.
- **BLOCK B**: 31 m^2 the energy production is 17,56 MWh/year, covering the 62% of the total requirement of thermal energy for domestic hot water. The energy needs for domestic hot water is 28,5 MWh/year.

Electricity production from photovoltaics systems

Unit of Measure	Power of PV plants [kWp]	Electricity production [MWh/ y]	Net area of PV panels [m2]	CO2 saved * [Ton/ y]
New Social Eldery	2,4	3,01	24	2,00

DHW production from solar thermal systems

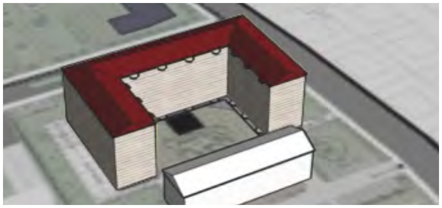
Unit of Measure	Energy production [MWh/ y]	Net area of S.Th panels [m2]	CO2 saved * [Ton/ y]
Block 1	46,8	86	13,728
Block 2	17,6	31	13,728
New Social Eldery	143	200	33,888

* Calculation method: each kWh produced by the photovoltaic system avoids the emission of 0.65 kg of carbon dioxide.

c|2 RESULT

Energy contribution of technology measures

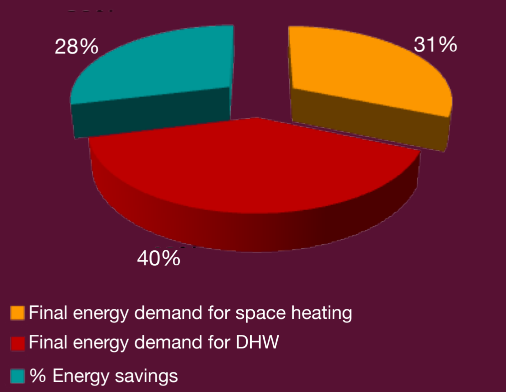
NEW SOCIAL ELDERLY – BLOCK 1



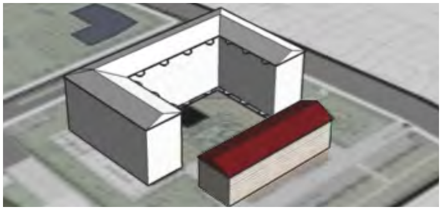
Forecasted final energy demand

Current (national regulation 2009) [kWh/ m^{2}y]	Final Energy demand for space heating [kWh/ m^{2}y]	Final Energy demand for DHW [kWh/ m^{2}y]	% Energy Saving [kWh/ m^{2}y]
70,11	30,3	30,3	14

Percentage of final energy saving in comparison to the national regulation limit



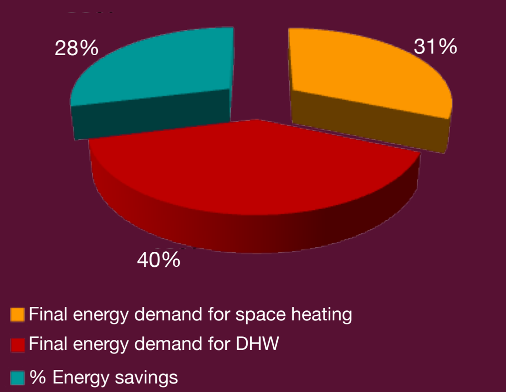
NEW SOCIAL ELDERLY – BLOCK 2



Forecasted final energy demand

Current (national regulation 2009) [kWh/ m^{2}y]	Final Energy demand for space heating [kWh/ m^{2}y]	Final Energy demand for DHW [kWh/ m^{2}y]	% Energy Saving [kWh/ m^{2}y]
76,0	23,8	30,3	29

Percentage of final energy saving in comparison to the national regulation limit



Assessing Performance /
of sustainable urban transformations
by Chiel Boonstra, Corrado Carbonaro, Lorenzo Savio

a| METHOD
- Assessing Performance (by Chiel Boonstra, Trecodome, international building energy expert)

b| APPLICATION
- Energy Balance of Concerto AL Piano District

c| RESULT
- From Nearly Zero to Net Zero Energy
- From technological solutions to holistic solutions

8

Assessing Performance /

a| METHOD


Assessing Performance (by Chiel Boonstra, Trecodome, international building energy expert)

Concerto Al Piano in Alessandria, Italy has been a valuable experience about intervening in a social housing area at the outskirts of a typical medium size city.
The interventions partly addressed existing buildings which have undergone an energy renovation by adding insulation and new windows.
The energy supply system was changed from a block heating scheme into a local district heating arrangement in anticipation of the installation of a biomass co-generation plant.
The planned biomass co-generation plant aimed to ensure renewable generation of heat and electricity.
Concerto Al Piano also included new buildings located in open areas adding new building typologies needed for the ageing population who can remain living in their own area, and for community functions. The new buildings demonstrate innovative technologies in achieving buildings with a low energy demand based on passive solar approaches with atriums and sunspaces, and advanced triple glazing and renewable cellulose fibre insulation.
The importance of the demonstration is the integrated approach combining the focus on the energy demand and supply side, whilst addressing the comfort and living conditions for individual tenants and the community development of the neighbourhood as a whole.

ENERGY DEMAND

External insulation and new window frames have been placed around the social housing blocks in Via Gandolfi in Alessandria. The appearance of the apartment blocks has greatly improved by the use of a palette of warm colours. The anticipated savings are in the range of 30 – 40% of the heat demand.

ENERGY SUPPLY

The biomass co-generation plant has not been installed for various reasons, so the buildings are still heated with gas boilers. As a consequence also adjustments of the water flows and temperature controls have not yet been implemented since these were planned to take place as part of the full implementation of the new district heating arrangements.

LIVING CONDITIONS

The tenants experienced poor

indoor climate conditions before renovation, which have been greatly improved by the insulation and glazing measures. However due to impartial implementation the control or limitation of indoor temperatures in winter has resulted in lower energy savings than anticipated.

COMMUNITY DEVELOPMENT

The community as a whole enjoys improvements because of the enriched provision of house types and re-arranged urban outdoor spaces.

LESSONS LEARNED

Concerto AL Piano shows the importance of understanding energy demands before and after in more depth. Both in energy calculations and in energy performance standards it is common to assume similar comfort conditions before and after renovation. In practice this is not the case. Learning from working in energy renovation projects throughout Europe it is striking that the heat demand in housing for existing buildings is rather comparable despite varying climatic conditions. One reason is that technical measures have been implemented to achieve a certain heat demand in the range of 150 – 200 kWh/m2. A second observation is that tenants adjust their comfort levels to levels which can be economically afforded. Throughout Europe there are many examples of fuel poverty. Tenants use less energy than should be needed to achieve good comfort levels.

After renovation indoor temperatures increase for a number of reasons. The effect of higher indoor temperatures during the heating season logically follows from the reduced heat losses. Temperatures drop much slower than in poorly insulated buildings, therefore the average temperature increases even if the same thermostat settings are being used. Secondly tenants may increase the thermostat temperature, because they can afford a higher comfort level, after the energy renovation.

A third reason is that higher indoor temperatures may happed due to lack of control options, which seems to be the case in Via Gandolfi. The installation of thermostatic valves and revised water flows in a radiator system has not yet taken place, since this is essential to adjust the heat supply per apartment and per room to the new insulated conditions.

When insulating a building without adjusting the size of radiators, supply temperature level or water flow, there is the risk of overshoot of heat supply, resulting in indoor temperatures well above perceived good comfort levels. Therefore better controls must be an integrated part of any thermal insulation project.

If we wish to achieve real emission reductions and real energy costs saving we need to overcome the effect of fuel poverty and improved comfort levels after renovation. Therefore more ambitious heat demand requirements needed to achieve environmental and cost savings. Current experiences in Europe indicate that heat demands from 20 – 50 kWh/m2 can be achieved in existing social housing schemes.

It is recommended to focus on real consumption before and after in order to ensure absolute emission reductions, not only relative to theoretically assumed comfort levels, as typically done in energy calculations and standards.

Concerto AL Piano has contributed to the redevelopment of major areas in Alessandria. It is recommended to continue along the lines of combining demand reduction programmes, with improved controls, with attention to ventilation and comfort conditions, with the implementation of renewable energy provisions.

b| APPLICATION

Energy Balance of Concerto AL Piano District

This neighborhood of Alessandria is deeply transformed by the interventions of Concerto AL Piano. The transformation is the result of a general improvement of social, urban and architectural environment of the area. The completion of urban voids, with the creation of the New Eco-Village and the New Social Elderly housing, improves the perception and the endowment of the district, otherwise incomplete. What undoubtedly has undergone significant transformation is the energy balance of the neighbourhood: the energy consumption of existing buildings of ATC was reduced of around 30-40% while the new buildings represent the next generation in Alessandria aiming to reduce energy consumption even with unusual typological solutions (such as the adoption of the micro-climatic atrium in the New Eco-Village) .
The energy balance of the neighborhood, supported by a local district heating network powered by a cogeneration plant for district gas (in the original project fueled by biomass), shows that the reduction of energy consumption is perhaps the most important effect of the project..
The analysis of the energy consumption of each building has been performed according to Italian building code (UNI TS 11300: 2008 resulting from the UNI EN ISO 13790: 2008). A,dedicated software has been used for the calculation of the final energy demand for heating and domestic hot water.
The efficiency evaluation of heating and electrical systems, of district heating networks, and of heat and electricity generation from the cogeneration plant,has been performed with direct and indirect data, as reported below.

ENERGY PRODUCTION FROM CENTRAL HEATING

The new cogeneration power plant fueled by natural gas, using typical cogeneration rates of the plant, provides an overall energy production efficiency of 86.5% of which 39.6% dedicated to the production of electricity and 46.9% for the production of thermal energy.
The evaluation of primary energy consumption for the RENEW settlement, before the refurbishment made by Concerto project, was converted from final energy demand into primary energy using the multiplier of 0.46, which corresponds to the overall efficiency of the Italian national electricity mix efficiency.

DISTRICT HEATING NETWORK

Design data adapted from consolidated literature have been used for comparisons.. Heat losses from district heating networks are ranging between 10% to 16% (source AIRU-ENEA "Survey on the sector district heating (ic 46)" according to the length of the network. In the calculation the value of 10% was adopted in virtue of the reduced size of the network.

ELECTRIC POWER NETWORK

The data used is provided by the Authority for Electricity and Gas, reporting average network losses amounting to 2.2% on the national network. In relation to the transmission of the energy produced by the CHP System, a value of 1% of losses was adopted.

Buildings system connection to the energy network

The buildings of Concerto AL Piano Concerto are connected to the new district-heating network through heat exchangers that replace the previous generation plants and thermal energy storage. The thermal energy losses have been estimated at 1%.

In addition to these general indications on the methodology specific choices have been made depending on the type of building analyzed.

RENEW

The energy consumption of the eleven existing buildings of ATC were evaluated during the design phase of Concerto AL Piano. In the monitoring phase an assessment was made on the overall energy balance of the district. Energy consumptions are taken from the final energy bills, in the period 2006-2009, and from the monitoring data in the year 2009-2010, the first season after the buildings refurbishment. The data of year 2009-2010, however, do not take into account the benefit of the district heating network, only operational from 2014. The contribution of the network to the energy balance of the district was simulated according to the data reported above. To evaluate energy consumption for heating and for domestic hot water, consumption data of natural gas were collected. These data incorporate the consumption for cooking, estimated as the 7.1% of the total (ENEA 2005).

Concerning the electrical consumption, the average for existing buildings in Italy amounts to 31 kWh/m2y.

The values of the overall efficiency of heating systems, production, distribution, control and emission are low, because the equipment is very old. During the retrofit, however, in addition to improving the efficiency level of production with district heating, the efficiency level for room temperature control was improved thanks to the use of thermostatic valves. After retrofit the global efficiency of the heating system rised from 0.65, to an overall value of 0.87.

NEW ECO-VILLAGE AND NEW SOCIAL ELDERLY HOUSING

For new buildings, the final energy consumption has been estimated in accordance with the Italian legislation of 2008. The following parameters have been identified: the final energy consumption for heating and hot water, and the energy demand of housing. Electricity demand was estimated at 20 kWh/m2 per year, which corresponds to the average consumption for new buildings in Italy. Production of heat and electricity from solar energy is the result of a simulation in accordance with Italian code procedure UNI TS 11300. The primary energy consumption has been worked out from the final energy of the buildings, , taking into account the energy production by CHP plant and all production and distribution losses.

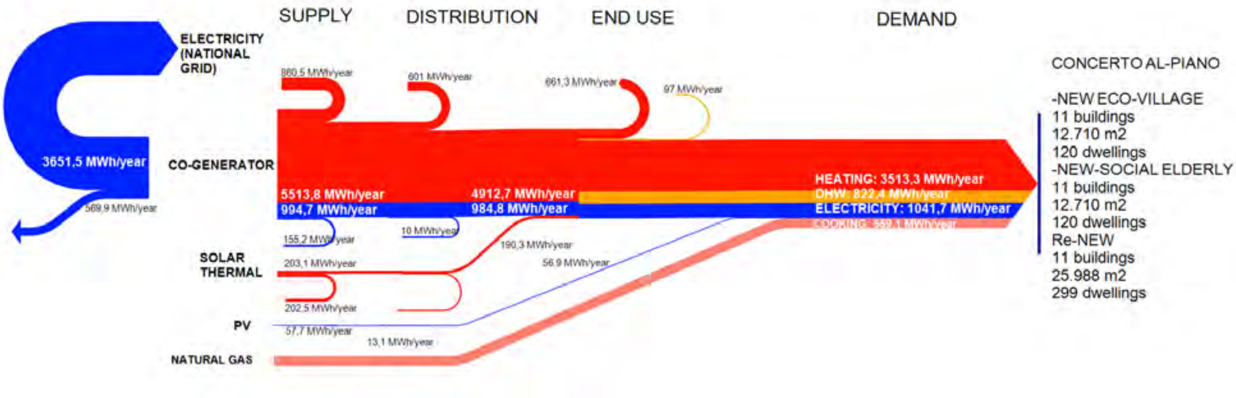
c| RESULT

From Nearly Zero to Net Zero Energy

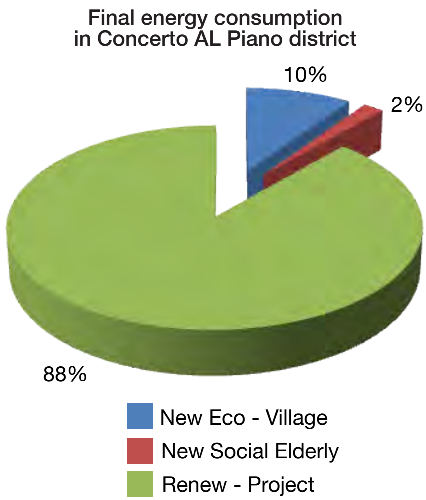
Performance evaluation helps understanding strengths and weaknesses of a comprehensive urban project that hosts a number of functions on the urban, district and building scale. Concerto AL Piano worked on a multi-level performance evaluation: from site-assessment to building energy monitoring; from the overall environmental quality to indoor comfort. All layers have specific expert tools for the analysis and evaluation and for all topics the most appropriate tools were selected. In particular, careful analyses were conducted on the quality of the urban project in relation with energy and environmental sustainability, health and comfort of indoor and outdoor environment. The quality of an urban project must also be assessed in relation to the available resources, to the level of site upgrading and to the upgraded social opportunities. Scoring methods may not fully comprehend the complexity of urban processes, but their indicators can at least provide evidence of the impact of changes. By means of an iterative process, these tools allow to progressively improve the result of each assessment topic (sustainability, health, accessibility, comfort, etc.).

Concerto AL Piano, as all other Concerto projects, was a precursor of the complex dispute between Nearly vs. Net zero energy into the real practice of an urban project. Undoubtedly, Concerto AL Piano has represented an experience of smart urban community for Alessandria by promoting an innovative regeneration of an urban site, with a mix of refurbishment and new construction of residential and non-residential buildings, representing the complexity of our urban situations. The several projects incorporate innovative energy technologies and contribute to the environmental quality, as well as to the quality of life, thermal comfort, lighting and ventilation of indoors, since eco-buildings are better buildings for the occupants. The results achieved by Concerto AL Piano can be easily summarized in the following table and in the related shankey diagram, showing the energy saving on the district scale. The energy consumption of existing buildings was reduced by a maximum of 48% that could be obtained for all dwellings with fine-tuning of heating systems. New micro-climatic buildings reduce energy needs at 38 kWh/m2y, even with unusual typological solutions for housing (building atrium). Although these results are lower than expected, we can consider this an example of low-energy district.

Under a more comprehensive perspective, when starting Concerto AL Piano the more ambitious goal of a Net Zero Energy district was pursued. The districts aimed at having a total renewable energy provision, based on a biomass district heating as auxiliary system. However, we learned that solving the energy use and emissions at the building level could not be achieved in a cost effective way, without approaching energy demand and supply at the same time. We suddenly recognized that sufficiency was a key concept to achieve through optimization of the energy demand versus the supply of renewable energies. Urban sufficiency is a stimulating concept. If efficiency means achieving the same end use with the least amount of resources; sufficiency means limiting the consumption of resources to the real essential, minimum needs. The real challenge is to set the appropriate minimum levels of needs without compromising the quality of life. Three key recommendations can be proposed, based on lessons learnt:



- projects and approaches either focusing on one side of the picture, i.e. building technologies, renewable technologies, or energy network systems, are uncoherent.
- Energy Sufficiency concepts can limit the consumption of resources to the real essential needs, at feasible levels
- Net Zero Energy concepts, only providing renewable energies without minimizing energy needs, can be inconsistent and contradictory.
The energy balance of the Concerto AL Piano district is the result of the analysis of final energy consumption of each building and the energy produced by the CHP plant. For each “homogeneous” group of buildings a summary sheet of key data and and a diagram of the energy flows was made and used in the calculation phase .
The energy diagram flow has been developed using the following input data:
Contribution of renewable energy
Final heat energy demand of building
Final consumption, taking into account the RES contribution
Final energy amount delivered at heat exchanger of building systems considering the heat losses (1%)
Energy delivered into district networks taking into account heat losses (10%) and electricity losses (1%)
Energy production rate of CHP plant, considering the losses from efficiency (13,5%).
From the results of monitoring and analyses, the RENEW district is responsible for most of the consumption of the Concerto AL Piano neighbourhood, both because of the size (25 988 m^2 of gross floor area compared to 12 278 m^2 of new building area) and because of the higher specific consumption of these retrofitted buildings in comparison with the newly built Eco-Village.



Re-New/Before

- 11 buildings (4 floors)
- gross heating volume: 335.248 m^3
- gross heating area: 25.988 m^2

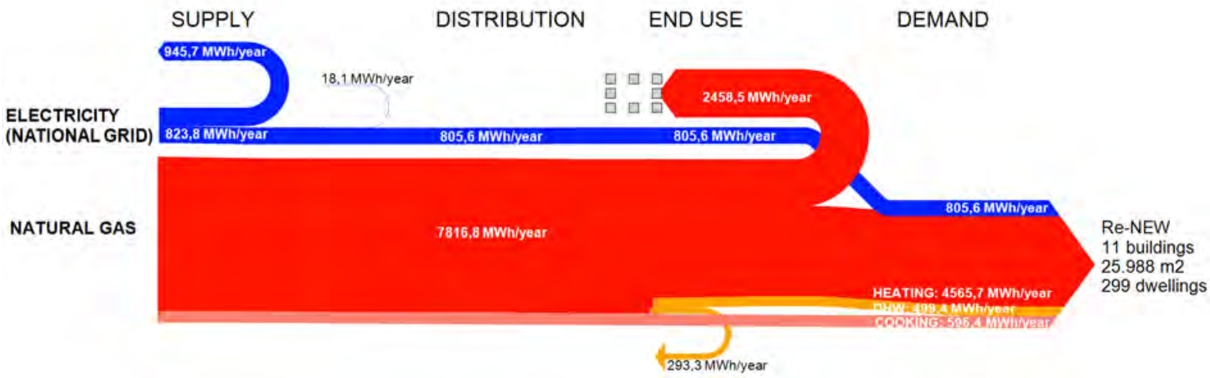
Average U value of the building envelope:
- Windows: 3,2 W/m^{2}K
- Roof : 1,62 W/m^{2}K
- Walls: 0,73 W/m^{2}K
- Ground floor: 1,44 W/m^{2}K

Energy demand for different final uses:

Space Heating: 4.565,7 MWh/y - central heating system powered by natural gas boiler (installed in 1980), average Global seasonal efficiency: 0,65.
Domestic Hot Water: 515,2 MWh/y - central heating system
Lighting and other electric uses: 797,5 MWh/y - national grid
Cooking: 246,9 MWh/y - natural gas

Passive Technologies: NO

SUPPLY SIDE				DEMAND SIDE		
ENERGY TECHNOLOGY plant typology	SOURCE OF ENERGY Tipology	SUPPLY (MWh/y)	DISTRIBUTION (MWh/y)	USE OF ENERGY tipology of energy use	END USE (MWh/y)	DEMAND (MWh/y)
national grid	elect. Form national grid	823,75	805,63	domestic use of electricity	805,63	805,63
	losses	945,74	18,12			
PV plant	elect. (PV)	-	-			
	losses	-	-		-	-
building heating plant	natural gas	7816,76	7816,76	heating	4565,68	4565,68
				losses	2458,45	-
				DHW	499,36	499,36
	losses	-	-			
solar thermal	solar	-	-			
	losses (S.Th.)	-	-	losses	293,27	-
network of n.gas	natural gas	596,41	596,41	cooking	596,41	596,41



Re-New/After

- 11 buildings (4 floors)
- gross heating volume: 335.248 m³
- gross heating area: 25.988 m²

Average U value of the building envelope:
- Windows: 2,2 W/m²K
- Roof : 0,31 W/m²K
- Walls: 0,29 W/m²K
- Ground floor: 0,91 W/m²K

Energy demand for different final uses:

Space Heating: 3.687,5 MWh/y - central heating system powered by natural gas boiler (installed in 1980), average Global seasonal efficiency: 0,65.

Domestic Hot Water: 558,7 MWh/y - central heating system

Lighting and other electric uses: 797,5 MWh/y - national grid

Cooking: 246,9 MWh/y - natural gas

Passive Technologies: Solar greenhouses south-west oriented.

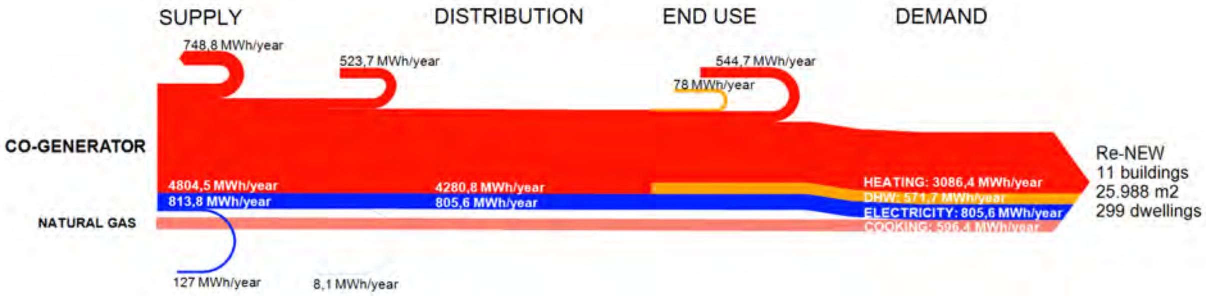
SUPPLY SIDE

ENERGY TECHNOLOGY plant typology	SOURCE OF ENERGY Tipology	SUPPLY (MWh/y)	DISTRIBUTION (MWh/y)
cogenerator	n.gas (cogen. elect.)	813,77	805,63
	losses	127,00	8,14
PV plant	solar energy (PV elect.)	-	-
	losses	-	-
cogenerator	n.gas (cogen. heat.)	4804,47	4280,79
	losses	749,83	523,69
solar thermal	solar energy (sol. Th.)	-	-
	losses (S.Th.)	-	-
network of n.gas	natural gas	596,41	596,41

ENERGY TECHNOLOGY plant typology	SOURCE OF ENERGY Tipology	SUPPLY (MWh/y)
cogenerator	electricity sold to national grid	3242,89
	losses	506,12

DEMAND SIDE

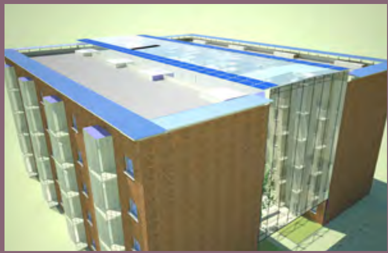
USE OF ENERGY tipology of energy use	END USE (MWh/y)	DEMAND (MWh/y)
domestic use of electricity	805,63	805,63
losses		
heating	3086,42	3086,42
losses	544,66	-
DHW	571,74	571,74
losses	77,96	-
cooking	596,41	596,41



New Eco - Village

- 5 buildings, 104 dwellings
- gross heating volume: 40.536 m^3
- gross heating area: 12.710 m^2

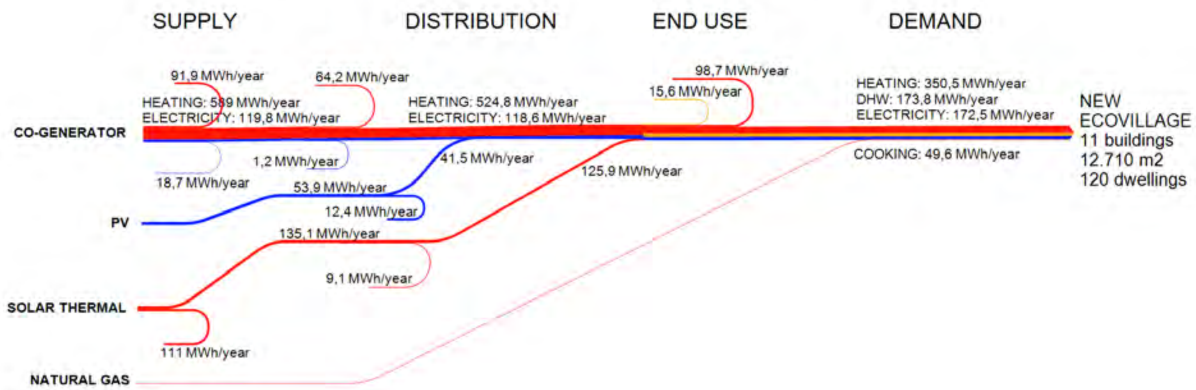
Average U value of the building envelope:
- Windows: 1,60 W/m^{2}K
- Roof : 0,20 W/m^{2}K
- Walls: 0,22 W/m^{2}K
- Ground floor: 0,21 W/m^{2}K



Energy demand for different final uses:

Space Heating: 418,1 MWh/y - central heating system powered by natural gas boiler (installed in 1980), average Global seasonal efficiency: 0,65.
Domestic Hot Water: 172,3 MWh/y - central heating system
Lighting and other electric uses: 170,8 MWh/y - national grid
Cooking: 120,7 MWh/y - natural gas

Passive Technologies: microclimatic atrium, greenhouses



New Social Elderly

- 2 buildings, 53 dwellings
- gross heating volume: 14.199 m^3
- gross heating area: 3.175 m^2

Average U value of the building envelope:
- Windows: 1,98 - 2,3 W/m^{2}K
- Roof : 0,32 W/m^{2}K
- Walls: 0,31 W/m^{2}K
- Ground floor: 0,30 W/m^{2}K

Energy demand for different final uses:

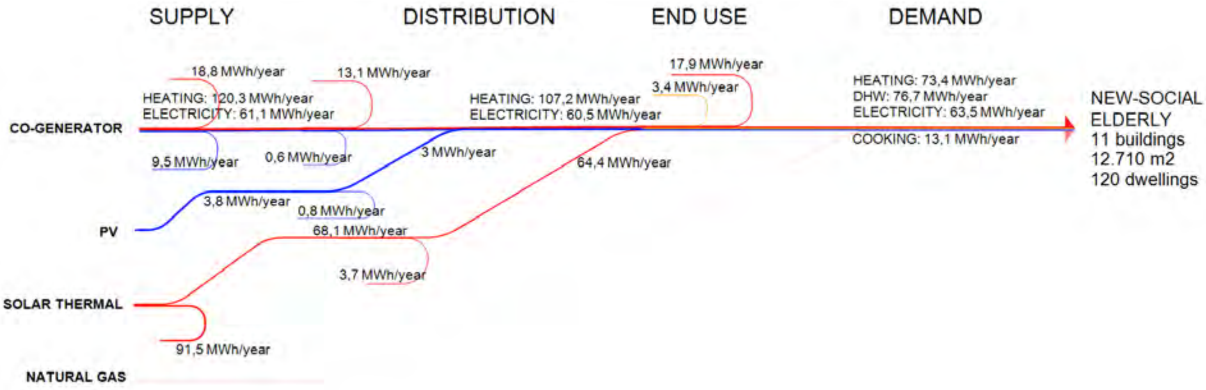
Space Heating: .... MWh/y - central heating system powered by natural gas boiler (installed in 1980), average Global seasonal efficiency: 0,65.

Domestic Hot Water: ...... MWh/y - central heating system

Lighting and other electric uses: 805,60 MWh/y - national grid

Cooking: ..... MWh/y - natural gas

Passive Technologies: NO



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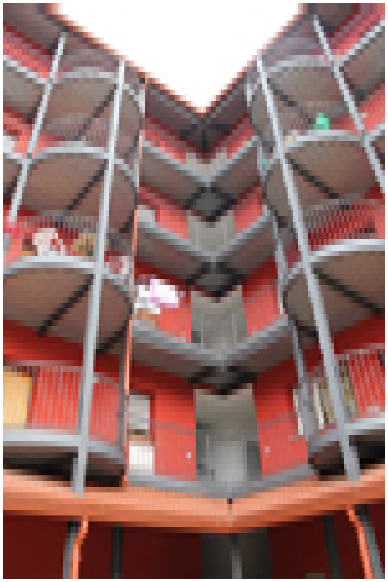
From technological solutions to holistic solutions

For many years, demonstration projects at the bulding and urban level were mostly designed to develop, demonstrate, validate technological solutions, at the building or district level. Currently, urban projects have scaled-up, becoming increasingly more comprehensive and holistic. Integrated energy solutions are among the most challenging achievements in a smart urban community. This was also true for Concerto AL Piano, looking for a good combination of energy demand reduction with renewable energies as auxiliary components.
The catalogue of renewable technologies in the project included: passive solar, solar thermal, solar photovoltaic and biomass district heating. All solutions were implemented, in various configurations and architectural integrations, with the exception of the biomass that had to be reconsidered. The change in fuel of the district energy system was caused by the new regulation of the Piedmont Region, who could not approve the biomass solution in the urban context. Prevalent winds would have brought the combustion products into the city centre, and the admitted levels of pollution could not be respected with the best available technologies.
The local regulation requires unrealistic particulate limits. In terms of total particulate limit in the exhaust gases, the Regulation Authority called for 10 mg/Nm^3 at 5% O_2.
Respecting this limit at any time is unrealistic with the best engines and extremely dangerous because of penal consequences for the owner and technology provider.
We illustrated this situation to the local and regional authorities, supported by international experts, but they kept the line. We believe the windless weather of North Italy (Val Padana) and its high pollution levels were at the base of this rigid position againts the biomass exploitation. To be noticed, the regulation (DGR 46-11968) was not in effect when we entered the project and designed the plant in 2007.
However, Concerto AL Piano had to comply with the lack of authorisation to find an alternative solution. In addition, the price of vegetable oil (soja oil) doubled, boosting up from 500 to1.000 euro/ton and this was another element that was reassuring both promoters and technology providers on the risks the original solution would have incurred. The doubled price produced a dramatic economical effect, and reduced the operation margin below zero. It is not a matter of better or worse financial return. With such a price, the owner chooses to stop the plant because when running he loses more money than when stopping it. As a consequece, the biomass plant was not feasible any more, and the alternative solution had to be identified, namely in a natural gas district heating system with cogeneration.
Based on the lessons learnt, three key recommendations can be proposed:

- integrated, holistic solutions are to be achieved in smart urban communities;
- sometimes, new available technologies cannot allow the achievement of environmental targets;
- air quality in urban context is a major concern and energy solutions that cannot comply with its improvement are to be considered inappropriate.



Concerto Training /
Training and coaching Concerto AL Piano
by Lorenzo Savio

a| METHOD
- Scenario Workshop

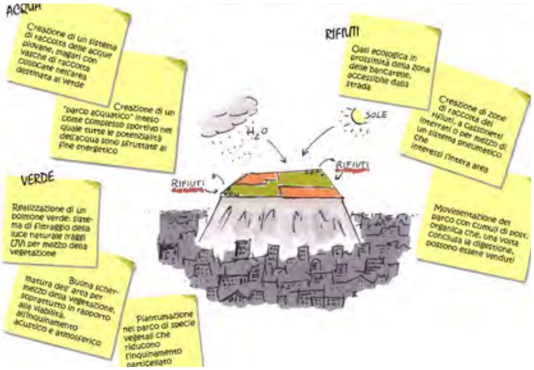
b| APPLICATION
- Training Activity

c| RESULT
- Prolongation: from managing the projects to managing the change

9

Concerto Training /

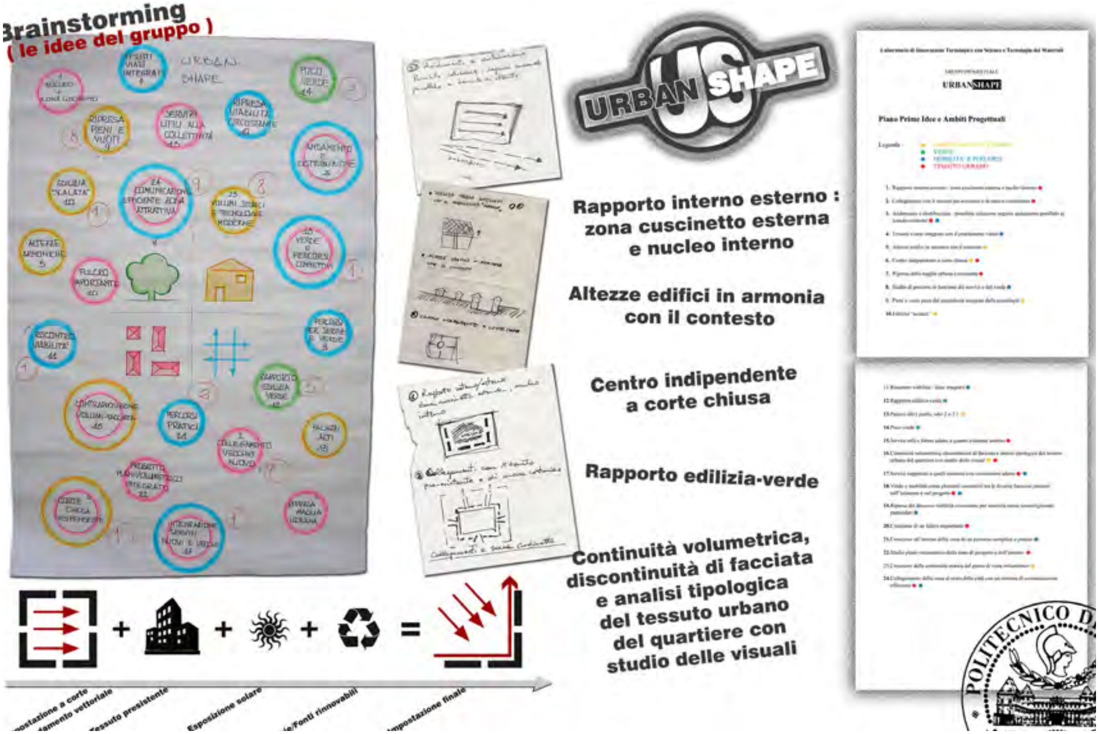
a| METHOD



Scenario Workshop

Concerto AL Piano became the topic of an intensive training activity, involving the students of the School of Architecture of Politecnico Torino, supported by the administration of Alessandria. It has been studied as a best practice of sustainable architecture in all its components: energy saving, bioclimatic architecture, natural building materials, and involvement of inhabitants in urban regeneration.
The students were committed in a learning by doing experience aimed at re-thinking and re-designing Concerto, and exploring different solution for New, Re-New and Retrofit actions and other integrated-energy interventions inspired by them.
The training method consisted in a Scenario Workshop, simulating in classroom the urban regeneration planning. Students were divided into role groups: Administrators, Inhabitants, Experts, and Investors. Each role group analysed strenghts and weaknesses, opportunities and risks of the urban area, from its role's point of view. New groups were formed, mixing roles and starting a discussion between different stakeholders, in order to establish guidelines and targets for the urban regeneration plan, that are shared and voted from administrators, inhabitants, experts and investors.
Thanks to this role game, the students had the experience of the complexity of Concerto projects, and understood the importance of cooperation in a sustainable urban process. Finally, the students went back to their role of young architects to develop their own urban regeneration project.


ecosistema
L'idea guida del progetto è nata dalla collaborazione di tutti i gruppi che avevano deciso di improntare il proprio lavoro secondo il modello del green building.
L'idea è stata quella di considerare l'edificio come un ecosistema in cui le diverse parti, per quanto mantengono una reciproca identità, collaborassero con i loro singoli apporti a rendere l'edificio efficiente sia sotto il profilo dell'ambiente e dei futuri abitanti. Le grandi sezioni in cui è stato diviso il nostro ecosistema erano dunque: riciclo e riuso, biomimetica, verde e materiali, percorsi e coinvolgimento. Ogni sezione per potersi integrare doveva soddisfarre i requisiti di sostenibilità ambientale, estetica, utilità e risparmio economico e ambientale.
costruendo il poster...
l'unione fa la forza!
il poster!
percorsi e mobilità
In particolare il filone cha abbiamo scelto di sviluppare è quello dei percorsi e mobilità. In quest'ambito ci siamo occupate di raccogliere riferimenti su idee progettuali che s'incentrino su questo tema per arrivare ad un'idea sintetica e che si riesca ad adattare senza forzature all'area in esame con i privilegi del tema scelto. I punti principali emersi dunque sono: l'esigenza di un progetto volto a favorire l'utilizzo dei mezzi pubblici dotati di tecnologie e materiali in grado di ridurre il consumo energetico. La costruzione di piste ciclabili interne collegate alla rete provinciale e la creazione di spazi gioco per famiglie e bambini con percorsi pedonali immersi nel verde, che spingano a una piena fruizione dello spazio a disposizione.
il progetto
Durante la fase di progettazione si è cercato di seguire quanto più possibile l'idea da cui si era partiti, cercando di creare degli spazi e usare delle tecnologie che fossero ecocompatibili e comunitarie.
Per questo si è deciso di utilizzare una copertura verde praticabile, per i suoi vantaggi di isolamento termico naturale e la possibilità di sfruttare anche questo spazio da parte degli inquilini. Sul tetto sono poi stati messi dei pannelli solari per la produzione di energia, incrementati da vetro fotovoltaico sulle vetrate di chiusura dei vani scala e sopra le serre. Il primo piano è stato interamente dedicato alla comunità: sul fronte sud ci sono delle serre che sono suddivise in lotti coltivabili dai sincoli condomini e che d'estate possono essere aperte. In questo modo si sfrutta il calore che si crea con il vetro e si dà la possibilità di cominciare a condurre una vita sempre più a km0, coltivando le proprie verdure. Annesse alle serre sono state dedicate due stanze per gli attrezzi e eventuali corsi di formazione e una lavanderia, sempre per ridurre i consumi e facilitare la socializzazione ed il coinvolgimento. In ultimo è stato inserito un bar, collegato al centro commerciale sottostante, dove vi potranno essere tenute delle riunioni e dei corsi per spiegare e il funzionamento delle serre e degli edifici, in modo che le nuove tecnologie possano essere divulgate e l'edificio funga da momento esemplare concreto di come si possa organizzare una vita ecocompatibile. Anche la distribuzione interna, su ballatoi ribassati garantisce a ciascun alloggio privacy e un piccolo terrazzo.
work in progress...
Green Building
POLITECNICO D


Brainstorming
(le idee del gruppo)
URBAN SHAPE
US
Rapporto interno esterno : zona cuscinetto esterna e nucleo interno
Altezze edifici in armonia con il contesto
Centro indipendente a corte chiusa
Rapporto edilizia-verde
Continuità volumetrica, discontinuità di facciata e analisi tipologica del tessuto urbano del quartiere con studio delle visuali
Piano Prime Idee e Ambiti Progettuali
Esposizione solare
POLITECNICO D

b| APPLICATION

Training Activity

The same Training Method has been applied, with some differences, in two sessions:

- Academic year 2006-07: “RE-run Concerto AL Piano”, the students focused on the process which originated Concerto AL-Plan and then developed alternative solutions for New, Re-New and Retrofit actions;
- Academic year 2008-09: “Extend AL Piano Concerto”, after analysing Concerto Al-Piano Project and visiting the district and the construction site of Re-New students designed a new regeneration plan in an adjacent area, assuming a specific “topic” between: “Green building”, “Urbane shape”, “Low cost architecture”, “High-tech building”, “Integrated energy building”.

All the new project assumed the energy conservation scheme of Concerto Al-Piano, which consist in:

- at first, the reduction of energy demand of existing and new buildings, using extra-isolated building envelopes and passive technology solutions;
- than, the use of renewable energy sources with active technologies, to cover the reduced energy demand.

In addition to the energy efficiencies of buildings, other issues concerning “sustainability” were considered: bioclimatic design, use of natural building materials, quality of urban spaces, integration of green architecture, design and integration of solar thermal and solar PV technologies in buildings, recovery of rainwater.
The training activity was structured whit a fixed framework:

- Process, students were involved in the simulation of a Workshop Scenario, in which they experimented the complexity of Concerto projects and the roles of different stakeholders;
- Plan, students analysed Concerto AL-Piano interventions at urban scale trying to understand and reproduce the energy concept aimed at a nearly-zero CO_2 emissions urban district;
- Project, students developed architecture projects (retrofit of existing buildings or new eco-buildings) with a focus on active and passive technologies for the improvement of energy performance;
- Product, students experimented innovative buildings products;
- Performance, some building energy performances were calculated in order to assess the effectiveness of the solutions and the technologies.

The Training Activity with the students included also many graduations thesis concerning Concerto AL-Piano topics:

- Strategia per la riqualificazione energetica di quartiere : un progetto dimostrativo europeo ad Alessandria / Lorenzo Savio (2007);
- Progetto Concerto al Piano: il nuovo villaggio integrato con l’ambiente / Valentina Marino (2008);
- Pro-village: tecnologie efficienti per l’ex villaggio profughi di Alessandria / Graia Teresa, Capone Egidio (2008);
- Progetto per l’integrazione architettonica di una centrale urbana di trigenerazione a biomassa / Gabriele Druetta (2010);
- L’innovazione incontra l’accessibilità nel mondo dell’anziano / Ciprian Cursaru (2011);
- La valutazione ambientale degli edifici. Analisi dei metodi e applicazione al caso studio del progetto Concerto AL-Piano / Chiarello Chiara (2011);
- I sistemi di valutazione

dell'ecosostenibilità ambientale: applicazione del metodo dell'impronta sostenibile urbana al progetto Concerto AL-Piano / Bacciarini Luca Mario (2011).

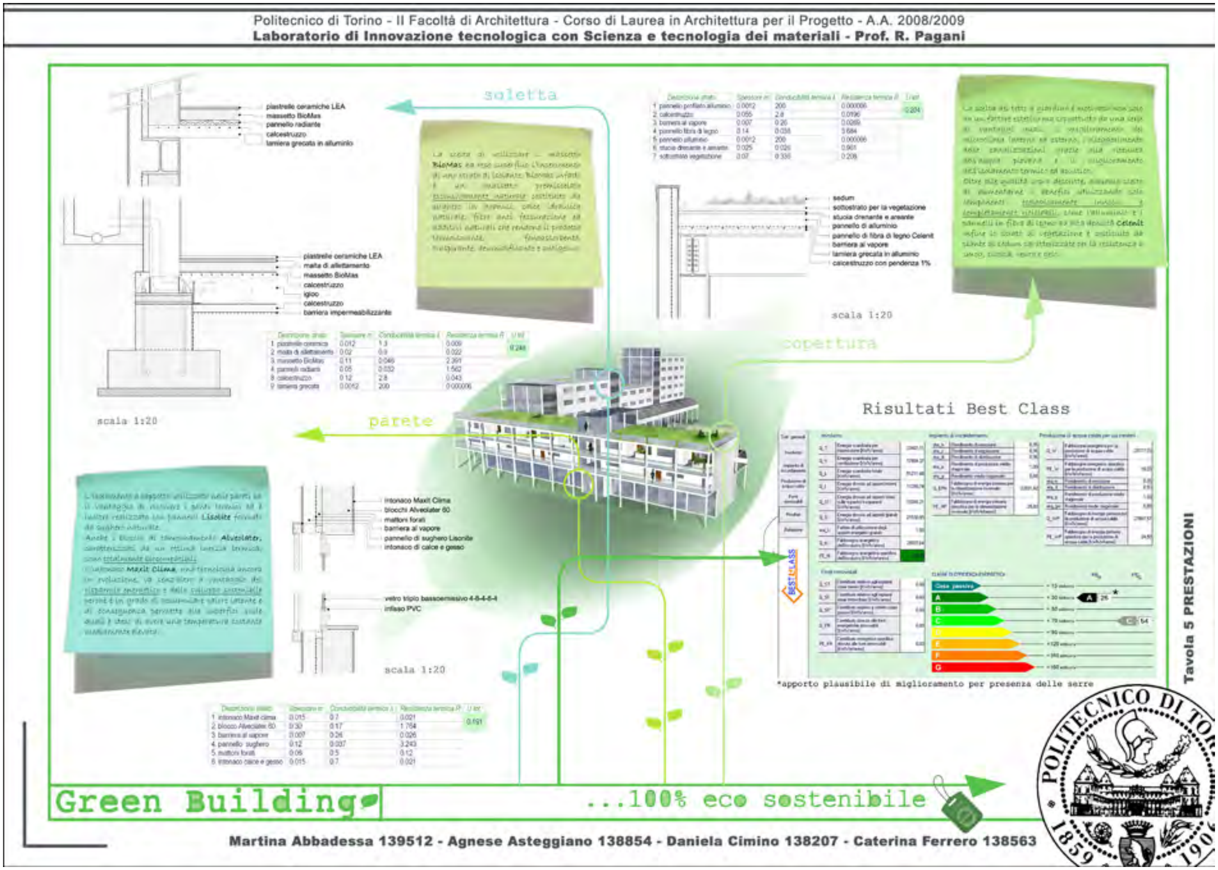
c| RESULT

Prolongation: from managing the projects to managing the change

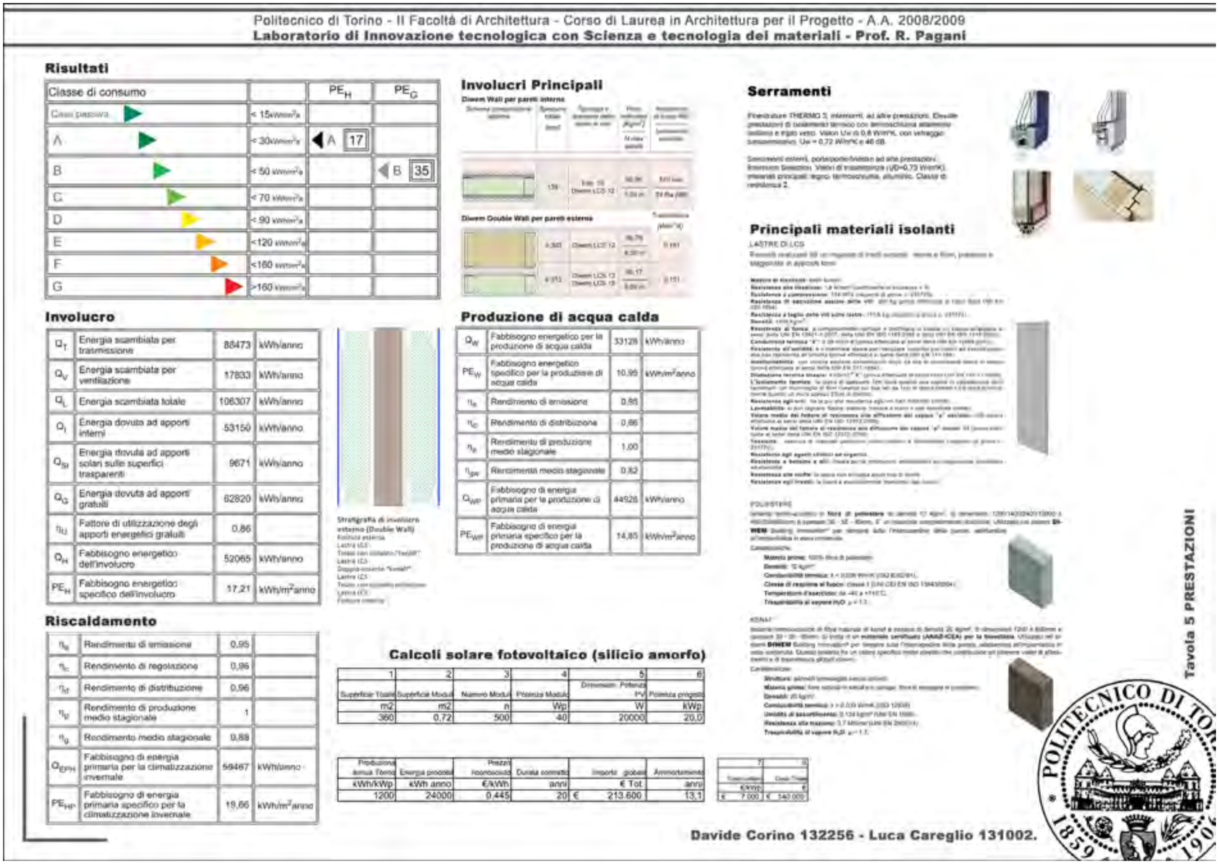
The students - by now young architects – learned the principles of sustainable architecture through a direct involvement in the in-progress demonstrative project. This Training Method is not usual in Schools of Architecture, but is very effective because students are in touch with a real urban regeneration process.
Thanks to Concerto Al-Piano, students had the opportunity to understand the importance of the different stakeholder role in a participated urban regeneration plan. The results of the design activity in “RE-run Concerto AL Piano” and “Extend AL Piano Concerto” were presented to the municipal administration of Alessandria and to AL-Piano partnership, in order to contribute with alternative and original solutions the development of the demonstration project.
from managing the projects to managing the change
As previously emphasised, Concerto AL Piano is characterised by a comprehensive approach involving administrators, planners, investors and users. It can be regarded as a significant training effort at the city and neighbourhood level. During the planning phase, a number of consultations and workshops have been carried out. A Local Community Task Force has been created for sharing and assessing the project, at each stage of implementation: it is constituted by city managers, citizens and associations, experts, promoters and builders. Through the coordinating team, training to architects, planners and urban managers was provided from the very beginning of the project by means of workshops and focus groups. Both the experience of the Local Task Force and the Students’ Training have been the real good practices that we can reckon as titles of Concerto AL Piano. Through the Task Force, a long-lasting effect on urban decision making and the perdurance of its influence has been granted. Through Concerto,

a step forward in stakeholders involvement was reached from which the local community does not come back. In addition, what has been touched on with the students' training is more durable and doable than any other actions: the prolongation and perpetuation of the effects along the time and professional carrier of each single student. The real added value of Concerto.
Based on the lessons learnt, three key recommendations on prolongation issues can be proposed:

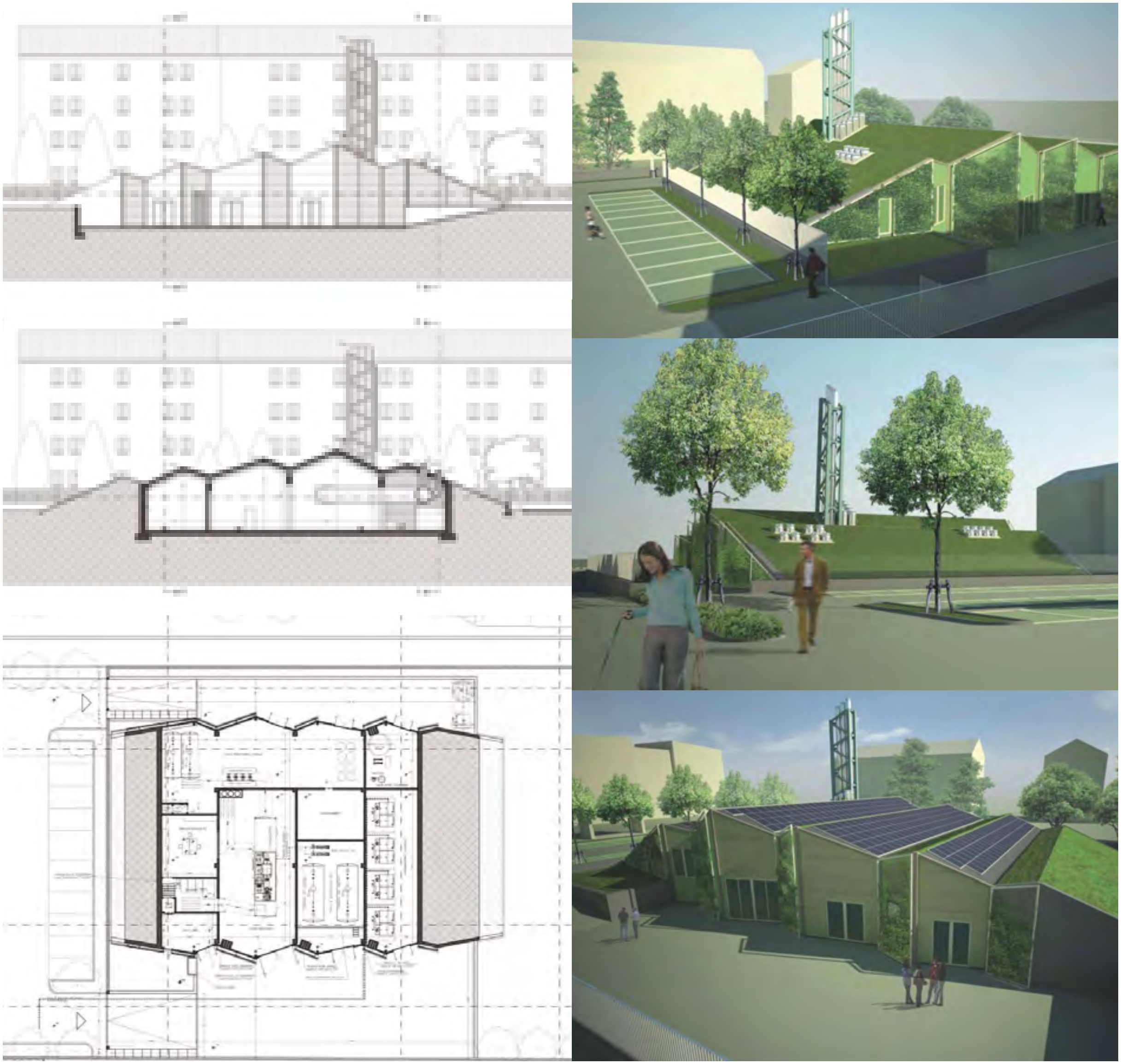
- Concerto dynamics, innovative decision making, local task force, are marking local communities from which it is impossible to go back;
- learning by doing, experimenting, coaching with a demonstration project is an asset for education;
- "prolongation" is perhaps the most effective result of Concerto AL Piano.



“Extend AL Piano Concerto” Academic year 2008-09



“Extend AL Piano Concerto” Academic year 2008-09



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