KGH problemi i perspektive novog veka

New HVAC Century-Problems and

Dott. Ing. Alex Sandelewski, CEng, FCIBSE,MASHRAE

European and Italian directives and standards

The European Directive 2009/28/CE makes it compulsory for all European Union states to issue directives aimed at reducing energy consumption and increasing the use of renewable energies, in order to comply with the provisions of the Kyoto Protocol and limit greenhouse gas emissions.

Italian Directive 28/2011

It states that new buildings or buildings undergoing sizable restructuring, 50% of the annual energy for sanitary hot water heating, and:

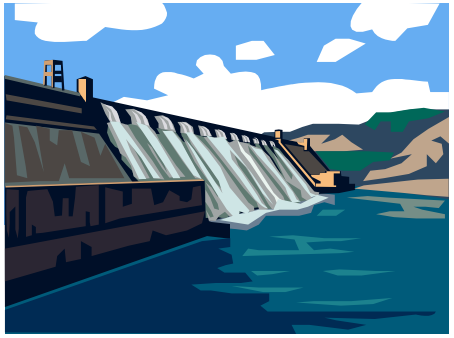
- 20% of the combined energy required for sanitary hot water production, heating and cooling until December 2013
- 35% thereof until December 2016
- 50% thereof after this date

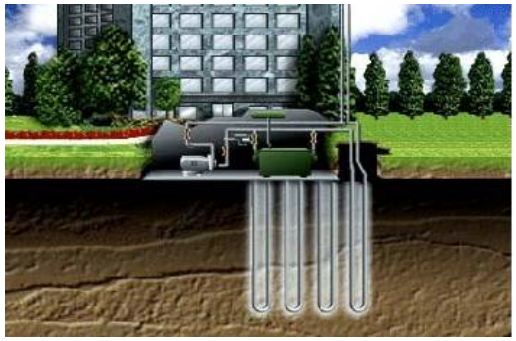
has to be produced using renewable energy supplies

What are renewable energies?

According to Decree 28, they are:

- Wind
- Solar
- Air, water and geothermal source heat pumps
- Hydraulic
- Biomass
- Garbage disposal gas





Defects of Directive 28/2011

1. It is more advantageous to use medium rather than high efficiency heat pumps.
2. No distinction is made between sources of auxiliary heating energy (electrical resistance, condensation boilers, other).
3. Non-electric heat pumps, such as absorption or engine driven ones, are penalized.
4. Use of free cooling is not considered.
5. Compliance calculations are carried out with average temperature values, which may lead to an erroneous determination of the renewable energy portion.
6. The obligation of using renewable energy does not apply if the building is connected to a district heating /cooling plant which supplies all the required heating/cooling energy, without considering whether this energy is produced from renewable sources or not.

Consequences of Directive 28/2011

Use of boilers, condensing or otherwise, has declined sharply, while heat pumps have taken off. In particular the easy availability of ground water in Northern Italy has boosted the use of ground water heat pumps.

NO

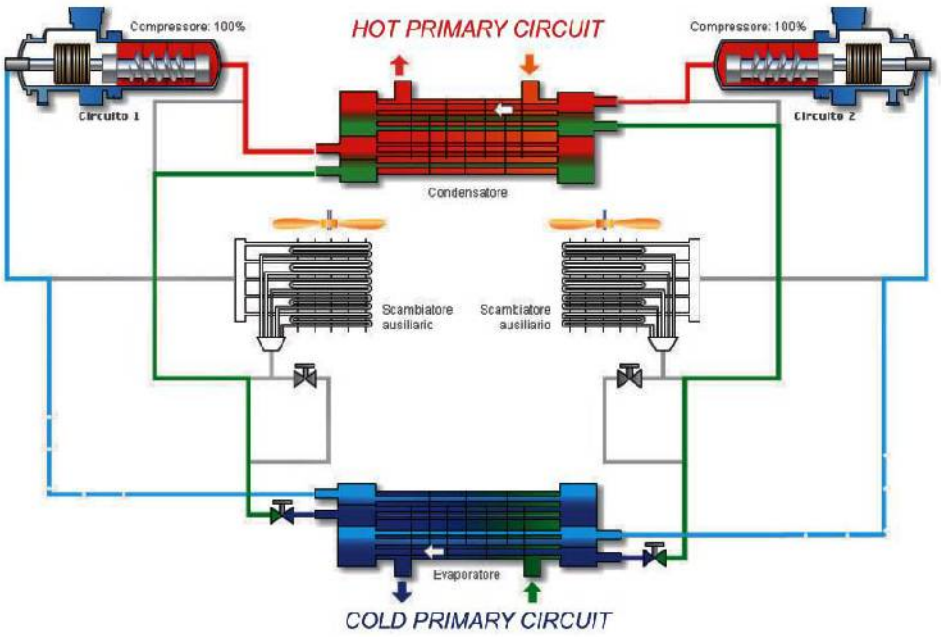
SI

Available products and solutions (1)

Four-pipe heat pumps, equipped with two circuits: one for heating/cooling and one for sanitary hot water production. The latter has always priority: whenever there is a demand for sanitary hot water, the unit switches to a high heating set-point (up to 65° C), (reversing the cycle in summer), and works with it until demand is satisfied, thereafter returning to space heating/cooling. These heat pumps are especially popular for residential applications.

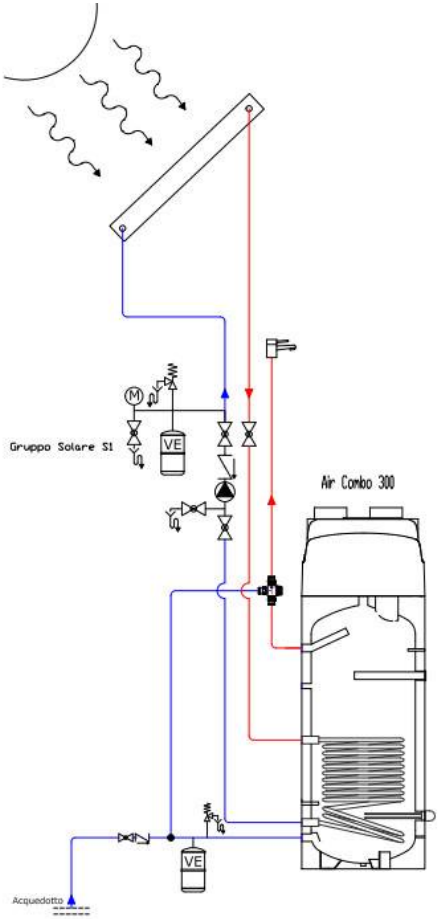
Available products and solutions (2)

Multi-function units (gruppi polivalenti), both air- and water source, are now available. They can simultaneously produce chilled and hot water according to system demand; no seasonal changeover is needed.



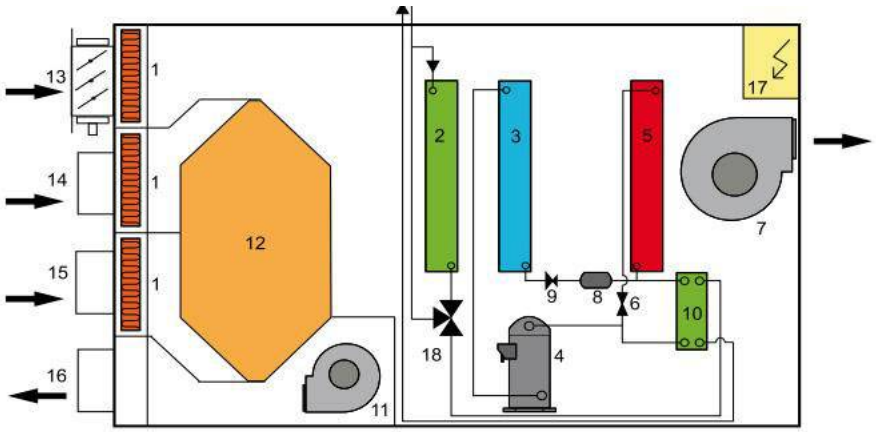
Available products and solutions (3)

This integrated system for sanitary hot water production features a 2 kW air-to-water heat pump using R-134a refrigerant, a solar circuit and a 300 l storage tank. The system can produce water up to 65° C; an optional electric heater can boost it to 90° C.



Available products and solutions (4)

Floor panels are very popular for heating, as they use low-temperature hot water produced by heat pumps. They can be used for cooling too, but in that case a dehumidifier is needed



Available products and solutions (5)

VRF/VRV systems

FOR

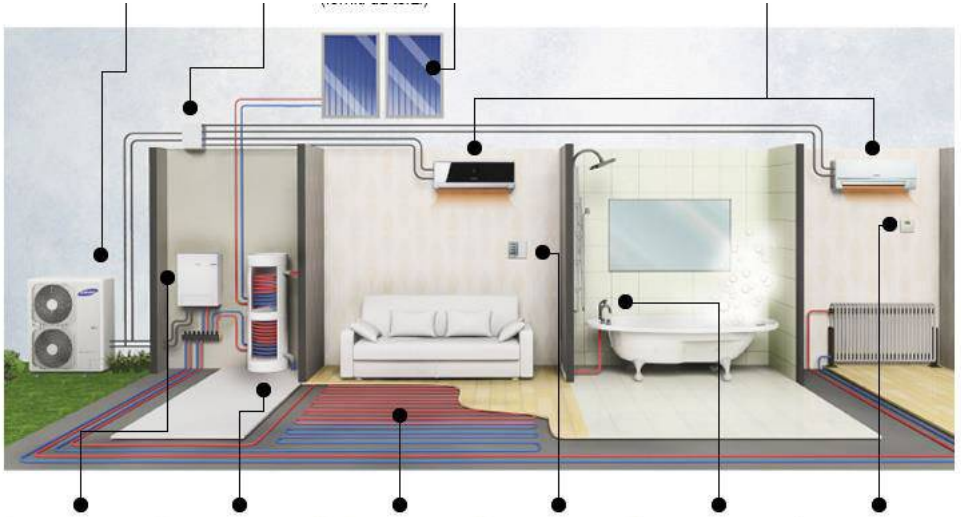
- Simple to design, thanks to manufacturers' selection software and assistance
- Fast and simple to install
- Space for piping

AGAINST

- Efficiency heavily depending on the piping length between internal and external units
- Physical limits for the overall and vertical distance

The solution: the hydronic modules

They are incorporated into a VRF/VRV system, and connected to the same outdoor units. They can produce either:

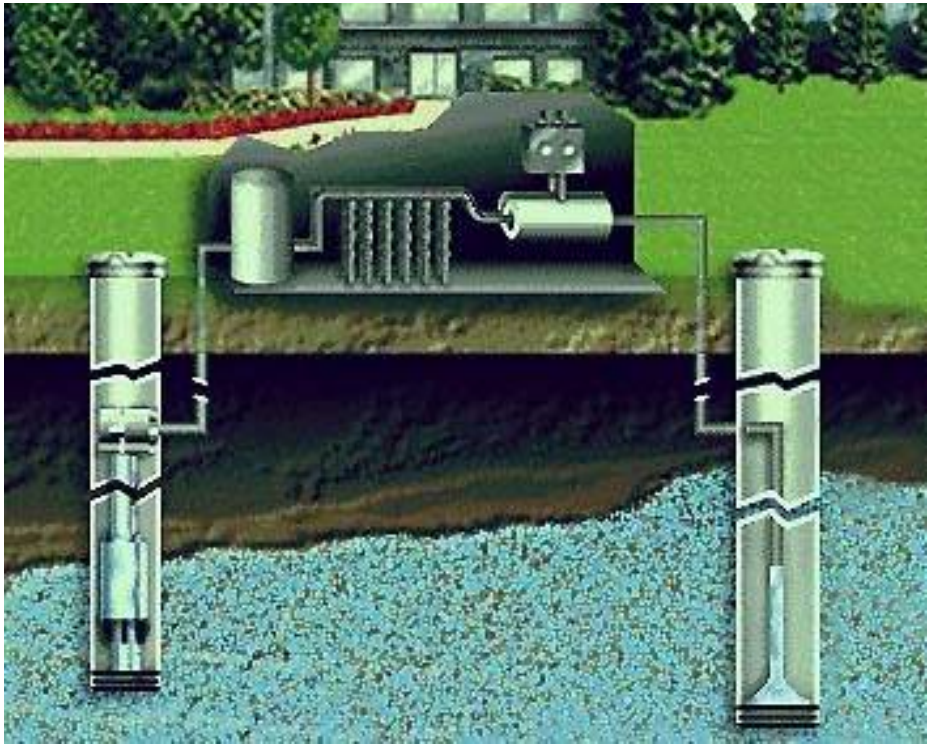


- Low-temperature hot water for radiant floor panel heating
- High-temperature hot water for radiator heating and sanitary hot water production

This allows very interesting applications especially for small residential systems, where heating and sanitary hot water are produced with hydronic modules, while conventional VRF/VRV terminals are used for summer cooling and winter pick-up load. Integration with solar systems is also possible

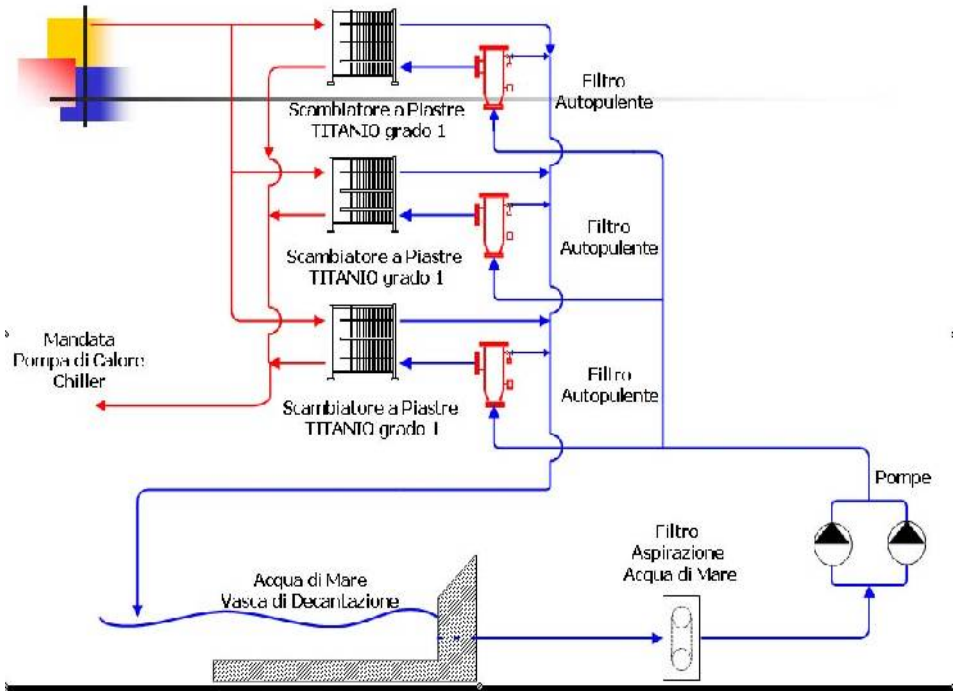
Ground water heat pumps

- In Northern Italy ground water is often available and usable. A well must be dug to draw water
- Used water can be fed back into the aquifer or discharged into a river or canal. Discharging into the public sewer is usually not allowed.
- Energy efficiency from heat pumps may be offset by pumping costs if well depth is high.



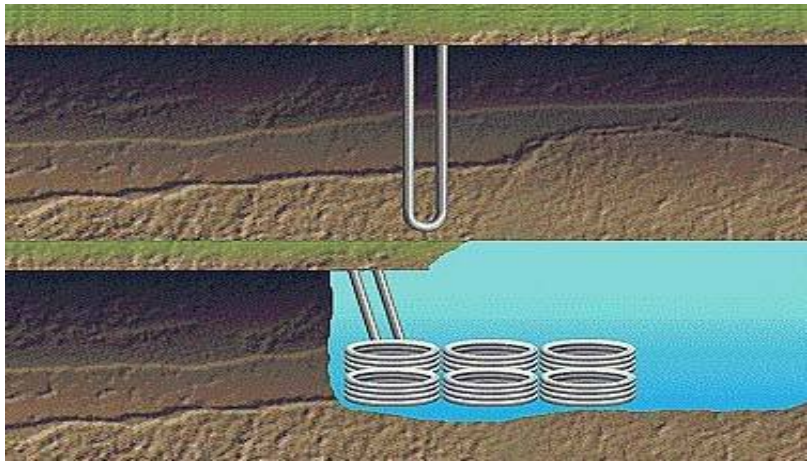
Surface water heat pumps – direct use

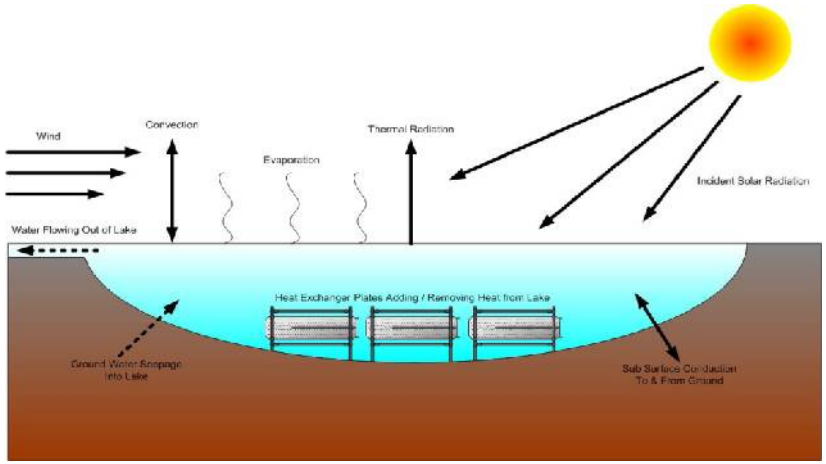
- If a river, lake or sea is available, water can be used in heat exchangers, with suitable filtration, as heat pump source
- Primary heat water ΔT is limited by regulations (3÷5 K)
- Summer-winter lake or sea water temperature variations can be high



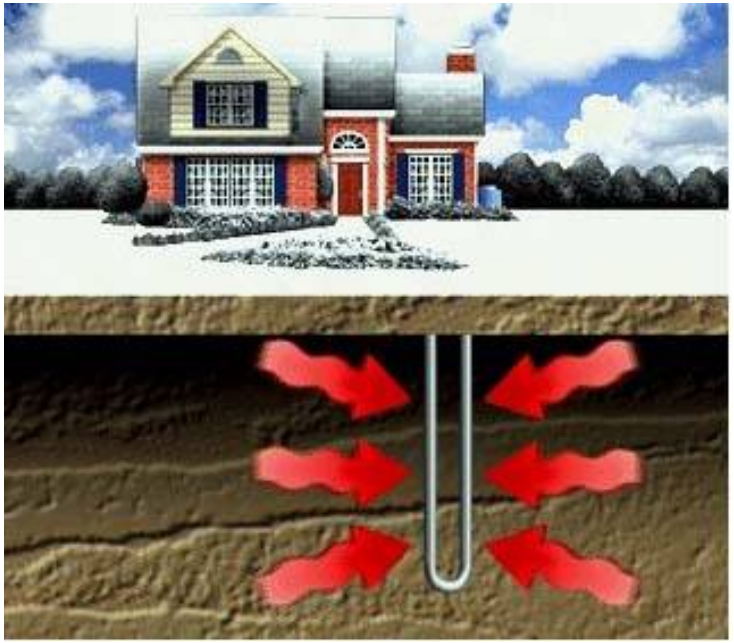
Closed circuit heat exchange with lake or sea water

- With PE coils. Each coil is 100 m long and exchanges 3.5 kW. Price moderate, but a lot of space is needed
- With submerged stainless steel or titanium heat exchangers. More compact and more expensive.
- System more energy efficient, as primary circuit is a closed loop





Geotermal (ground-coupled) heat pumps



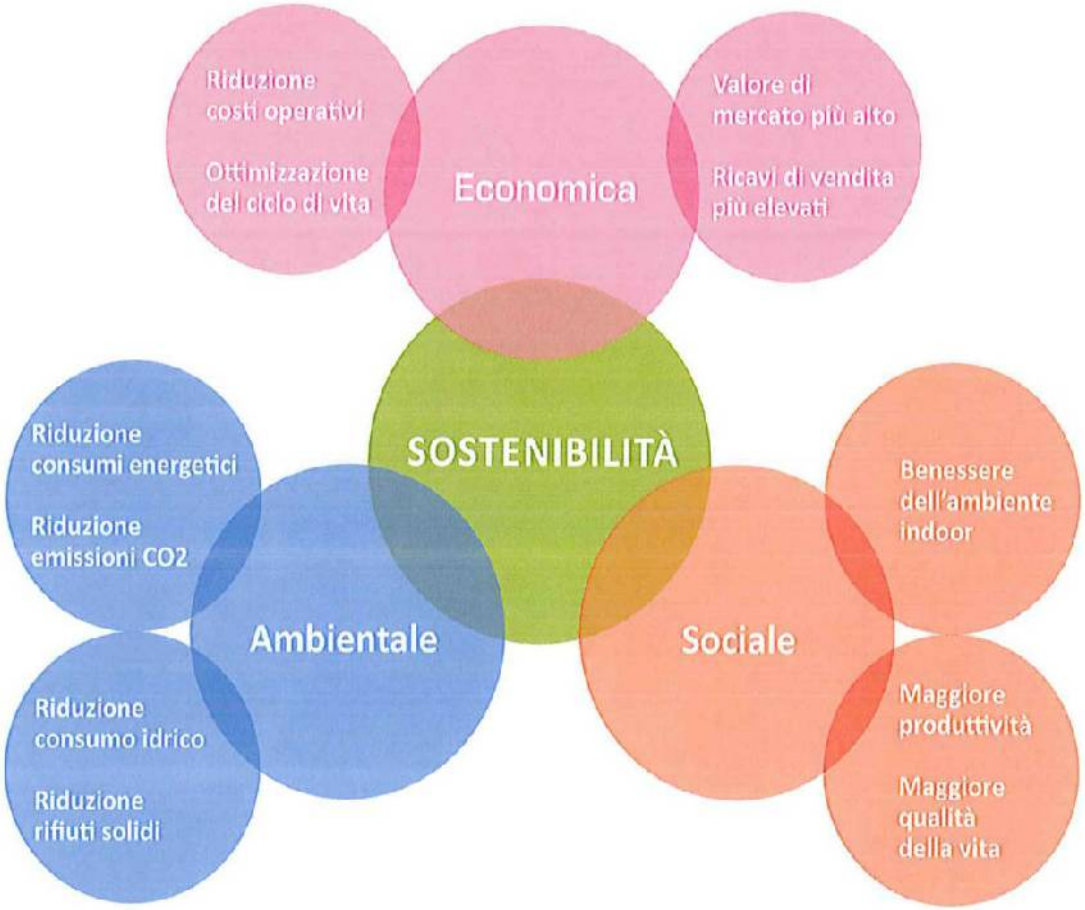
Summer

Winter

Boreholes do not interfere with ground water, but are expensive, at least in Italy. Thus, despite being very energy efficient, this system is not very frequently used.

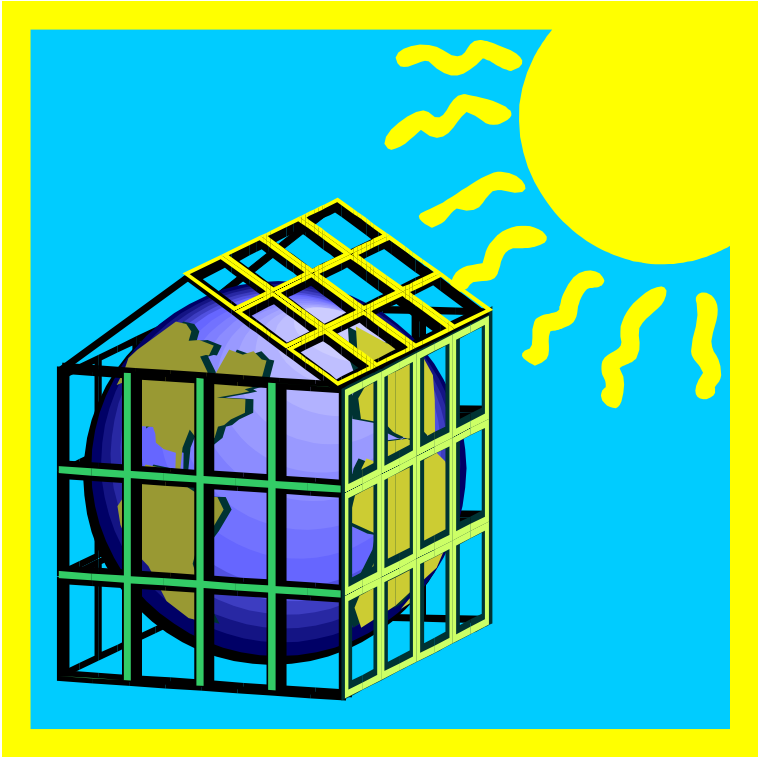
What is sustainability ?

Sustainability is acting so that development satisfies the needs of the present generation without compromising the capacity of the future ones to satisfy theirs



Sustainability-considerations

- Sustainability is focused on the distant future (30÷years).
- “Green” design concentrates on short term goals, such as indoor air quality, energy efficiency, operation and maintenance and satisfying the present needs of the Client.
- Sustainable design must go beyond this, and, while



The chief sustainability protocols in the world (in alphabetical order)

- BREEAM (UK)
- CASBEE (Japan)
- DNK (Germany)
- Green Star (Australia)
- HQE (France)
- ITACA (Italy)
- LEED (USA)
- Minergie (Switzerland)
- Resolution (Spain)

BREEAM OR LEED ?

When did they start?

- BREEAM (Building Research Environmental Assessment Method) was introduced in 1990 by BRE (Building Research Establishment), a former government organization, now private.
- LEED (Leadership in Energy and Environmental Design) was developed by the US Green Building Council in 1998, which is a national non-profit membership body.

What is the chief difference between these?

The process of certification.

- With BREEAM, the evidence is mandatorily collected/prepared by certified assessors, who assess the evidence against the credit criteria and submit it it to BRE, which then issues the certificate.

CATEGORIES

LEED

- Sustainable sites
- Water efficiency
- Energy and atmosphere
- Materials and resources
- Indoor environmental quality
- Innovation in design

BREEAM

- Management
- Health and well-being
- Energy
- Transport
- Water
- Materials
- Waste
- Land use and ecology

AT-A-GLANCE:LEED

PLUS

- Better known overall in the world thanks to aggressive and efficient marketing
- Lots of information available
- No need for a certified assessor

MINUS

- Based on US methods and standards
- Heavy documentation required
- No independent audit of the assessment
- Mixing building functions and forms in the same project is

AT-A-GLANCE: BREEAM

PLUS

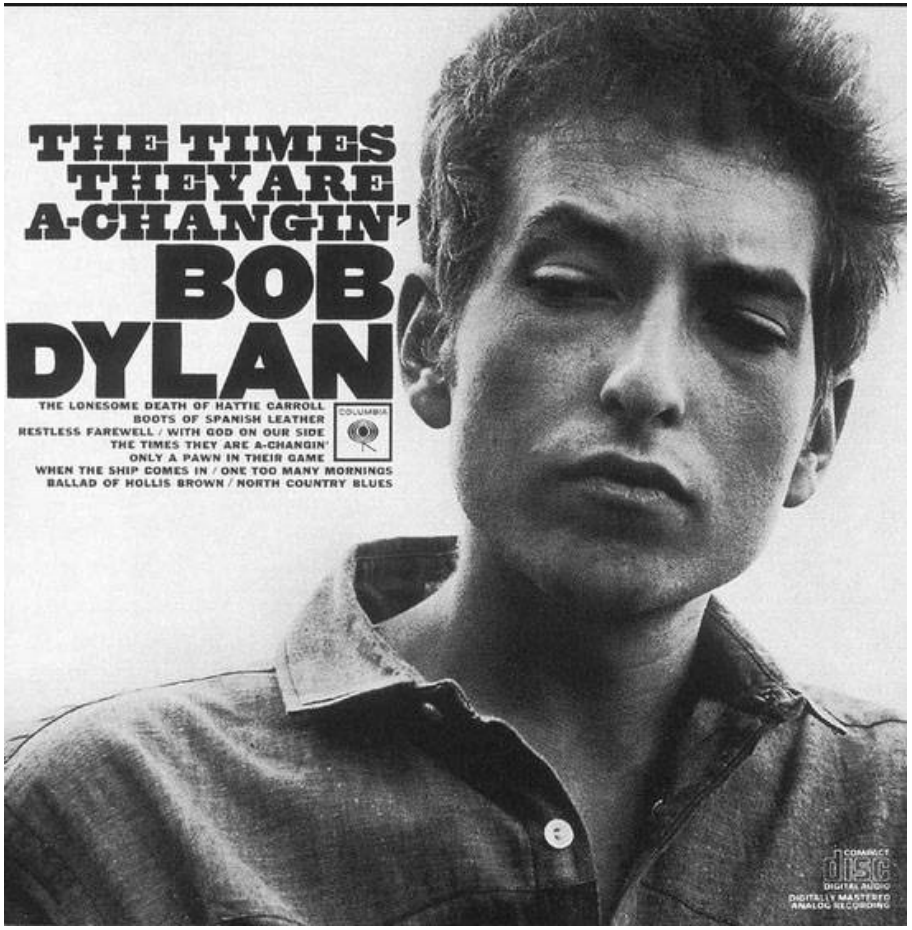
- Allows comparison and benchmarking of different buildings
- Independently audited
- Adjusted to European standards and European culture
- Can assess any kind of building with the

MINUS

- Very exact requirements
- Complicated weighting system
- Market profile
- Cost of compliance

Time to change!

Bob Dylan sang it in 1964. Now, 50 years later, the same applies to HVAC. If the issues in the past decade were comfort and energy efficiency, it is now time to broaden our view, and design with our mind set on SUSTAINABILITY.



Thank you for your attention!