

SOLARBUILD

**"INTEGRATION OF SOLAR TECHNOLOGIES INTO BUILDINGS IN
MEDITERRANEAN COMMUNITIES"**

ENEA

Dip TER UDA SISTEN

Local Italian Report

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December 2007

1- Introduction

Italy is one of twenty seven states composing European Union; it is the fourth country with reference to the population (58.948.000 Inhabitants) and the seventh with a surface of 301.338 km².

Italian territory is placed between 35° and 47° north parallel, it is a peninsula, that starts from north (alpine arch) and goes into Mediterranean sea, there are also Sardinia (island), Sicily (island) and some other little islands.

Italy shows a big coast development (about 7458 km) and many hilly zones (41,6%), mountainous zones (35,2%), flat land zones (23,2%); middle altitude is about 337 meters over level of the sea. By climatic view point, we find a subtropical Mediterranean climate in south zone (summer temperature over 40°Celsius) a continental temperate climate in north zone (winter temperature also under -20°Celsius); this different climate is because of the particular extent of Italy like latitude (from north to south).

These different climate zones generate a big variability in the number of wintry daily degree (i.e. reference values: 568 Lampedusa 5165 Sestriere).

In Italy also the global solar radiation value on horizontal surface depends on different latitudes; yearly middle energy is 1500kWh/m² (0,129 tep/m²).

Italy is one member of G8 (the group of 8, the most industrialized countries) and is the seventh economic power in the world with a PIL of 1791*10⁹ \$ and a PIL of 30383\$ for everybody (FMI 2007). According to OSCE, in the year 2004, Italy was the sixth most exporter of manufactured goods in the world.

Principal economic activities of the country are to remember tourism, fashion, chemical industry, motor-car industry and food industry.

Italian energy's need is about 197,8Mtep (2005); the energetic voucher corresponds to 2,7% of PIL (2005) and strongly depends on energy's importations that amount to 167,72 Mtep (2005), 84,8% of the total need.

On terms of end uses, the energy's need is about 146 Mtep, of which 28% for industry, 30% for transports, 32% for civil uses, 2% for agriculture.

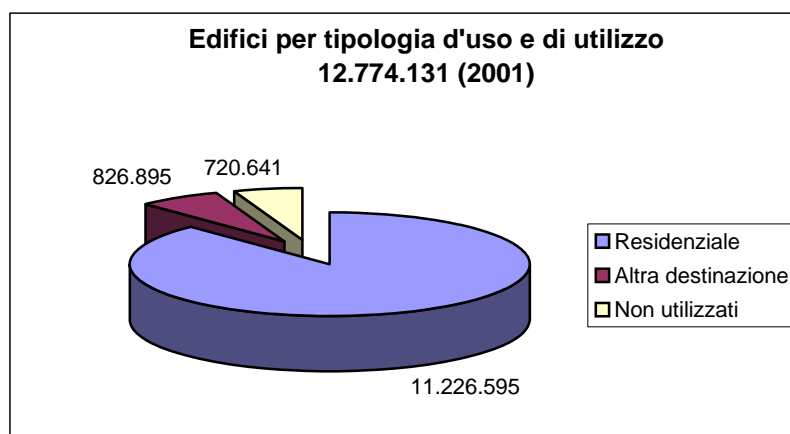
88% (and over) of energy consumption descends from non renewable fonts (natural gas, 36%, petroleum derived products 43%, solid fuels 9%);

7% is produced from renewable fonts.

Solar font (2005) produced 0,007 Mtep of photovoltaic energy and 0,021Mtep of thermal energy (solar collectors).

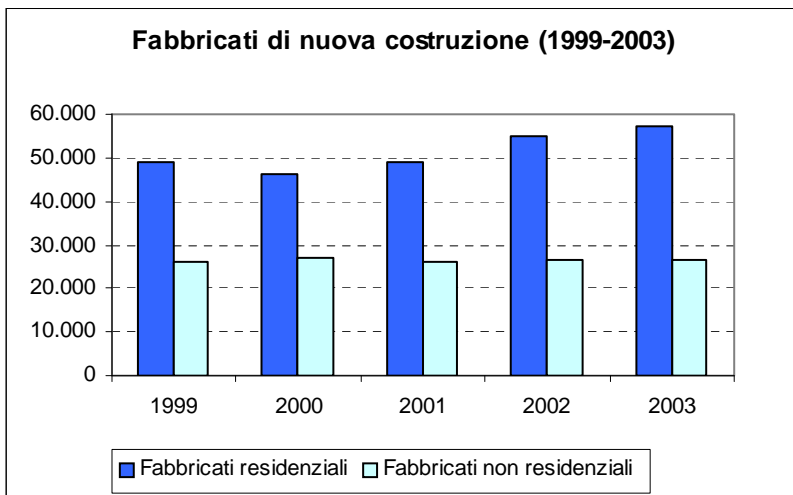
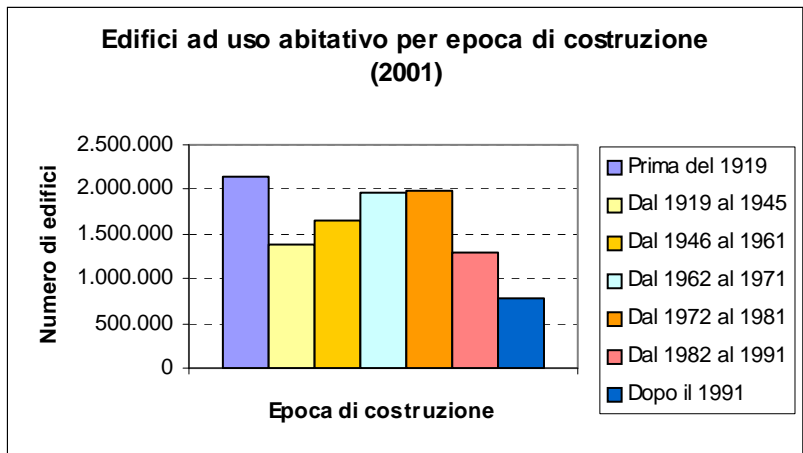
2 Building and energy data

According to the results of Italian 2001 census on population and dwellings, buildings in Italy amount to 12,8 millions. About 88% of these is destined for residential use, 6,5% is for another destination (hotels, offices, commerce and industry, communications and transports, other utilizations) in the remained 5,5% there are non utilized buildings.



More than 30% of the Italian residential buildings was built before the end of 1940 (more than 60 % was built before 1919); the 50 % of the stock building was built in the period from end of 1950 and the beginning of the 1980.

The figure on the right shows the time distribution of the residential buildings at 2001, in seven age classes.



In the period 1999-2003, the new buildings built was about 77.000 per year; of those the il 66% for residential houses.

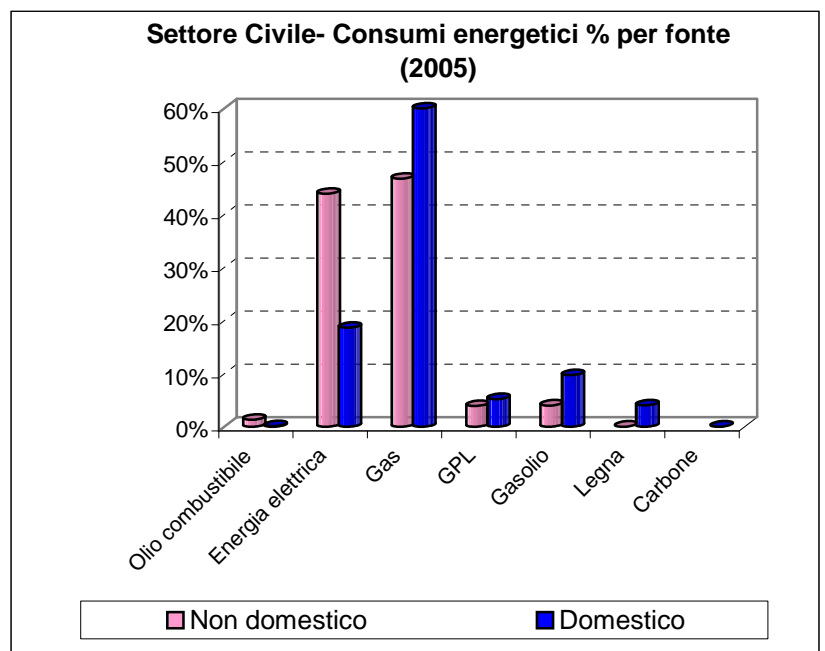
In the period from 2001-2003, the new buildings have a rate with an average of 8% per year for residential buildings, in a while was grewed of the 0,7% per year for non residential building.

In the same period the refurbishment of existing buildings was developed with a ratio of 12% per year with a number of

operational actions four times plus the ones for the new buildings construction

The energy consumptions for the civil sector (residential, tertiary, Public Administration services), in the period from 2000-2005 are grewed with an average of 3.5%. In 2005 this ratio arrived at about 47,1 Mtep.

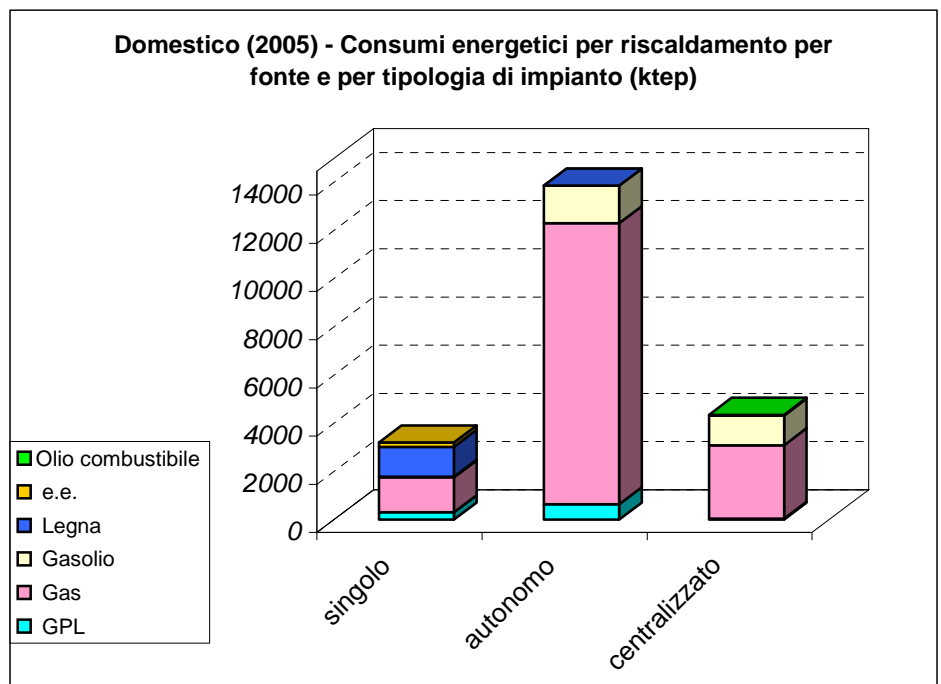
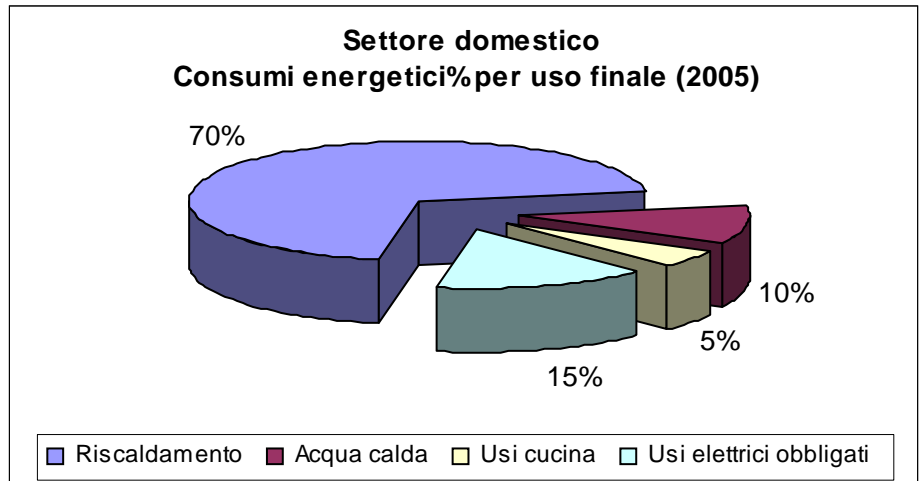
The non residential consumption is about 34% (15,7 Mtep) of the total consumption of the civil sector with a strong percentage of electricity and of CH₄ (more than 90% of the total). The energy consumption of residential buildings is two times respect the non residential one; the energy sources more in use are the electricity and the CH₄ that represent together more than 85% of the total.



In the non residential sector the consumption are more important for the climatization of the buildings in a while in the residential sector more important is the climatization of the dwellings; in this sector the consumption are for the 80% due to the heating system for the dwellings and to the production of Hot Sanitary Water.

For residential heating system in buildings the energy consumptions (2005 data), are produced form natural gas (75% of the total); the gasoline is the 13% of total consumption for heating while the wood and GPL are respectively the 5,6% and 4,6% of the total. Due to the system heating plants, from 1990 it is recorded less energy consumption in district heating system, but these phenomena find more energy consumption of the autonomous dwelling plants; for single heating plants there is a little bit of more consumption.

3 Overview of supporting policies, targets, support mechanisms and the role of the main players



The most recent laws enforced to regulate the residential building construction sector were the Presidential Decree of 6 June 2001 No 308 "Unified text of laws and regulations for residential building construction" and its modifications through the Decree of 27.12.2002 "Modifications and integrations to DPR 6 June 2001 ". In particular Art. 128 of the "unified text" deals with building energy certification. It promotes a deep revision and innovation of the different Rules, Norms and Regulations at municipality level, also referring to the new regional urban and building laws.

Starting 1996, with the process of decentralization Regional laws were issued to regulate the Residential Building sector, both private and public. For the private building sector a number of regional and municipal Urban Regulations were enforced. The trend is to introduce provisions for energy saving/energy performance not only in new buildings but also in existing buildings when

major renovation occurs. This tendency is fully in line with the content of the EPD and creates the legislative background for its application.

Among general principles for the new order of the public residential building it is worth mentioning the transfer to the municipalities of the ownership of the former public residential building stock, the transformation of the Public Housing Institutes into public economic entities with managing tasks and the decentralization to municipalities of most of the competencies such as managing and access criteria to public dwellings.

Building codes and building energy certification Codes for new buildings have been reinforced in Italy in 1975, 1982, 1989. In 1993 new standards (Decree 412/93) were set for new buildings and renovation works, to be enforced by local authorities. Sanctions are forecast in case of non compliance. Buildings after 1993 use 11 % less energy than before 1978 and 5% less than between 1978 and 1989.

In October 2005 the Decrees N°192 and N°311 in 2006 were issued for the application of the Directive 92/2002/CE on the efficiency in building sector. They were defined the standards and the rule for the new and refurbishment building construction for the energy certification in buildings.

These laws updated not only the mandatory energy efficiency requirements for the shell of new residential and non-residential buildings, but revised also completely the methodological approach with the introduction of rules and calculation methods to determine the seasonal energy consumption. The decrees 192/2005 and 311/2006 will set criteria for design and maintenance of buildings and will further reduce the power lost by transmission. It is expected that emissions of CO₂ will be reduced by 10% in two years in the new residential buildings.

In 2001 legislation was established via two Bills approved on April 20 setting quantitative targets for electric and gas distribution companies (Ministry for Productive Activity issued, together with the Ministry for Environment, the Decrees "about the national quantitative targets for energy savings and RES development" and "about national quantitative targets for the improvement of the energy efficiency of final end uses"). Within these decrees, the National Authority for Energy and Gas (AEEG) was appointed for the definition of reference technical norms and the preparation) of specific guidelines for the design, delivering and evaluation of possible actions.

At least 50% of the primary energy savings should be obtained through energy efficiency measures which produce a reduction of electricity consumption, while the rest can be obtained via projects improving only the energy efficiency, i.e. without a saving in electricity or gas final consumption, provided that primary energy savings are obtained (e.g. fuel switching from other fuels to electricity). An illustrative list was attached to the Decrees with 14 classes of projects and more than 35 sub-classes, including the use of RES (photovoltaic systems below 20 kW and solar collectors for sanitary hot water production). An Energy Efficiency Certificates (TEE) market has been created to increase cost-efficiency of the projects.

Starting 1998 several fiscal measures were introduced to support energy saving intervention when ordinary maintenance, restructuring and improvement is due:

- Law No. 449/97 allowed a fiscal reduction of 41 % of the cost (VAT included) related to building restructuring - including renewable energy sources - carried out during 1998 and

1999. The reduction applies only to building owners and is due on personal income tax (IRPEF), divided into five to ten annual rates. The reduction is applicable for costs limited to 77.468,53 € per building unit per person per year. • In December 1999 law No 488 was published, encompassing mainly a new round of fiscal incentives (-36% on expenses in this round) for energy savings maintenance and renovation activities in buildings carried out in the year 2000, with a maximum of 77.468,53 €. The incentive can be applied also to the purchasing of building that has been refurbished by a firm. In addition, a reduced VAT (10%) is applicable for the material used and the maintenance activities. The fiscal incentive has been reduced due to the contemporary introduction of the VAT reduction (-10%).

- The possibility of 55% deduction for energy saving purposes related to upgrade the performance of the buildings or elements of the buildings foreseen in the Decree 311/06. The same Law prolonged also the reduction of VAT to 10%.

These laws were not specifically designed for energy saving purposes only, but also to support the construction sector and for the reduction of the black market in restructuring; however, for a higher quality of the material and qualified manpower used they increase also the potential for thermal efficiency of buildings.

Starting 2005 the Ministry delle Attività Produttive promoted the first action to support the PV plants grid connected named “Conto Energia”. The goal will be to install 3000 MW of PV within on 2016, 1200 MW of which use these incentives.

4 Current status of solar energy technology applications (approx. 3 pages)

Italy is one of the least energy intensive countries in the world, but nevertheless has a complex system of energy policies and measures. One of the main reasons is the strong reliance on the import of energy carriers such as oil. Italy was estimated to be 80% reliant on imported energy sources from countries such as Libya and Algeria (EIA, 2000). This high proportion of imported energy has forced energy prices higher than in other countries and has also driven development of alternative sources of energy.

Another reason for the complexity is the fact that many policies and measures are still (partly) implemented by regional and local governments. Energy responsibilities are shared between the state, the regions and local authorities. Climate change policy, renewables support and data collection is based on a localised approach, which results in great differences between the regions.

There is an energy Authority that gave the go ahead to the self-production of energy with small sized plants from renewable sources today. The authority has passed measures to promote the self production of electric energy from small plants supplied by renewable energy sources with a power up to 20 kW in accordance with the Region Energy Department. With these measures the authority implements the 2003 decree for the promotion and the development of the renewable sources. The authority envisaged the possibility to sell to the local electric grid the energy output from renewable sources made with plants whose power is not superior to 20 kW.

In this way the Ministry of Environment, Regions and Local Authorities have promoted many projects and actions for the Renewable Sources development. The Regions and Municipalities, for this aim, have changed the building construction regulation to improve/extend the building efficiency and the natural renewable energy sources.

The Decrees 192/05 and 311/06 define the obligation for the new buildings to install the solar technologies for electricity and thermal energy production in residential and non residential

buildings. So all the new project will be built with the solar PV and thermal technologies integrated in the building.

Therefore, the “designer” will be able to work out alternative solutions mixing together the relative energy “ratings” to obtain excellent results. Consumers are more and more interested in buying technological advanced systems and are more involved in the market of solar buildings. Many Local Energy Agency in collaboration with the Institutional Office, Research Center and the Categories Associations are working. It is a large interest of Regions and Local Authorities to promote project and challenge to solar building houses. Regions more involved are Emilia Romagna, Lazio, Liguria Lombardia, Sicilia, Campania that start with voluntary proposal to upgrade the public buildings, particularly the schools, or challenge for passive houses or solar buildings (i.e. Sperlonga Municipality, a town near LATina, have promoted a challenge for a new solar houses project in which the design must use the Renewable Sources and the integration of new material and technologies for a high performance house.

The Municipalities of Rome, Asti and other have carried out in Altener program a European Solar Exhibition project. In this project was designed several solar residential buildings as in Saline-Ostia-Rome, or in Asti. At this time some winner projects are in construction phase.

PV technologies and plants are in developing time and many architects and engineering are involved in project with high integration design. As show in the paragraph 6 the development of the technologies gives a lot of possibility to the designers.

There is the need to diffuse the knowledge and the technical information not only to the technicians but also to the users. So in South of Italy Sicily region has carried out an important project named SICENEA by which was organized several workshops and training courses to promote the solar energy and the energy efficiency in buildings and to contribute to renewable to Italy’s targeted reduction of greenhouse gas emissions. The project are carrying out some proposal to create a Energy Service Office in all the Sicily Province to promote project for new building and refurbishment one with solar technologies and the creation of small enterprises, in Sicily, develop the market of solar technologies and to create new business energy company.

In fact not all the Region have a local market. Region as Lazio, Campania, Emilia Romagna, Toscana and others have a local market with many technicians for solar technologies but other Region as Umbria, Basilicata and others must use no local technicians or producer with a problems for the diffusion of the solar technologies

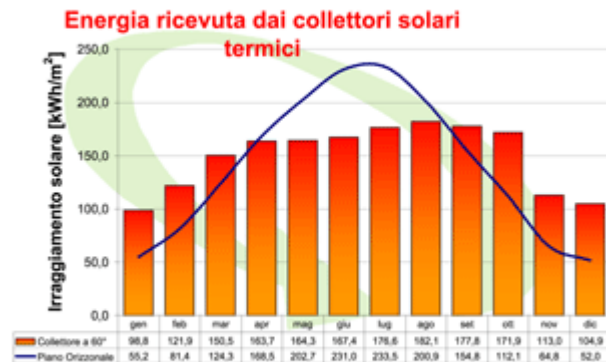
Some Success example

The building Light House in Sperlonga



The Municipality of Sperlonga near Latina, Center of Italy, with the Ministry of cultural Heritage the Architects Association and the ATER (social housing Body) promoted a challenge for innovative solar buildings in a site near the sea. The winner was a project of residential building with 24 dwellings. The building is in A class due to the high performance of material and design.

The figures below show the cost benefit of investment and the solar energy from solar panels

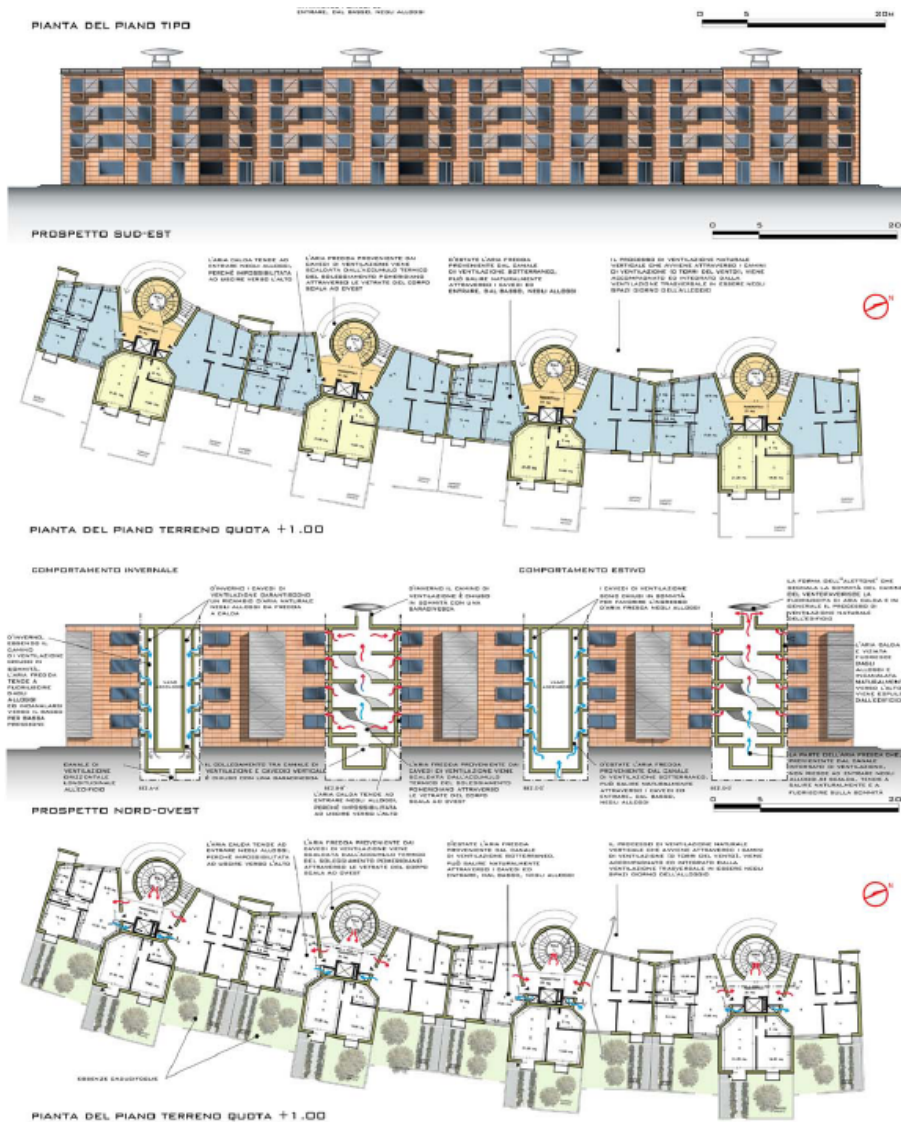


Thermal insulation of the envelope

Thermal insulation

		Trasmittanza [W/m²*K]
Facade	Laterizio porizzato da 25; Cappotto da 10	0,32
windows	Wood with double glass low emissivity	1,70
Floor level 0	insulation	0,22
Roof floor	insulation4; Isolante da 16	0,22

Participation in the Community Altener program 2002 Rome and Energy Agency Municipality A winner project for 56 dwellings in bioclimatic solar building



SOLEGGIAMENTO

Casa bioclimatica
presenza dei separati sistemi tecnologici: spazi-aria per accumulo termico passivo
batterie termiche integrate agli alloggi; canali di ventilazione a circolazione forzata
e aspirazione dall'aria per sfruttarne la pressione; iniezioni acqua ventilata

Fonti rinnovabili di energia: Predisposizione di impianto fotovoltaico
Produzione di energia elettrica

Fonti rinnovabili di energia: Impianto solare termico
Produzione di energia termica per acqua calda sanitaria

Fonti rinnovabili di energia: Impianto solare termico
Produzione di energia termica per riscaldamento e scaldamento degli ambienti

Uso di materiali ecologici:
Pannelli bioclimatici in sughero per isolamento termico dalle pareti; pareti ventilate in
cotto strutturale; uso "Mansoni" di costruzioni eleganti per la struttura; piante bioclimatiche
che ad acqua trattamenti e venticature con malta stuccata e rasatura naturali

Note informative generali
Progetto premiato al Bando di Confronto concorrenziale "Programma di Recupero Urbano" art.11, legge n. 493/93.

Località
Quartiere IACP di San Basilio
Via Filottrano/Via del Casale di San Basilio

Committente
A.T.E.R. di Roma

Architetti progettisti
Arch. ILARIA GATTI (capogruppo IACP)
Arch. ALESSANDRA BATTISTI
Arch. FABRIZIO TUCCI

This examples, however, are shining one. There are some problems that we have understood to promote and develop the solar technologies. The main problems are:

- o To change the building regulatory and do more easy the procedures for install solar system or plants:
- o to promote training courses for all technicians
- o to disseminate Best Practice in public buildings
- o research and innovation to upgrade the competition of the actors in the market.

5 Barriers impeding building integrated solar technologies

The mainly barriers in Italy, that limited the development of the building integrated solar technologies are: a) economical; b) information; c) administrative; d) visual impact; e) infrastructural.

- a) Economical barriers. In Italy the investment costs are more high compare to the other UE Countries because the poor diffusion of these technologies. The Ministry of Environment together with Ministry of Economic Development promoted the Conto Energia program for PV plants, totally or partially integrated in buildings. The Conto Energia, have the purposes to grow the the energy demand of PV plants, to reduce the investment costs, giving a fixed cost, related to the integration class, to the kWh produced from the PV plant. Other actions will be on going to develop and optimise the technologies, the methodologies to project the PV plant and to have more standard component for the market. Very important are the benefits for the environment and social economical sector applying the Renewable Sources.
- b) Information barriers. We have a gap with other European Countries because the environmental awareness is growing but not very diffuse in people too. Few people knows the potential possibility on the use of renewable sources to upgrade the environment and the comfort. There is a problem on the creation and development of big and medium enterprises in the fields of production, installation and distribution of the technologies, and there are few firma that offers an integrated services. These situation involve the policy marketing shortage, the lack of the chain sales, the quality warranty of the product and of installation, a good formation policy for the technicians, (design, installation maintenance and so on).

Administrative barriers. These kinds of barriers are bureaucratic procedures. They involve the Department of the Energy Authority, Regions Municipality, and some times the Ministry too. To change the regulations and the legislation to simplify the procedures is not simple because it needs to work in a way to revised completely the legislation to promote new rules and more friendly procedures. It is expected that will happen in a short time however the Finanziaria 2008 law will produce some simplification procedure to obtain fiscal deduction for energy saving purposes. There are financial barriers, especially for final users with low energy consumption, which consider energy efficiency a low priority due to the long payback time of the investments, barriers due to long bureaucracy, lack of technical knowledge and sometimes barriers due to ambient and comfort conditions. To overcome these barriers, awareness and informative campaigns are forecast by the two Bills both as accompanying measures or standalone projects.

The Bill for electricity includes the obligation for the distributors to prepare an annual plan of their projects and measures, taking into consideration environmental and energy guide lines established at regional and local levels; the annual plan should be sent to regions and autonomous provinces, which in turn can stipulate agreements with the distributors to achieve their regional and local energy and environmental targets using own financial resources.

- c) Visual impact barriers. In Italy the cultural Heritage in the city, the historical town, the conservation of historical landscape and similar urban situation are a great resources but a strong barriers too. The building Municipality regulation, the Regional legislation and the National one are not easy to apply. It happen that you can work in a way for the Municipality regulation but not for the Regional or for the National law so you don't know how you must work or you don't understand who is that stop the action. Naturally for new

buildings or new urban area it is more simple to project and build a buildings but this market is only 1% of the market, however when you involve, onto a new project, an heritage site you meet the same problems for a refurbishment project. For our culture the problems for the conservation of cultural heritage and historical buildings and landscape have the priority on all the other action so the energy performance is always a second purpose. It is necessary that it will be define evaluation indicators, new technical standards with a interdisciplinary technicians equip job.

- d) Infrastructural barriers. Our electrical grid need to upgrade and to renew to promote and apply the PV generation. The actually supply grid was projected, managed and controlled to one electric current direction. To accept a great percentage of district generation the grid must be changed to become in a bidirectional way. There is need to develop our electrical system of strong investment and important action plan on the grid and on supply equipments.

6 Future opportunities and plans, most promising market niches

In 2005 it was promoted the electric production from the PV plants grid connected. The Conto Energia legislation promote, with more expensive rates, the small PV power plants, typically used in a residential buildings. To stimulate the market there are different rates for the PV integrated , or partially integrated or non integrated in a building (i.e. the rate is more 10% if the PV plant is integrated in a building).

The purposes of this initiative are to encourage the PV solar technology in the Country, in the users and to avoid the use of the external area of the building so the technicians must overwork on the buildings using the right solar exposition.

On 2020 it foreseen a PV potential power of 8500 MW, by which 7500 will be “integrated in the buildings” and 1000MW form PV plants. At the end of July 2007 in Italy was installed about 70 MW of Pv plants (by which about 12 MW done on 2006), and the 20% are grid connected.

In 2002 a study of International Energy Agency - Photovoltaic Power Systems Programme (IEA-PVPS, Task 7) has defined the potential power of the PV technologies integrated into the buildings. For Italy it was estimated a roof area of about 763,53 km² (about 410 km² for residential buildings and the other in tertiary sector) and a site for the façade of 286,32 km² (about 18 m² per man people). The Pv potential production integrated in buildings is about on 126 TWh/year (that is the 36% of the electric energy consumption for the 2006). The innovation in the PV technologies is one of the most important aspect for the designer of the building and for the technicians. The PV film is the technology more interesting for our technician people; you can use it as shading devise or as glass panel or for the roof protection and so son,. It is running in the market and many buildings have a PV system made with this technologies. With this kind of technology it is possible to make several shape and different spatial dimension that can fit with the envelope shape or adapt to the roof. Other question is that you can obtain two aims: satisfy the technical requirements for the building and to produce energy for the users with PV solar plant.

The integration is the holistic way to design a building .You can save for the building construction, material and component, and for the user clean energy from the sun. The industrial situation, in Italy, is critical because there is few firma that produce the technology and the PV components; in spite that the solar radiation is very strong the PV installed is poor and we must import the technology and components.

Other question but very important is the costs. In our Country the PV plant costs are more expensive that in other Country and the different cost of the film PV components for the integrated PV application in the buildings don't help the application of this technology. If the price will be deeper the market will develop with many possibilities of applications.

The DM 192/2005 "application of the Directive 2002/91/CE on energy performance in buildings" has in force to use in private and public new buildings to use the Renewable sources to produce energy for Hot sanitary Water or for heating plan and electricity for the building. The heating solar plant must produce the 50% of the primary energy need this value will be reduce for application in buildings onto historical site. The Finanziaria law 2007 allowed a fiscal reduction of 55% of the cost (included VAT).

Actually, in residential buildings, the heating solar energy production is the 0,07 Mtep in a while the energy consumption to produce Hot sanitary water is 4,7 Mtep; these rate is the goal of the solar technology market.