AGENZIA NAZIONALE
PER LE NUOVE TECNOLOGIE, L'ENERGIA
E LO SVILUPPO ECONOMICO SOSTENIBILE

DISTRIBUTED GENERATION AND ENERGY EFFICIENCY FOR ACHIEVING ENERGY SELF-SUSTAINING INDUSTRIAL AREAS

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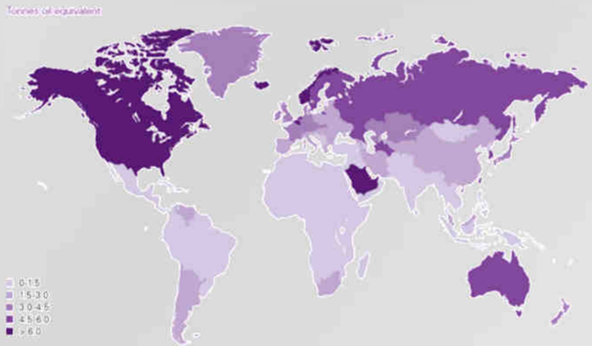
EUROPEAN DIRECTIVE 2010/31/UE

It 's well known that higher consumption in industrialized countries affects the industrial and the residential sectors.

For this reason, in these areas, we can concentrate interventions for the containment and the progressive reduction of energy consumption.

We know that increasing the energy consumption we increase harmful emissions into the atmosphere. So it is very important to find a solution to minimize our consumption, however, without give up our energy needs.



Energy Consumption ↑ → **Emissions CO_2** ↑

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EUROPEAN DIRECTIVE 2010/31/UE

The buildings sector represents 40% of the European Union's total energy consumption: reducing energy consumption in this area is therefore a priority under the **"20-20-20"** objectives on energy efficiency. The 2010/31/UE Directive contributes to achieving this aim by proposing guiding principles for Member States regarding the energy performance of buildings.

EUROPEAN DIRECTIVE 2010/31/UE

The Directive, in the introduction part of the document, points out that: *"Member States should authorize and encourage designers and planners to appropriately value the optimal combination of improvements in energy efficiency, the use of renewable sources and the use of heating/cooling district during the planning, design, construction and renovation of* ***industrial*** *or residential* ***areas****"*

EUROPEAN DIRECTIVE 2010/31/UE

According to the Directive Member States shall adopt a methodology for calculating the energy performance of buildings which takes into account some specific elements:

- the thermal characteristics of a building (thermal capacity, insulation, etc.)
- heating insulation and hot water supply
- the air-conditioning installation
- the built-in lighting installation
- indoor climatic conditions

The positive influence of other aspects (i.e. local solar exposure, natural lighting, electricity produced by cogeneration and district or block heating or cooling systems) are also taken into account.

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EUROPEAN DIRECTIVE 2010/31/UE

The Directive is applied on two different levels:

DIRECTIVE

NEW BUILDINGS | **EXISTING BUILDINGS**

Member States shall put in place minimum requirements for energy performance in order to achieve cost-optimal levels. The level of these requirements is reviewed every 5 years.

EUROPEAN DIRECTIVE 2010/31/UE

New buildings shall comply with these requirements and undergo a feasibility study before construction starts, looking at the installation of renewable energy supply systems, heat pumps, district or block heating or cooling systems and cogeneration systems.

When undergoing major renovation, **existing buildings** shall have their energy performance upgraded so that they also satisfy the minimum requirements.

EUROPEAN DIRECTIVE 2010/31/UE

When new, replaced or upgraded **technical building systems** such as heating systems, hot water systems, air-conditioning systems and large ventilation systems are installed, they shall also comply with the energy performance requirements.

Building elements that form part of the **building envelope** and have a significant impact on the energy performance of that envelope (for example, window frames) shall also meet the minimum energy performance requirements when they are replaced or retrofitted, with a view to achieving cost-optimal levels.

This Directive strongly encourages the introduction of **intelligent energy consumption metering systems** whenever a building is constructed or undergoes renovation.

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EUROPEAN DIRECTIVE 2010/31/UE

(ART. 9) According to the Directive the Member States shall ensure that:

- by **31 December 2020**, all new buildings are nearly zero- energy buildings
- after **31 December 2018**, new buildings occupied and owned by public authorities are nearly zero-energy buildings.

By December 31, 2012 and every three years, the Commission publishes a report on the progress made by Member States to increase the number of near-zero energy buildings.

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EUROPEAN DIRECTIVE 2010/31/UE

Article 2 defines a **nearly zero energy building** as, *“a building that has a very high energy performance, as determined in accordance with Annex I. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby.”*

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EUROPEAN DIRECTIVE 2010/31/UE

The common perception held for too long that the energy efficiency in industry is too complex to be tackled.

By analyzing the documents on the European policy for energy efficiency in industry, however, there is an international effort to change this condition: the Directive 2010/31/UE includes, in fact, the areas and industrial buildings between the objects to subject to regulation, and is trying to develop **protocols and guidelines** to direct the designer in the choice of technology, plant engineering and management best suited to meet the demands of efficiency of a building for the production.

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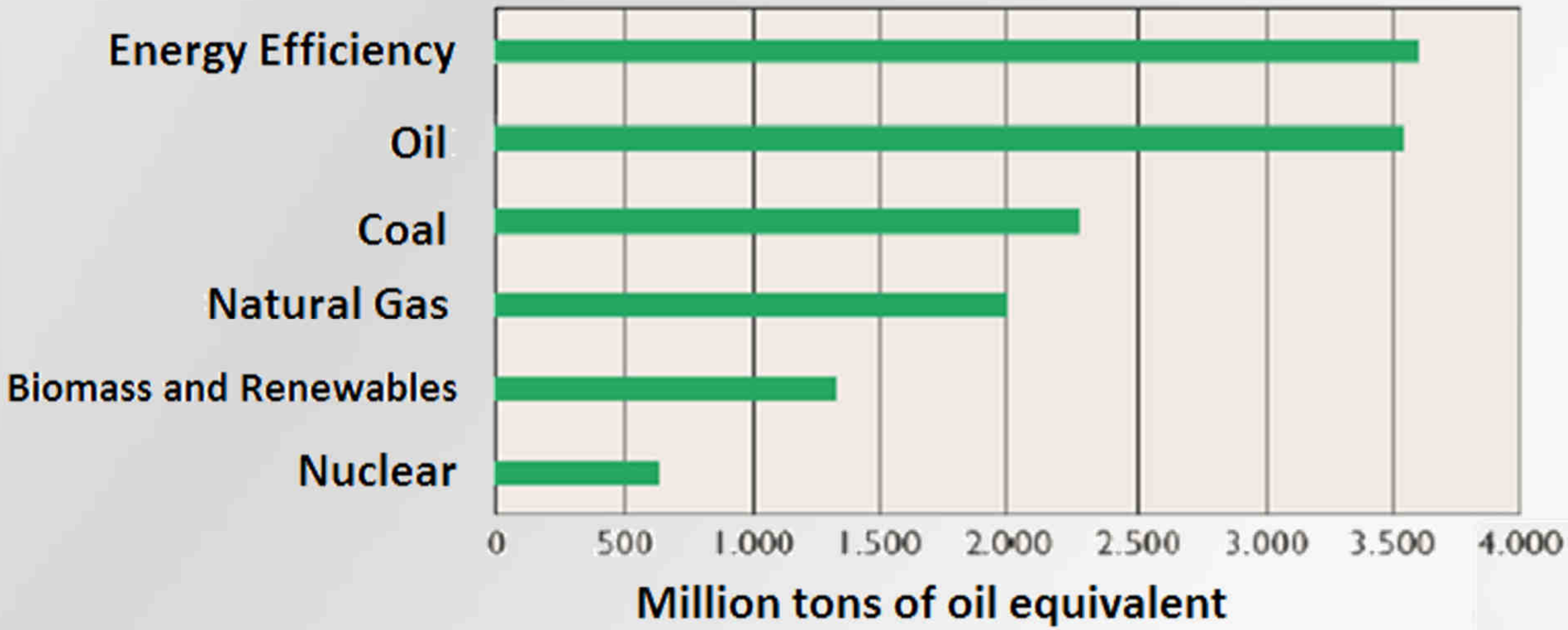
ENERGY EFFICIENCY: "SIXTH FUEL"

The grafic below represents the role of the various resources in the global energy balance and shows us how energy efficiency could be considered a "sixth fuel", being the major source and also the "cleanest".



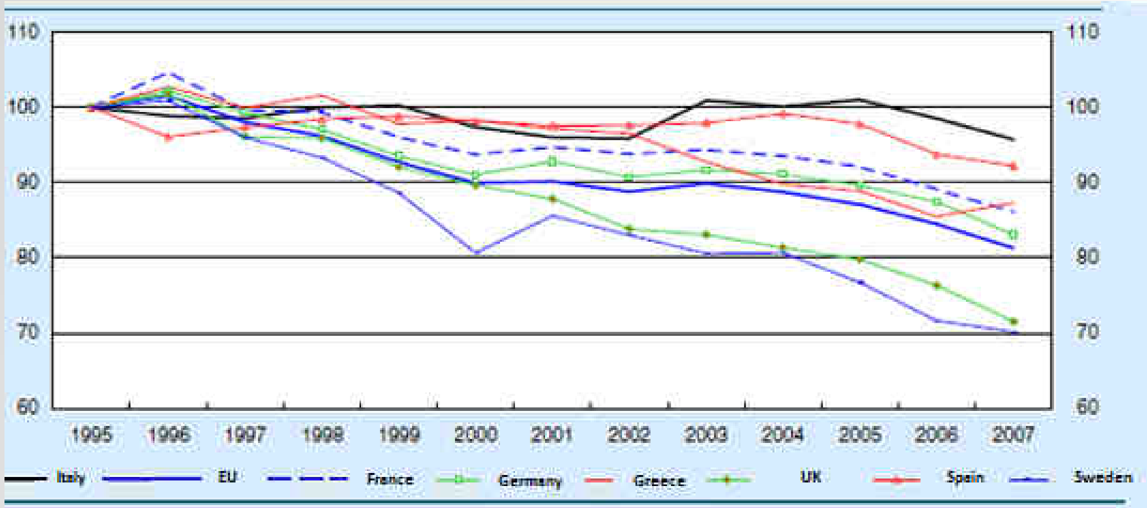
ENERGY DEMAND MANAGEMENT

An indicator of energy efficiency in a country is the **Energy Demand Management**. It is the macro-economic measure of the consumption. It is defined as energy consumed per unit of wealth produced. Thus, more this indicator is low, greater is the energy efficiency of the country.

We can represent it as a curve.

The right image represent the Energy Demand Management of some countries in Europe.

ENERGY DEMAND MANAGEMENT IN EUROPE

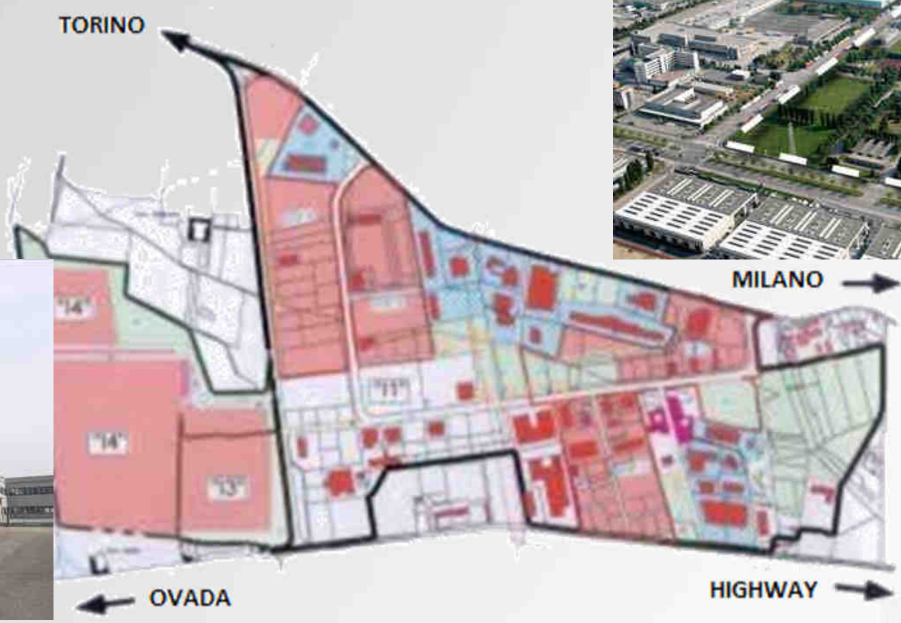


Elaboration performed using data from EUROSTAT

Rate base: 1995=100

INDUSTRIAL AREAS: MACRO AND MICRO

Before you begin to define what are the main problems of the industrial areas is necessary to make a clarification. The issues related to consumption and sustainability must be addressed on two levels: a micro level, which covers the single production unit, and a macro one which covers the whole area.



ENERGY COMPONENTS OF AN INDUSTRIAL AREA

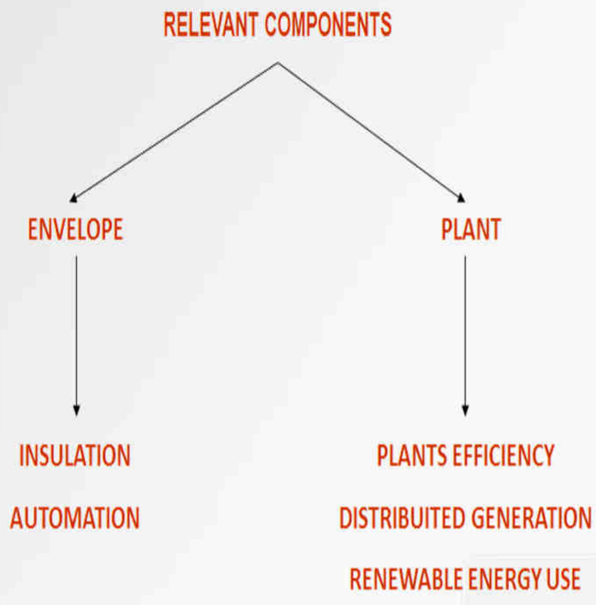
Therefore, an industrial area can be splitted into multiple components, these components are closely related. To get the best performance conditions is very important that each component is never disconnected from others in the evaluation phase.

The main components that must be considered are: the **envelope** and the **plant.**

Each of these can be improved by split according to specific requirements. The envelope can be evaluated as an individual unit that is part of the area and it will be evaluated, analyzed and studied according to two important components: the **insulation** and **automation**.

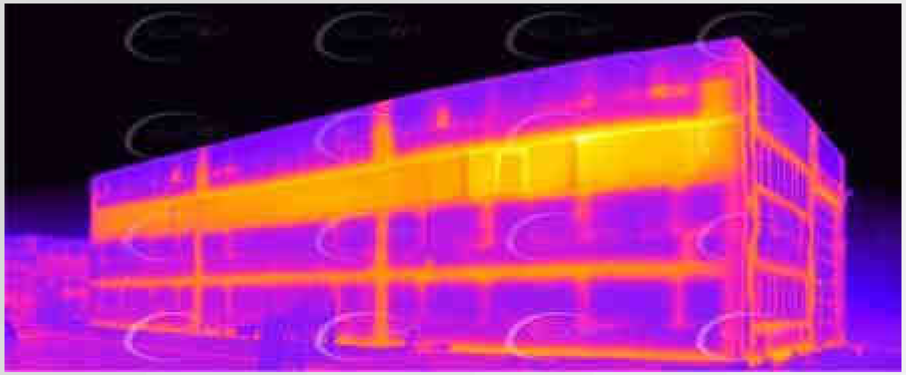
The plant in the case of self-sustaining and high efficiency industrial areas should be considered as a macro component of the area, not as an individual unit and it is splitted into several complex components: the **plant systems**, the **distributed generation** and **renewable energy use**.

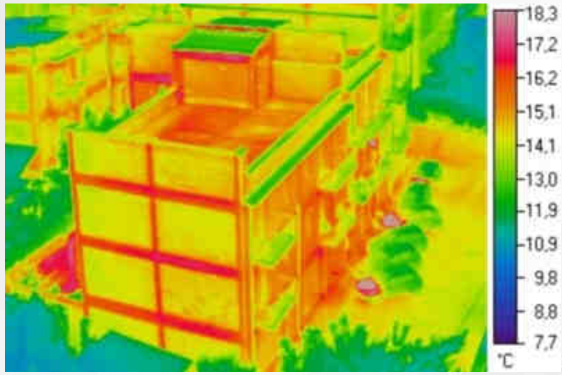
Now we will analyze each of these factors to evaluate inefficiencies, weak points and technical solutions that allow us to make them energy efficient.



ENVELOPE INEFFICIENCY

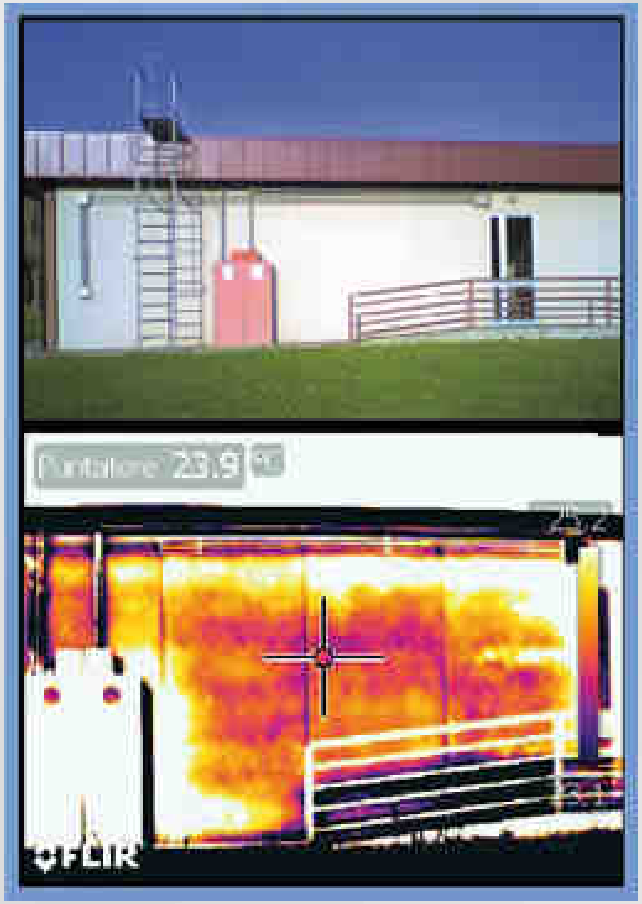
These pictures are industrial buildings thermographic measurements. The thermocamera can detect the temperatures of the elements analyzed by measuring the intensity of infrared radiation emitted by the element. With this instrument, then, we can assess the temperature of a wall and thus how much heat is dissipated to the outside. The colors like yellow, red and orange indicate the points of greatest dispersion of the envelope.





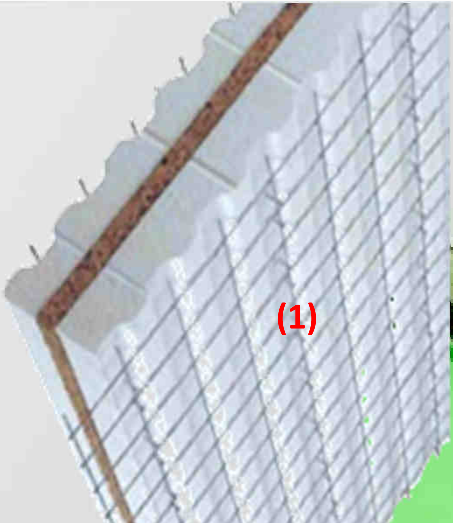
INDUSTRIAL BUILDINGS THERMOGRAPHIC MEASUREMENTS

ENVELOPE INEFFICIENCY



If we observe the images we see that there are high heat loss and this is an indicator that communicates the absence of insulation on the perimeter walls. It is needless remembering that to an increasing heat loss corresponds an increase of the fuel that we canto burn to maintain a good temperature inside and thus it increase the emissions into the atmosphere.

NEW TECHNOLOGIES FOR BUILDING ENVELOPE



(1)

(2)

(3)

Today there are numerous technical solutions that allow us to overcome these problems on new industrial building and on existing ones.

In the left picture we can see, for example, a precast panel (1) with polystyrene and cork for insulation. In addition to having thermal function, it is also reinforced with a network of steel, thus it also has a static function. This system is easy and quick to assemble, has excellent thermal performance and has a very low cost.

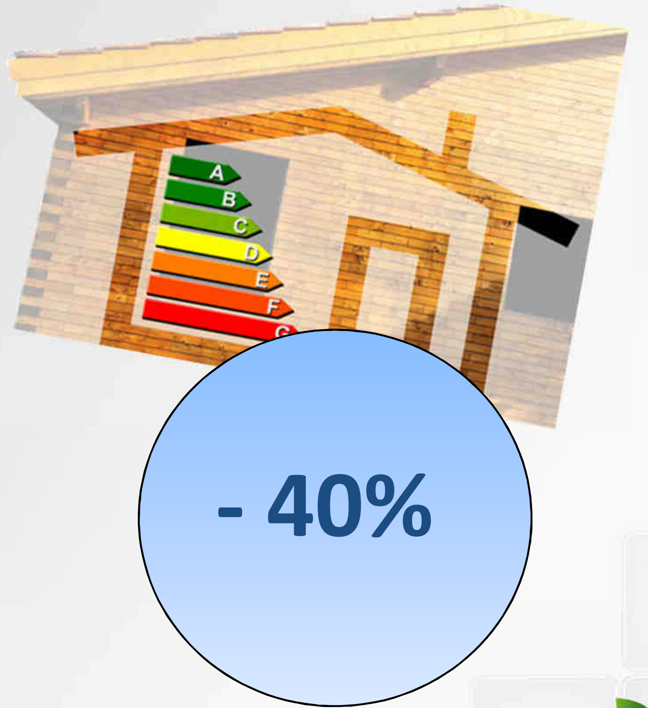
The picture above (2) is a system that allows to insulate the industrial floors to reduce losses and at the same time it give them a greater resistance to loads. The big advantage is that it can be applied on existing floors.

The last image (3) is a building block for industrial sheds with internal insulation.

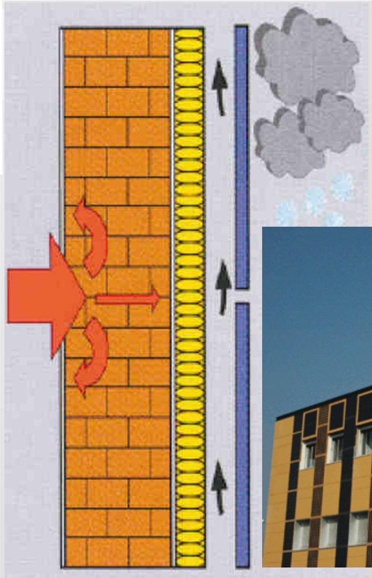
NEW TECHNOLOGIES FOR BUILDING ENVELOPE

These are just a few examples. All these systems are easily available on the market and have the same cost of a traditional system. But they are **much more energy efficient**.

As an example, an industrial building constructed using these materials can reduce energy losses of 40% and then we can have a 40% of reduction in the costs and emissions.



NEW TECHNOLOGIES FOR BUILDING ENVELOPE (ACTIVE SYSTEMS)



VENTILATED FACADE (1)

GLASS DOUBLE SKIN FACADE

There are also **active systems** that can be used to improve the efficiency of the envelope.
For example the **ventilated facades** or **glass double skin facades**.

The ventilated facade (1) is a type of facade composed of two insulated layers separated by a cavity through which the air can flow.
In winter, the air has the function of insulating pad and contributes to improving the thermal insulation.
In summer the air flowing in the cavity removes a large amount of solar heat and it creates a natural cooling that reduces the need for refrigeration and promotes a decrease in energy consumption; in addition it allows to dispose moisture which may condense on the cold side of the insulator.

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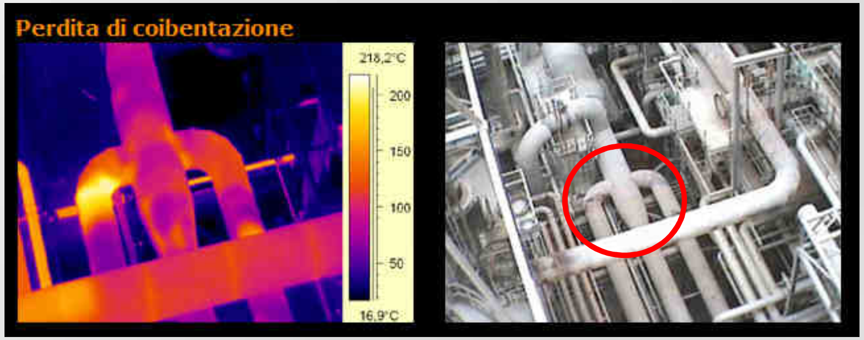
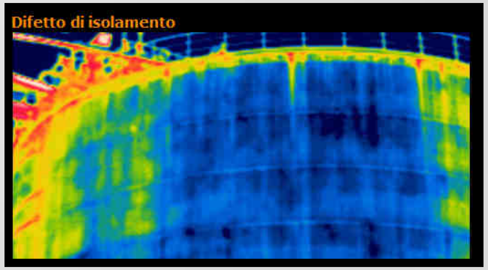
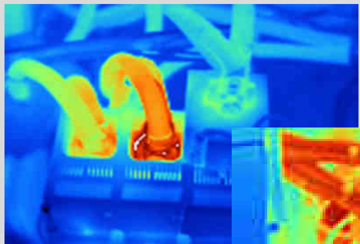
PLANT INEFFICIENCY



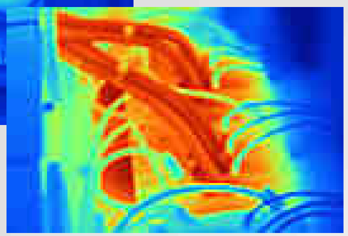
PIPING SYSTEM: LOSS OF INSULATION ON PIPING (1)



TANK CONTAINING AMMONIA: INSULATION FAULT (2)



LOOSE TERMINALS (3)



UNDERSIZED CABLES (4)

These pictures show others thermographic measurements but, in this case, we can see industrial equipement. Especially in the existing plant systems we can found conditions such as those represented in the images. Inefficiencies due to damaged insulation or insulation evil placed, incorrectly connected terminals or undersized cables.

All these conditions should be strictly avoided because they cause huge losses of energy.

Is very important to proceed with careful maintenance of the facilities and making continuous checks.

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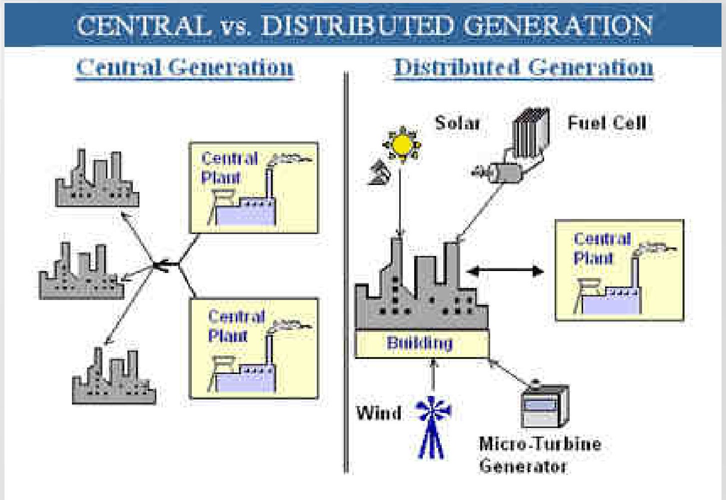
NEW TECHNOLOGIES FOR PLANTS

Even in the case of plants there are techniques and materials that improve the energy performances.
Today it is easy to find great high **insulated pipes** with materials that resist even at extremely high temperatures.
It 'a good rule, in plants whit dispersion of fumes or hot water, use **heat recovery systems**.
Another innovative application are the **cogeneration systems**. A cogeneration plant provides for the combined production of electricity and thermal energy obtained from a single source (primary energy) implemented in a single integrated system.
If this system is also implemented to produce cooling energy, we obtain a **trigeneration plant**. These systems have very high efficiency and they have found numerous applications in the industry sector. In recent years, in Italy, they are also used in residential buildings in replacement of conventional boilers.

INSULATED PIPES

COGENERATION PLANT

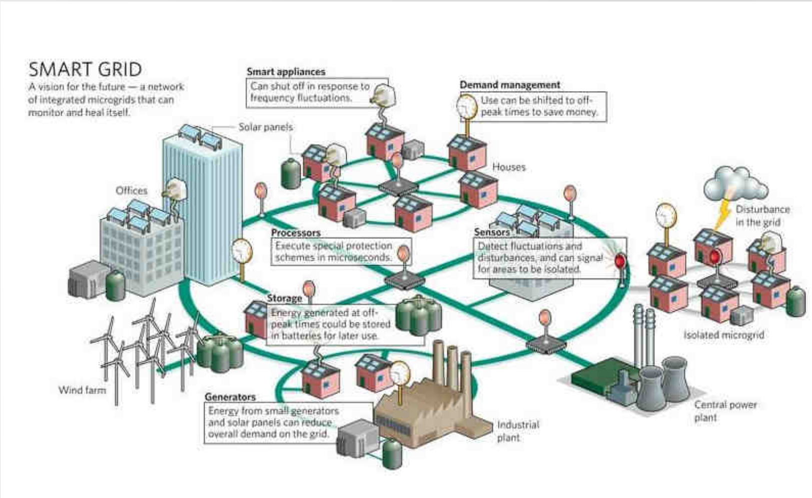
DISTRIBUITED GENERATION



In order to give a renewed impulse on energy efficiency, the European Commission presented a new energy efficiency plan containing measures to achieve additional savings in the supply and use energy. The **proposed Directive 2011 (COM) 370)** includes, among other points, also distributed generation.

The proposal puts the **energy efficiency** and **distributed generation** among the priorities of political and economic strategy for the coming years.

DISTRIBUITED GENERATION



As distributed generation can be indicated the relocation of production facilities on the territory. It usually occurs in the presence of free private enterprise development in the field of renewable energy.

It represents a different way of thinking and managing the power grid, not based on large power plants connected to extensive networks, but on production units of small-medium-sized, evenly distributed on the territory and connected directly to utilities or other low voltage networks.

The distributed generation is the only form of generation that allows the diversification of energy carriers and the exploitation of renewable energy resources. In this case, in fact, it can used different energy production systems which offset each other and the network becomes the storage and distribution system.

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DISTRIBUITED GENERATION

One of the most important benefits of distributed generation is the shorter transmission and distribution electricity networks and then a lower cost of distribution. The proximity of the energy plant to points of final consumption allows a lower transmission of electricity and less dispersion in the distribution network. Today, a high percentage of electricity produced, is dispersed during transport. Distributed generation, approaching the power plant to the end point of use also increases network reliability, because in the case of break down of a plant it does not involve the interruption of supply, but it is offset by presence of other plants.

A midsize power plant reaches 80% of the overall performance compared to 35% of the best large power plants.

Thank you

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