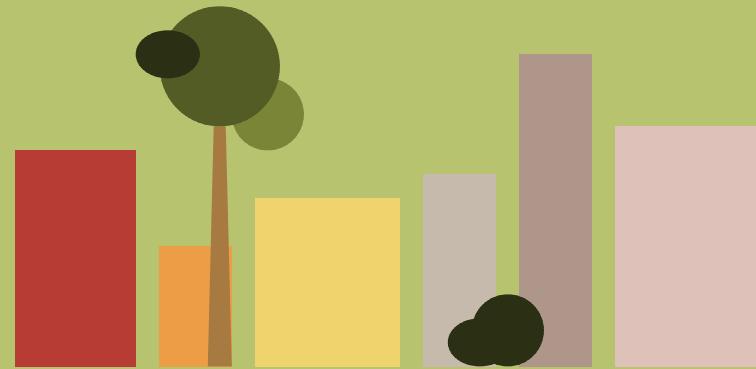


Energy efficient buildings retrofitting



Outdoor



Green areas



starting point

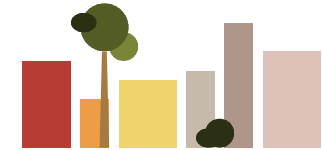
urban areas covered by concrete pavements and buildings absorb 10% more solar radiation than green areas covered by vegetation

improvements

an appropriate layout of residential green and parking areas can reduce heat absorption, improving the outdoor microclimate and the indoor living conditions as well

- vegetation can absorb up to 90% of the solar radiation
- vegetation shadowing can reduce up to 50% energy consumption due to air-conditioning
- the cooling caused by the transpiration of a single tree is equal to five small air-conditioner

Green areas



how to do

- trees, bushes and hedges can shadow outdoor areas and the lower parts and windows of buildings
- for southern-exposure sides of the buildings, it is preferable to have plants with caducous leaves, in order to take advantage of solar radiation in winter time
- caducous creepers are suitable for eastern and western exposure sides of buildings, while evergreen creepers should be positioned northward, where they can improve winter insulation
- hedges and trees can be used as windbreakers

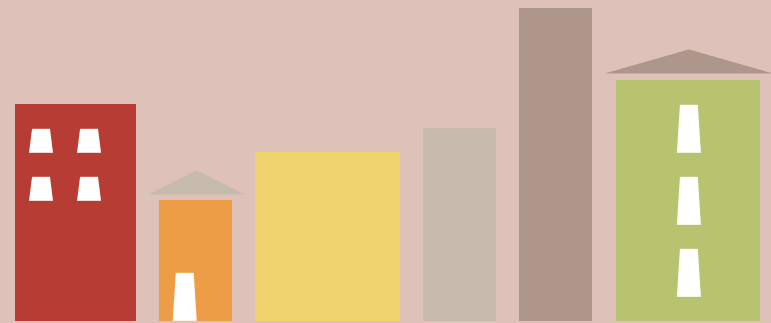
Green areas



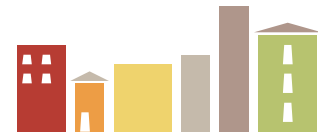
it is good to know...

- interventions concern green and parking areas close to the buildings
- costs mainly concern planting and/or substituting new plants. Managing costs usually do not increase

building
structure



E External walls insulation



starting point

many buildings waste a large amount of energy through their external walls due to a poor thermal insulation. Such a situation increases heating costs and worsen indoor comfort.

improvements

a proper insulation can be achieved by placing on the walls a continuous layer of insulating material. Natural and industrial materials are available.

advantages:

- reduction of heat losses and costs;
- reduction of thermal bridges

External walls insulation



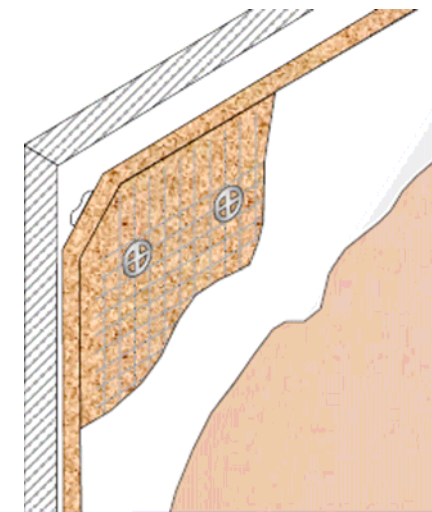
how to do

Natural (such as cork or wooden fiber) and industrial (such as polystyrene) insulating materials are available

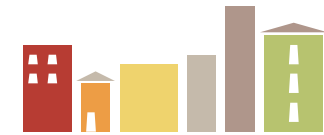


it is better to place the insulating layer outside, in order to take advantage of the heat storage capacity of walls and to eliminate thermal bridges

internal insulations are suitable only for rarely used flats, as they guarantee a faster heating



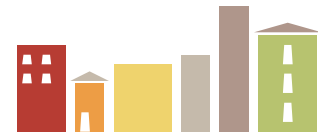
E External walls insulation



it is good to know...

- costs vary according to the used materials
- in order to reduce costs, it is better to combine the intervention with other maintenance activities
- if placed externally, the insulating material has to be properly protected

Windows insulation



starting point

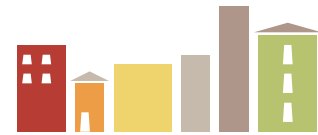
about 30% of heat losses occurs through windows and their casings

improvements

it is easy to obtain energy savings acting on these architectural elements:

- savings up to 10 - 15% installing new gaskets
- savings up to 5 - 10% adding a double-glazed window to the frame
- savings up to 15 - 20% doubling the frame or substituting the existing one with double-glazed windows with low emissions level

Windows insulation



how to do

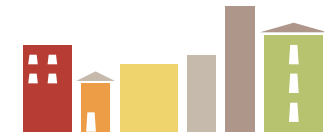
some improvements can be obtained without acting on casings:

- installing new gaskets;
- using heavy curtains (without covering radiators);
- adding a second casement;
- adding a second window.

but the best results are obtained by changing it:

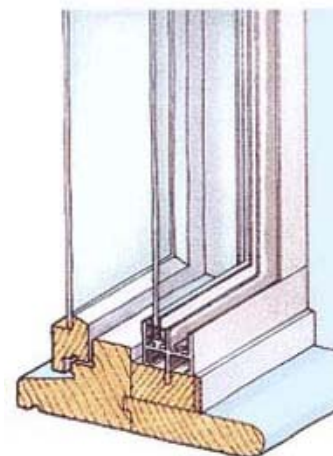
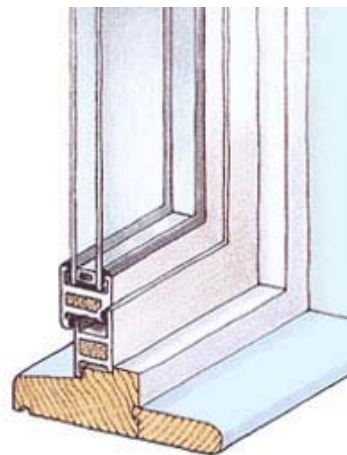
- choosing double-glazed windows;
- or special treated glass with low emissions;
- frames with thermal break.

Windows insulation

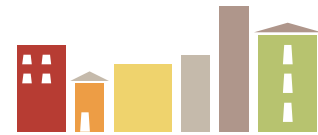


it is good to know...

- minor interventions (i.e. new gaskets and curtains) are very cheap and effective
- changing casings is a good idea when the old ones are getting too aged
- changing casings of the entire building increases its esthetic and economic value



Roof insulation



starting point

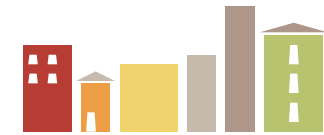
heat losses through the roof are often the highest ones, and they can account for up to 35% of total losses

improvements

roof insulation can reduce costs between 10% and 20%, depending on roof characteristics and on the used material;

a well insulated green roof can significantly improve indoor comfort

Roof insulation



how to do

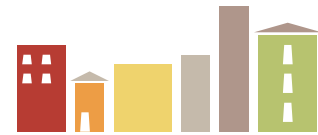
insulating material for pitch roofs can be placed:

- *till the roof*, placing the insulating layers under the bearing structure
- *under the roof*, placing insulating layers over the bearing structure and under the covering layer
- *under a new roof*, retrofitted replacing the covering layer with a ventilated roof

for horizontal roofs, it is possible to create green roofs, transforming the roof in a beautiful hanging-garden and improving insulation as well



Roof insulation

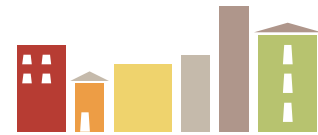


it is good to know...

- costs depends on the used material and on its thickness. Placing the material over the bearing structure is more expensive
- in order to reduce costs, it is better to coordinate the intervention with other roof maintenance activities
- energy savings assure a payback time of few years
- sometimes it can be easier and cheaper to insulate the attic instead of the roof

P

assive heat storage



starting point

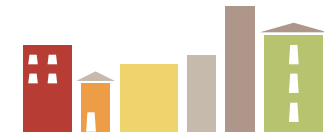
the solar radiation, if properly captured, stored and distributed, can be used as an alternative heating system in winter time, improving comfort and reducing energy consumption

improvements

green-houses are commonly used in agriculture, but they can also be used as passive heat storage system, contributing to the heating of residential buildings

P

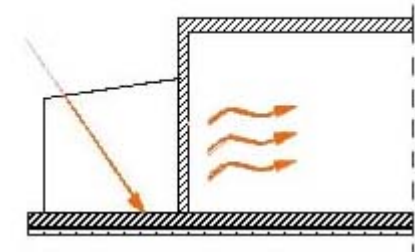
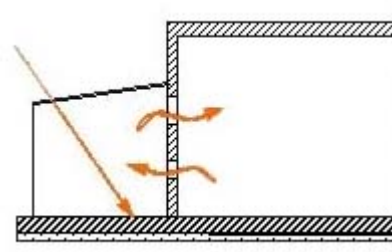
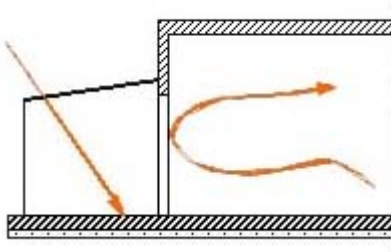
assive heat storage



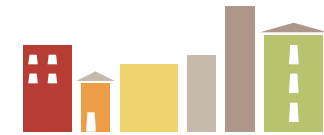
how to do

green-houses are made by glass structures, according to the following recommendations:

- exposure must be southward
- envelope must be transparent
- ventilation has to be guaranteed
- shadowing must be possible
- they must be properly linked with the other environments of the building
- they should not be artificially heated or cooled

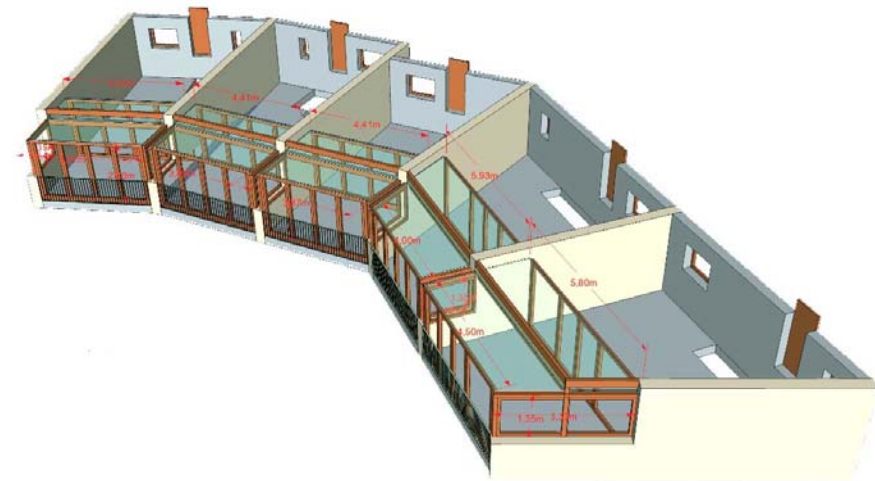


Passive heat storage

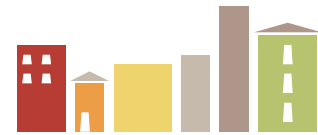


it is good to know...

- payback for new buildings is 10 years. Lifetime of the structure is 25 years
- retrofitting of old building should be done on the entire structure of the house, for esthetical and practical reasons
- the technical design of the intervention should be done by competent professionals, stressing the energy savings



Windows shadowing



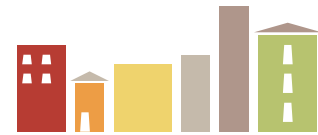
starting point

windows allow heat and light to enter the indoor environments, uncontrolled exposure to sun can cause indoor over heating

improvements

a proper windows shadowing guarantee indoor comfort and light control, reducing the adverse effects of solar radiation in summer time

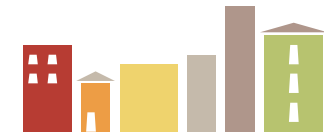
Windows shadowing



how to do

- rolling shutter and blinds can only shadow window openings, reducing the light control possibilities
- curtains or other shadowing devices placed over the windows or over building parts can avoid their heating, thus improving the indoor conditions
- mobile shadowing devices can act as dimmers, and are useful to avoid blindings

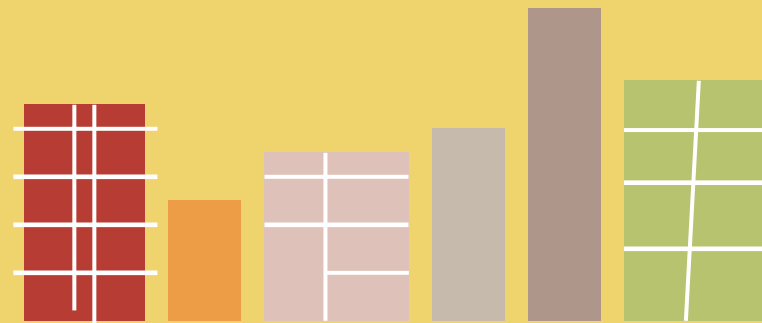
Windows shadowing



it is good to know...

- shadowing is essential for southern and western exposure sides of the buildings
- it is advisable to carefully integrate interventions with the architectonic characteristics of the building
- in order to reduce costs and improve effectiveness, it is better to coordinate the intervention with other maintenance activities of the external walls

indoor



E Environments arrangement



starting point

indoor environments should be arranged according to their function, in order to improve the comfort taking advantage of the solar radiation

the margin of action in old buildings is often reduced, as the position of the environments is constrained for technical reasons

improvements

optimal environments arrangement allows to take advantage of solar radiation for heating and lighting purposes

- when indoor renovation occurs
- when it is possible to switch environments position without acting on the main structures

Environments arrangement

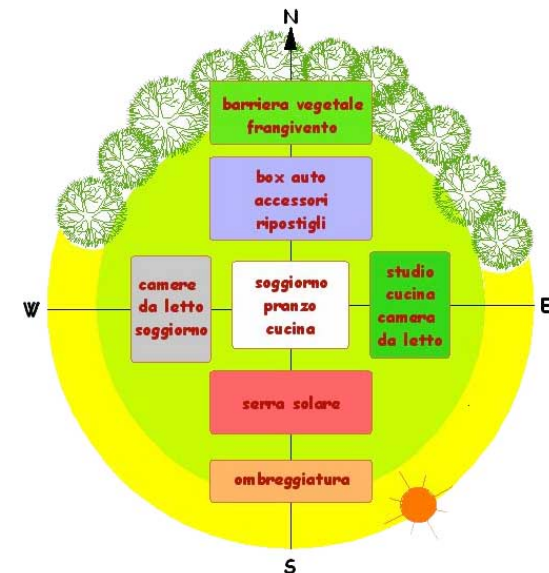


how to do

- the most often used environments (kitchen, dining room, living room...) should have south-eastern, southern or west-eastern exposures
- the northern exposure should be reserved to the environments without special lighting and heating needs (corridors, store room...)

it is good to know...

- services environments with northern exposure can improve the insulation in the rest of the apartment
- rooms with southern exposure receive heat trough walls and windows



Aeration



starting point

aeration is critical to assure hygienic conditions inside buildings
opening doors and windows aerates the environments but causes heat losses

improvements

energy efficient aeration can be reached by means of:

- a “shock strategy”, opening simultaneously many windows
- an aerating mechanical system

an aerating mechanical system can save between 20% and 40% of the consumed heat



Aeration

how to do

- it is not useful to install an aerating system if the apartments is not aerated very often by the dwellers
- in the most recent systems, the warm exiting air is used to heat up the incoming fresh air
- in old building, systems with “decentralized elements” are suggested

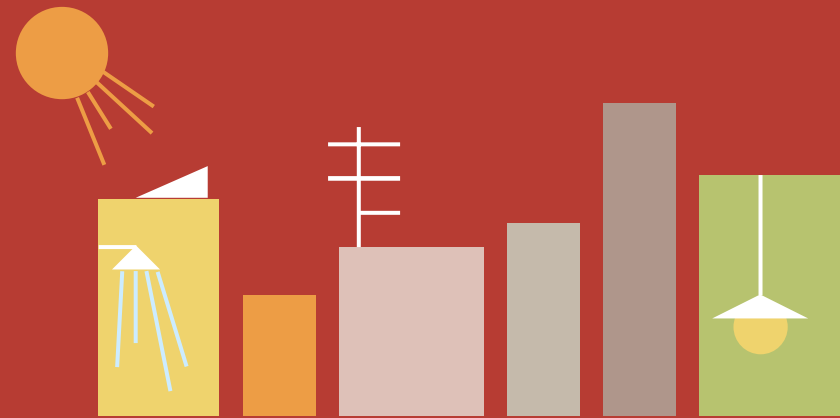
Aeration



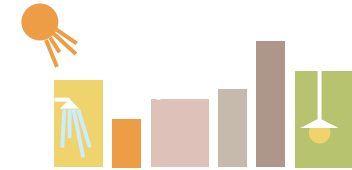
it is good to know...

- purchasing and installation costs are still high, while operating costs are low
- the number of decentralized elements is equal to the number of rooms to aerate
- external aerating system may decrease the esthetical value of buildings

equipments



Photovoltaic systems



starting point

photovoltaic systems are used to produce electricity from the solar radiation

they have high investment cost, but there are many subsidies that can reduce the payback time, making the installation of photovoltaic panels an extremely interesting intervention

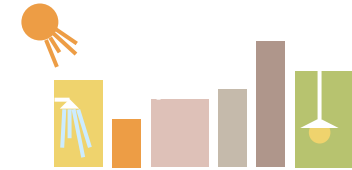
improvements

the photovoltaic panels increase the energy efficiency of buildings.

panels can be installed:

- on roofs, horizontally or with an inclination according to the longitude
- on shadows free walls

Photovoltaic systems



how to do

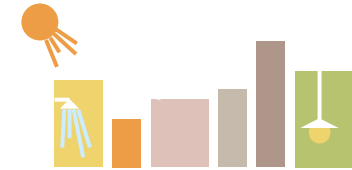
photovoltaic systems reduce the fossil fuels consumption for each produced kWh :

- 250 grams of fuel are saved
- the emission of 700 g of CO₂ is avoided

a cell of 10 cm² can produce a current of 3 Ampère and a power of 1,5 Watt

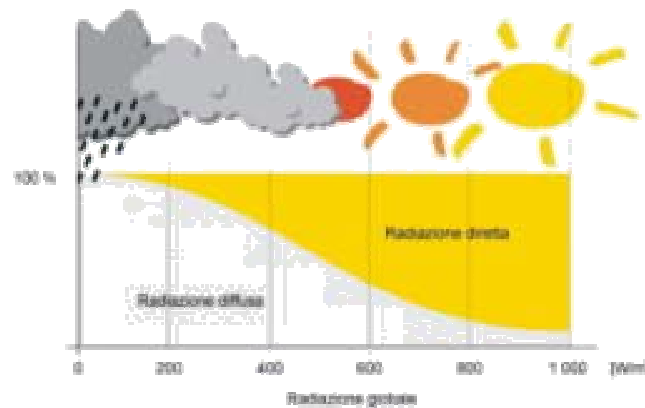
the installation is very easy if the building is predisposed

Photovoltaic systems

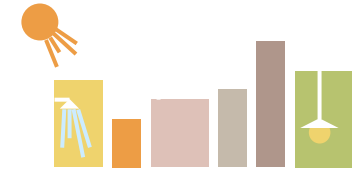


it is good to know...

- electricity production varies according to the season of the year, to the meteorological conditions and to the day/night alternation
- the connection with the electricity network is maintained to assure electricity in any condition
- solar cells should undertake regular maintenance



Lighting



starting point

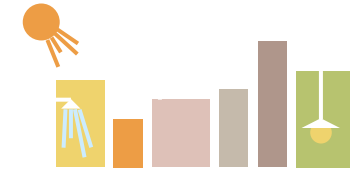
lighting is responsible for 10% - 25% of the energy consumption in a building

incandescent lamps waste as heat 90-95% of the used energy

improvements

modern lighting systems can save up to 50% of the energy with a very low initial investment and short payback time

Lighting



how to do

In outdoor common places:

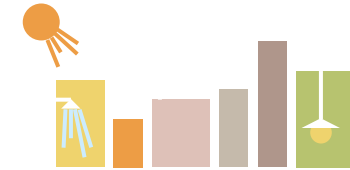
- Use lighting systems correctly set-up
- Use a timer to turn-off some lights when they are not needed

In indoor common places, it is possible to use a timer or a sensor that automatically switches on the light only when needed

It is always a good idea to substitute incandescent lights with energy saving lamps, such as compact fluorescent lamps, unless they are switched on and off very often and remain on a very short time

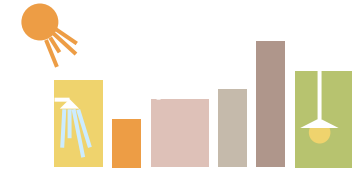


Lighting



it is good to know...

- Energy saving lamps last up to 10 times more than incandescent lamps, using 5 times less energy
- Energy saving lamps need some seconds in order to reach the maximum lighting level
- They should be used where they are not frequently switched on and off, as this could decrease their life-time



Cooling system

starting point

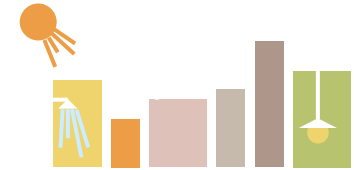
Sun is welcome in winter time, but it can heat up too much buildings in summer. Many modern buildings are not adequately insulated and they thus need a cooling system

improvements

There are many ways to improve the cooling in a building. It is possible to:

- improve windows and walls insulation;
- shadow sun-exposed openings;
- improve the local micro-climate by acting on the vegetation.

If these actions are not enough, then a cooling system must be purchased. But it must be chosen with care!



Cooling system

how to do

a cooling system is always an energy and economic cost

it is advisable to contact a specialized technician in order to correctly design and dimension the system

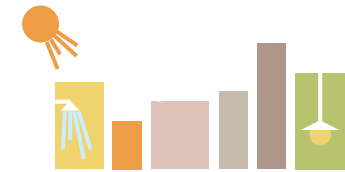
as an estimation, a chiller working in a 20m² room, 6 hours a day per 4 months a year:

- emits 340 kg of CO₂ / year
- consumes 560kWh / year

Cooling system

it is good to know...

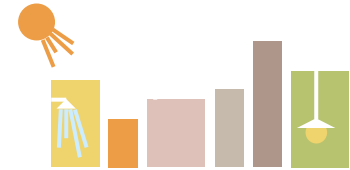
- A-class devices have a good efficiency; they consume 30% less energy than C-class devices
- the use of an inverter allows to adapt the power output of the system and save up to 30% of the electricity
- DC-devices (continuous current) are more efficient and less noisy than AC-devices
- coolers remove heat from indoor and bring it outside. The outgoing air flux can reach high temperatures, up to 45 °C



Energia		Condizionatore d'aria
Costruttore		Logo
Unità esterna		ABC 1 2 3
Unità interna		ABC 1 2 3
Bassi consumi		
A		
B		← B
C		
D		
E		
F		
G		
Alti consumi		
Consumo annuo di energia, kWh in modalità raffreddamento <small>(il consumo dipende dal clima e dalla modalità d'uso dell'apparecchio)</small>		X.Y
Potenza refrigerante kW		X.Y
Indice di efficienza elettrica <small>(il suo regime (a più elevata possibile))</small>		X.Y
Tipo: Solo raffreddamento	—	←
Raffreddamento/ riscaldamento	—	
Raffreddamento ad aria	—	←
Raffreddamento ad acqua	—	
Rumore (dB(A) re 1 pW)		

Gli spessori illustrati confermano una scelta particolarmente

Norma EN 1416
condizionatori d'aria
Direttiva 2002/91/CE - Etichettatura energetica



Heating

starting point

from time to time it is necessary to change the heating system. It is then a good idea to look around...

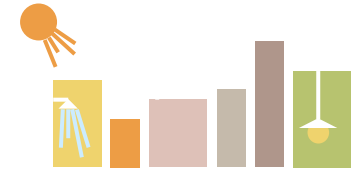
- fossil fuels prices are always rising
- environment-friendly technologies are becoming more and more advantageous

improvements

new technologies permit energy savings and more comfort:

- heat pump: takes heat from a cold source (air, water or ground) to a warmer one with an high efficiency
- solar panels: can be used to heat the indoor environment, they have no energy consumption, but heat is not always available
- boilers: they can be fed by biomass and reach very high efficiency (i.e. condensation boilers)

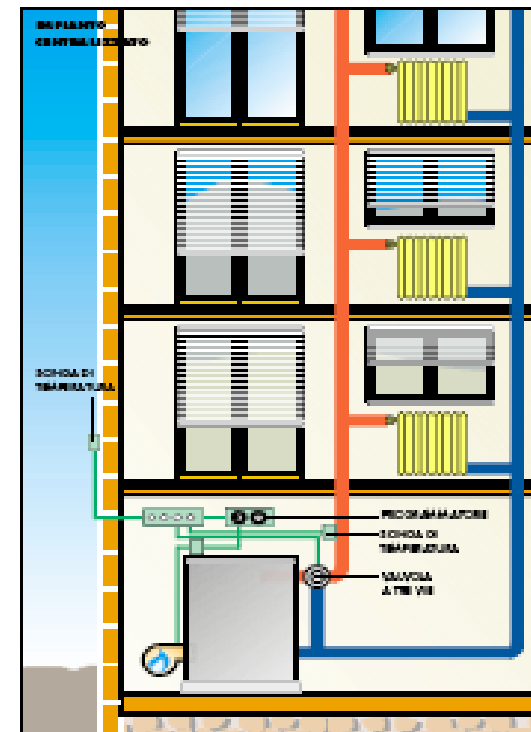
Heating

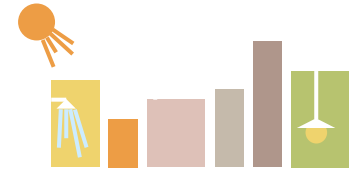


how to do

centralized system are more efficient

- installation costs are lower when compared to the installation of a number of small boilers, one for each apartment
- less power is needed, efficiency is higher, lifetime is longer and costs are lower
- the management is easier

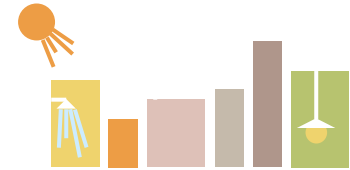




Heating

it is good to know...

- substitution costs are variable and they depend on the desired technology and degree of efficiency
- the substitution is cheaper if it is done when the old boiler is aged and need to be changed anyway
- a regular maintenance is important (at least once a year)



Hot water from the sun

starting point

hot water for heating and sanitary purposes is still mainly produced using fossil fuels.

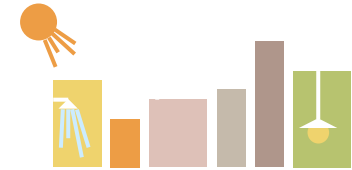
it is however possible to produce hot water from the sun!

improvements

a well designed solar system guarantee at least two third of the energy for hot water production (depending on the sunshine!).

it is then possible to save a considerable amount of fossil fuels and to reduce CO2 emissions

Hot water from the sun

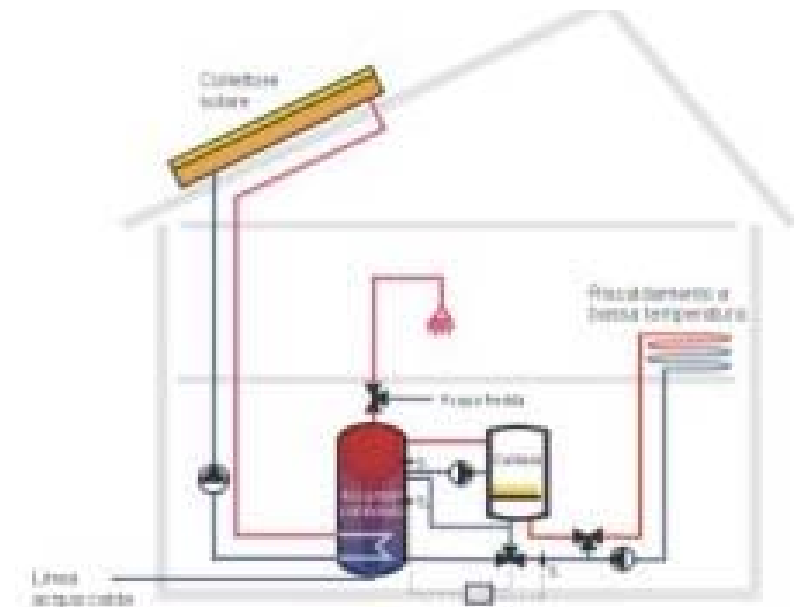


how to do

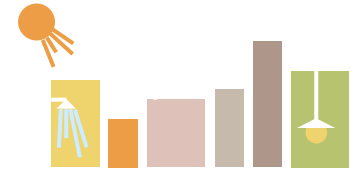
hot water production is performed by sun collectors, which are absorbent bodies where a special fluid or water can capture the solar radiation and store it under the form of heat.

There are two main typologies of collectors:

- thermosyphon systems, cheaper and suitable for sanitary hot water production. The storage tank is usually placed over the panel.
- pump driven systems, more expensive but more efficient, they have a larger storage tank that can be placed anywhere.



Hot water from the sun



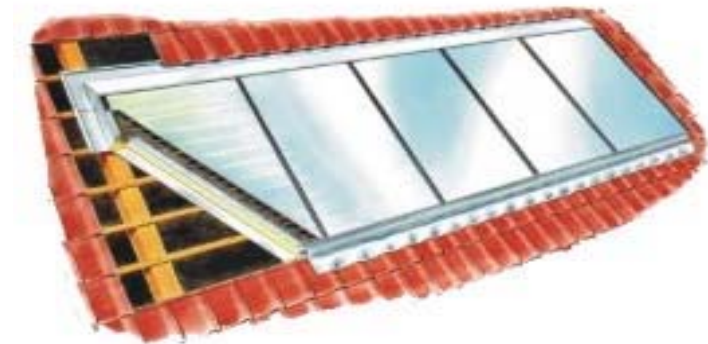
it is good to know...

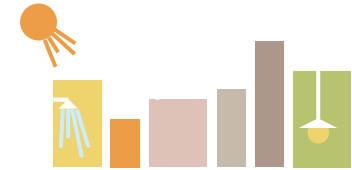
- solar panels are guaranteed for 20 years, but their lifetime can be even longer

Payback time is 4-5 years if they substitute an electric boiler or 8-10 years if they substitute a gas boiler

panels can be placed:

- over roofs or on the ground, with the right inclination
- over inclined roofs, mounting the panels over the covering layer and without any roof modification
- over the roof bearing structure, removing part of the covering layer. The panel itself is used as covering surface.





H

Heat distribution

starting point

cast iron radiators use water at 70-80 °C. Air close to radiators heats up and move upward, while colder strata remain close to the floor

such a system is not really efficient and it does not assure an adequate comfort

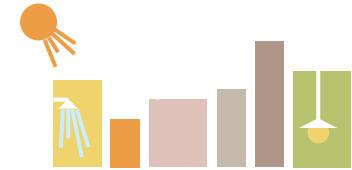
improvements

distribution systems at lower temperatures consumes less energy and increase the comfort

radiant heating systems (e.g. underfloor systems):

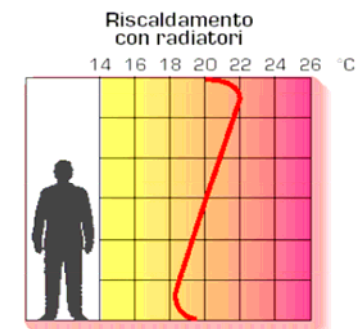
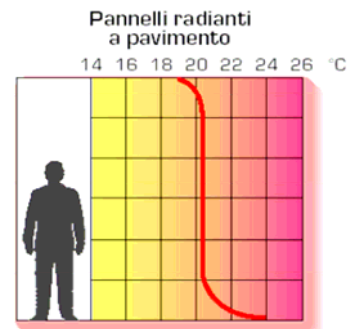
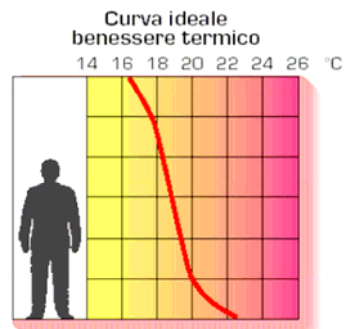
- can save 20-30% of the energy
- do not create air movements. Warm air remains where it is needed
- given the large radiant surface, they guarantee a slow and uniform heating

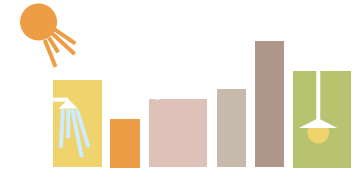
Heat distribution



how to do

- Chinese, 2000 years ago, used to heat houses making holes in the floor in which hot smoke was let through
- radiant systems uses the same principle, using many small diameter tubes in the walls and on the floor in which hot water is distributed
- the tubes are properly insulated and they are not visible from outside
- the hot water has a temperature of 35-40 °C and it can thus be produced by means of solar panels





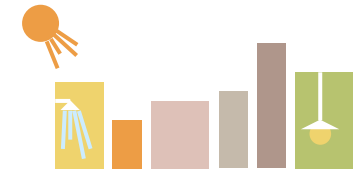
H

Heat distribution

it is good to know...

- radiant heating systems can be used to cool the apartment, by letting cold water through the tubes
- the installation requires the old floor to be removed
- the thickness of the system may reach 5-10 cm
- the lifetime is very long and usually guaranteed by the producers

Temperature control & heat metering



starting point

a traditional heat distribution system uses water always at the same temperature. But rooms are not at the same temperature and have different needs:

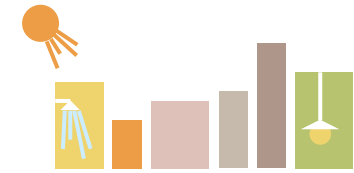
- each room is influenced by sun exposure, windows dimensions, utilization by people, utilization of electric devices...
- each apartment is influenced by many factors, such as the presence of non heated environments nearby



improvements

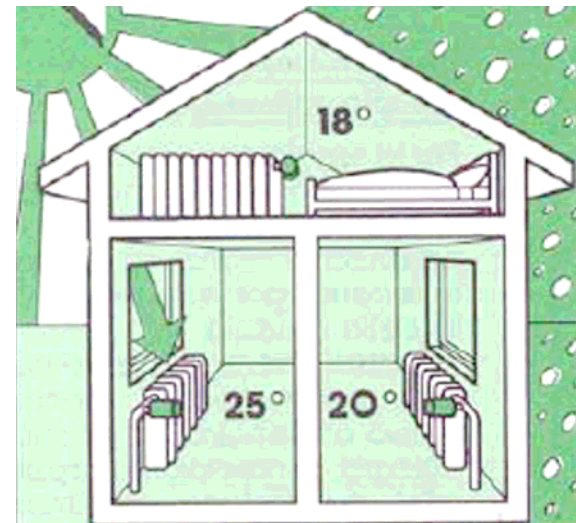
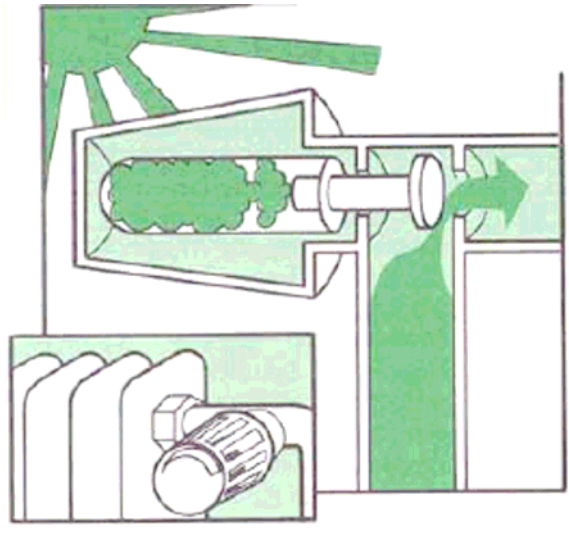
the solution is to control the temperature autonomously in each room and apartment, in order to guarantee the comfort without wasting energy

Temperature control & data management



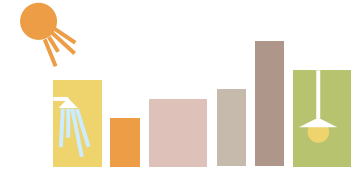
how to do

- substitution of the manual valve with an automatic valve for each radiator. The automatic valve regulate the flux of hot water according to the actual needs
- installation of heat meters in order to record the actual heat consumption in each apartment



T

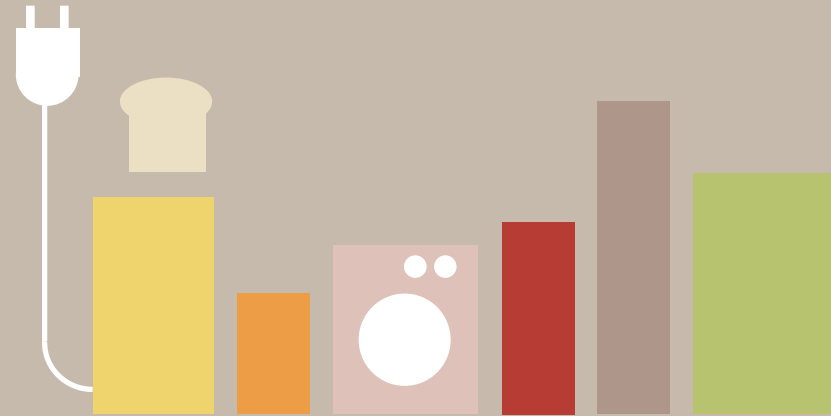
emperature control & data management



it is good to know...

- an increase of the temperature of 1°C can increase consumptions by 10%
- the installation of automatic valves allows savings of 10-20%
- the cost of automatic valves and heat meters is not high, and the payback time is just few years
- the installation of meters must be agreed by all the building inhabitant, and it is cheaper if the distribution system is horizontal

electrical-
appliance



Electrical appliances



starting point

electrical appliances (DHW-boiler, fridge, washing machine, TV, dish-washer, oven etc.) are responsible for 80 % of the domestic electric consumption.

look at the label!

on the energetic label, mandatory in the EU, are listed the basic information necessary for an aware and conscious choice, like consumption's category, average consumption, main characteristics and functions.

use your head!

- put in the fridge only food at room-temperature, never if they're hot;
- place the fridge in the freshest area of the kitchen;
- during the warm season, open the fridge door as rare as possible;
- use the wash programs (temperature and time) of the washing machine according to the real dirty-level of the clothes;
- before putting the dishes in the washer, remove the remnant without water;
- turn off all the stand-by led by switching the main button; led and watches use energy: few, indeed, but often it is just wasted!