



Sustainability, energy and housing: basic notions

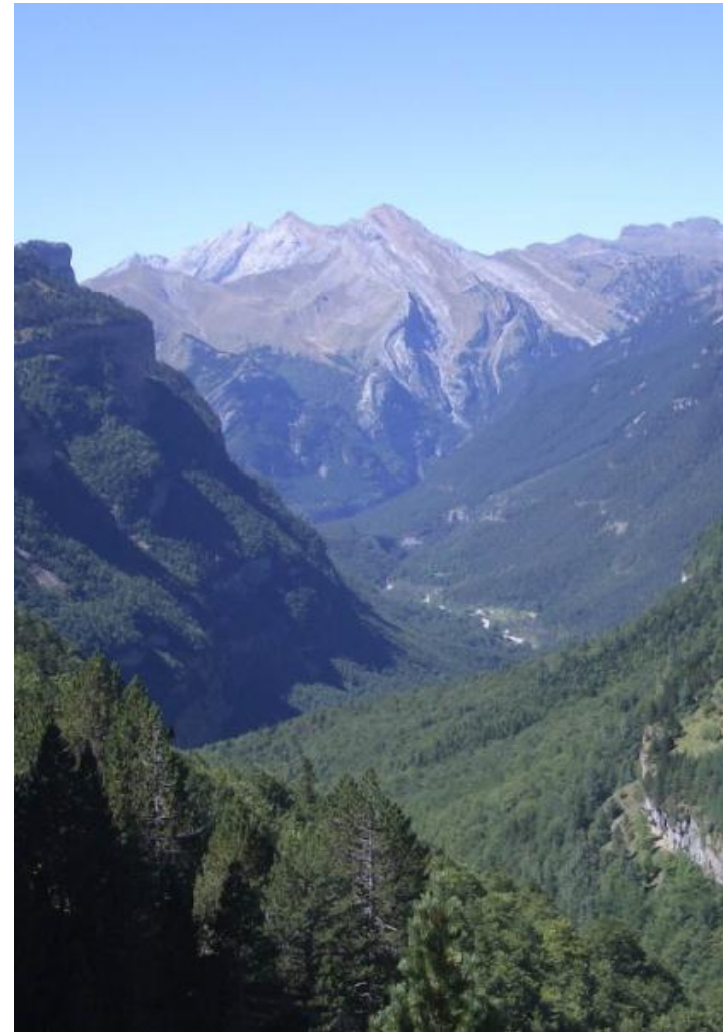
Eco-City Project



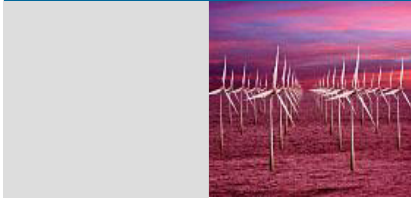
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Objective



- Promote society awareness about the importance of looking after the environment.
- Develop a critical vision of our society and our own habits.
- Learn some key concepts related to sustainability, energy, bioclimatic architecture...
- Show more sustainable rules of behaviour.



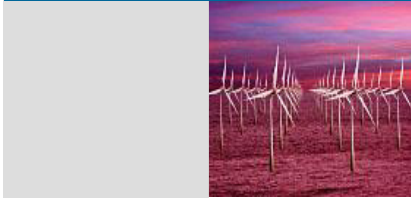


PART I

SUSTAINABILITY



What's the matter with me, doctor?



DIAGNOSIS?

Cholesterol
Diabetes
Heart attack
Lung cancer
Cirrhosis



What's the matter with me, doctor?



What does our future hold?



Is there any cure?





Global heating



- ✎ Presently, **Climate Change** is one of the most serious problems we face.
- ✎ A rise of average temperatures has been reported in the last 50 years.
- ✎ According to experts, average global temperatures could increase between 1.4°C and 5.8°C from now until 2100.
- ✎ It affects the whole Earth y it has its origin in greenhouse effect gases.



Global heating



The consequences of climate change are serious:

- Glaciers melting
- Sea level rise
- Droughts/Floods
- Alterations on Earth's ecosystems
- Increase of fires - Deforestation
- Increase of pests and invader species
- Spread of subtropical diseases
- ...





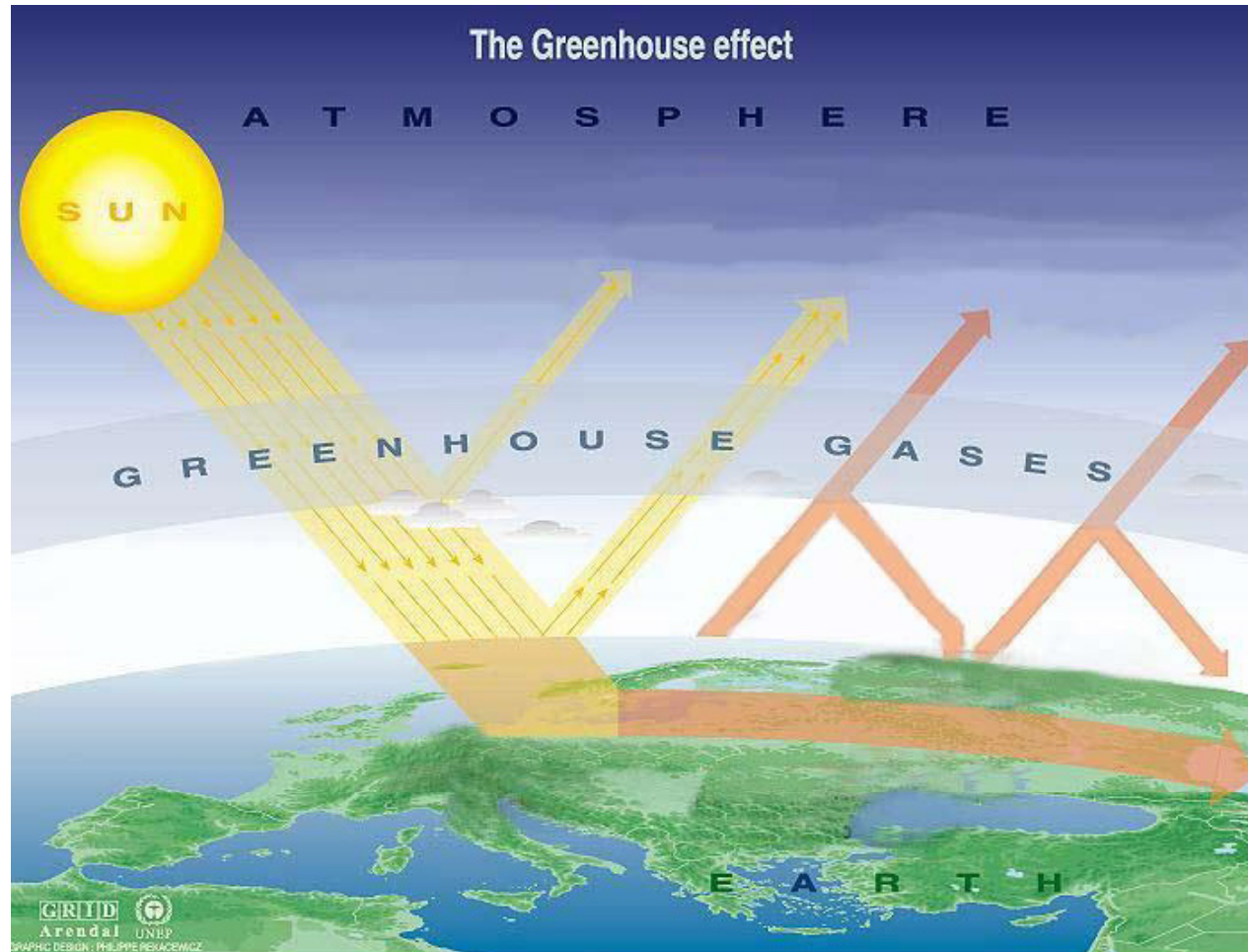
Global heating



- The greenhouse effect is a natural phenomenon that allows life on the Earth.
- Some of the gases in the atmosphere retain part of solar radiation, keeping the global average temperature at +15° centigrades (-18°C without the greenhouse effect).
- If gases concentration grows, the Earth's temperature rises and global heating takes place.



Global heating



Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography; United States Environmental Protection Agency (EPA), Washington; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

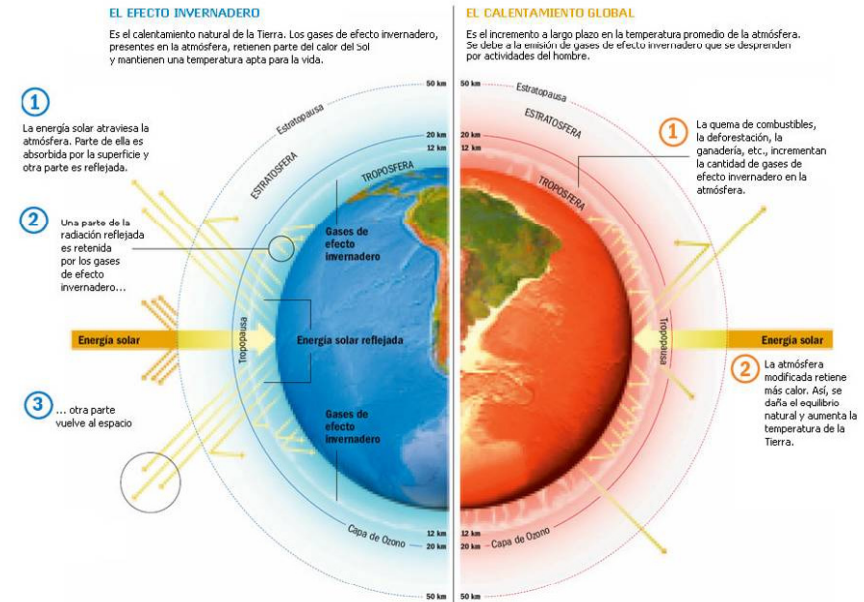


Global heating



Greenhouse effect gases

- ✦ Water vapour (H₂O)
- ✦ Carbon dioxide (CO₂)
- ✦ Methane (CH₄)
- ✦ Nitrogen oxides (NO_x)
- ✦ Ozone (O₃), and
- ✦ Chlorofluoro carbides (*artificial*)





Global heating



Around 20% of the World is estimated to emit 75% of gases

Who emits greenhouse effect gases?

- ✦ Electricity companies
- ✦ Transport
- ✦ Industries
- ✦ Buildings
- ✦ And all users of fossil fuels: oil, gas and coal





Kyoto Protocol



- Its objective is to reduce 5.2% global greenhouse gases on 1990 levels by the period 2008-2012.
- The Protocol contains legally compulsory objectives for the industrialized countries to reduce their emissions of the 6 greenhouse gases.
- It was agreed by the Governments in **1997**, but it came into force on **16th of February 2005**, after being ratified by 55 countries that added up to 55% of greenhouse gases emissions.
- Today, 166 countries ratified it.



Kyoto Protocol



	Emissions 1990	Kyoto Agreement
Europe	24 %	-8%
Spain	1,9%	+15%
Germany	7,4 %	-21%
USA*	36,1 %	-7%
Japan	8,5 %	-6%
Canada	3,3 %	-6%
Russia	17,4 %	0%

USA has not ratified the Agreement

Developing countries: have no limits to their emissions



Sustainable Development



- “Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Bruntland Report *Our Common Future* 1987, United Nations World Commission on Environment and Development.
- Sustainable development has to take into account economics, social and environmental aspects.



Sustainable Development



- Economic objectives: To achieve economic development to be efficient and dissociated from environmental decline, so the use of resources be the minimum possible, not damaging the operational environment and not bringing richness for some to the detriment of others.
- Social objectives: To seek respect for diversity and wholesome development of communities and individuals, guaranteeing the conditions that permit to exercise human rights and social cohesion.
- Environmental objectives: To demand the protection and conservation of nature and its resources, ensuring its continuity and guaranteeing biological diversity.

Source: *Prospect Research on Social Behaviour regarding Sustainable Development*. Ministry of Industry. Spain



Sustainable Development



Population (million)	1950	1975	2000	2003	2030
World	2520	4070	6070	6300	8130
More developed Regions	810	1050	1190	1200	1240
Less developed Regions	1710	3020	4880	5100	6890

United Nations Report ` *World Urbanization Prospects. The 2003 Revision.*

Sustainable Development

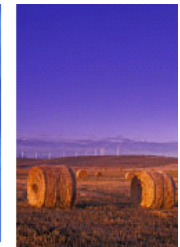
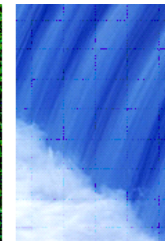




Sustainable Development



- ✦ **Renewable resources:** water, air, ground, woods, sea and farming products.
 - ✦ Resources should not be used faster than they can be renewed.
 - ✦ Waste should not be generated in higher amounts than those that can be absorbed by the environment without damaging it.
- ✦ **Non-renewable resources:** They depleted by use.
- ✦ Efficiency in use of resources has to be improved.



Agenda 21



- ✦ In the Earth Summit held in Rio, Declaration on Environment and Development (1992), 173 countries endorsed **Agenda 21**.
- ✦ This is an Action Plan that the countries should carry out to transform the present development model into a new more sustainable one.
- ✦ **Local Agenda 21** is the most widely spread and accepted document on the part of local authorities to tackle with serious environmental problems with a “thinking globally, acting locally” approach.



<http://www.cfnavarra.es/MedioAmbiente/agenda/Municipios/municipios.html>



Ecological footprint



- The **ecological footprint** is an environmental indicator that measures the impact of a given human population – country, region or city – on its environment for the maintenance of that population's production and consumption model.
- It is the biologically productive surface (woods, meadows, farming land and seas) needed to produce the resources to be used and absorb the generated waste.
- The **load capacity** is the biologically productive land area that we have at our disposal to produce what we consume and to absorb the waste we generate.
- This allows us to know our consumer limits.
- If we divide the Earth's productive area between all its inhabitants, each person will get 1.8 hectares to meet his/her needs.



Ecological footprint

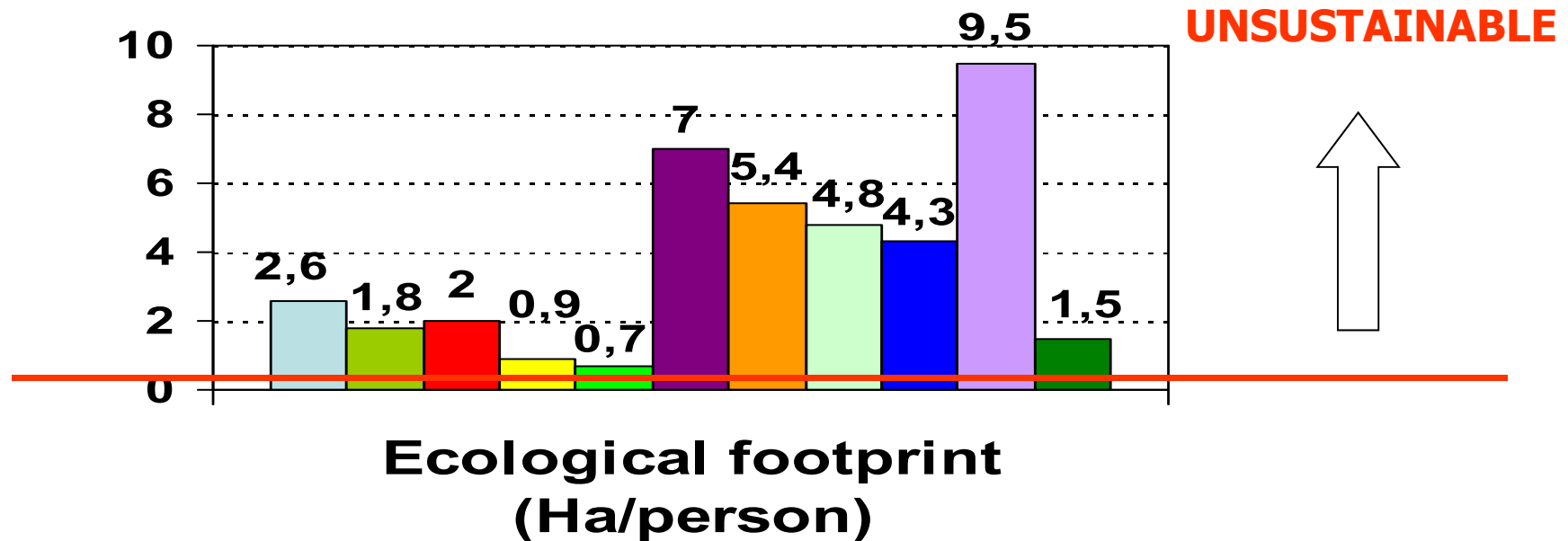


- ✧ If a population's ecological footprint is smaller than the load capacity of its territory, that population is self-sufficient.
- ✧ If one population's ecological footprint exceeds the load capacity of its territory, that population runs into **ecological deficit**.
 - ✧ It is either using productive land from other parts of the world or resources belonging to future generations. Is **UNSUSTAINABLE**.





Ecological footprint



Argentina	Ecuador	Turkey
Morocco	Ethiopia	Sweden
Great Britain	Spain	Japan
USA	China	

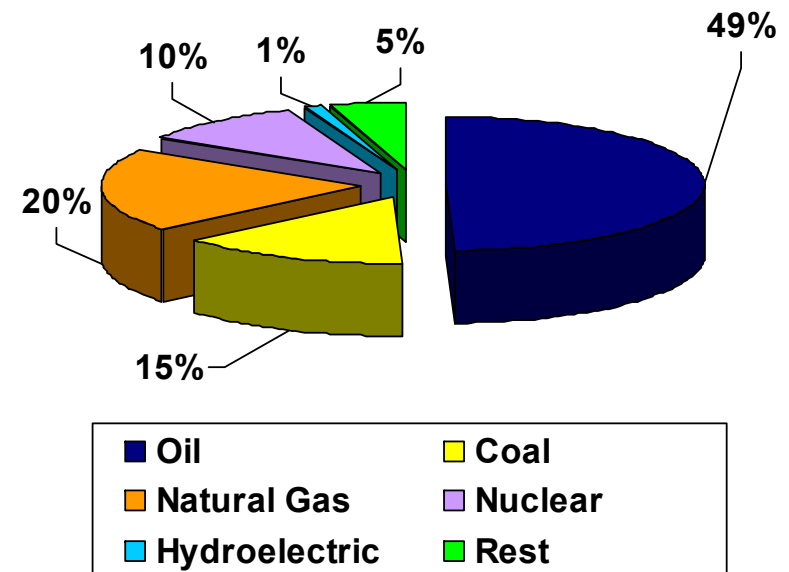


Energy and consumption



- ✦ We call primary energy to directly or indirectly available natural resources for their use in energy generation.
 - ✦ Non renewable: Oil, Natural Gas, Coal.
 - ✦ Renewable: Hydroelectric, Biomass, Solar and Wind Power.
- ✦ Secondary energy: is the type of energy generated in different transformation centres destined for different sectors of consumption and/or other transformation centres.
 - ✦ Electricity, petrol, diesel oil, liquefied petroleum gas, coke, charcoal, biofuels...
- ✦ Spain imports 75% of the primary energy that uses, as against 50% average in the EU.

Primary Energy Consumption in Spain - 2005



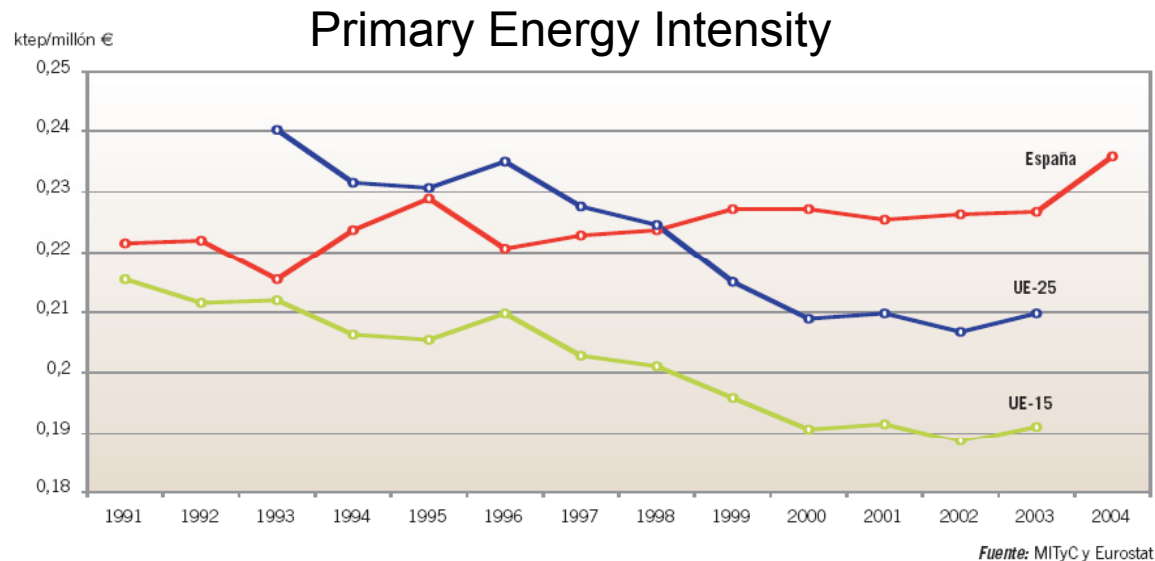
IDAE. MITC



Energy and consumption



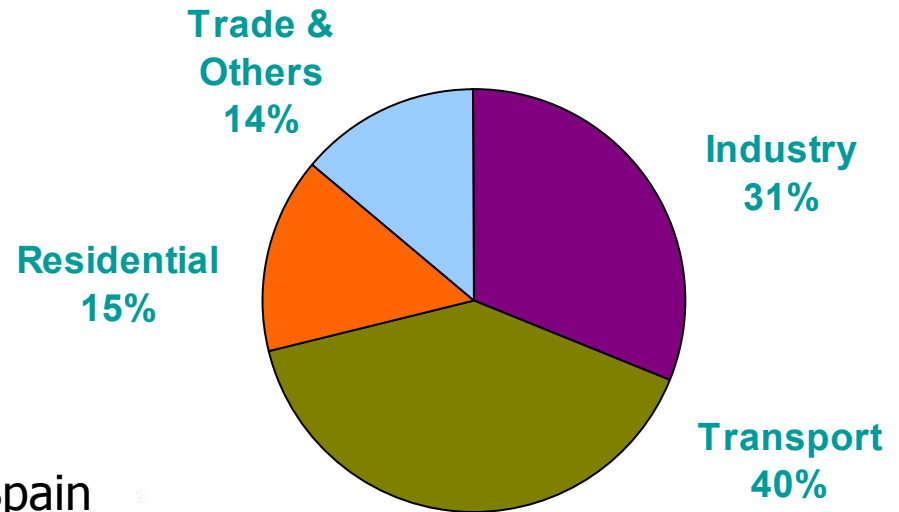
- ✧ The **Energy intensity** is the quotient between primary energy consumption and Gross Domestic Product (GDP), and represents the amount of energy used to produce one unit of GDP.
- ✧ It is an indicator of a country energy efficiency.
- ✧ **Energy efficiency** can be defined as the decrease of energy consumption maintaining the same energy services, without reducing our comfort and quality of life.



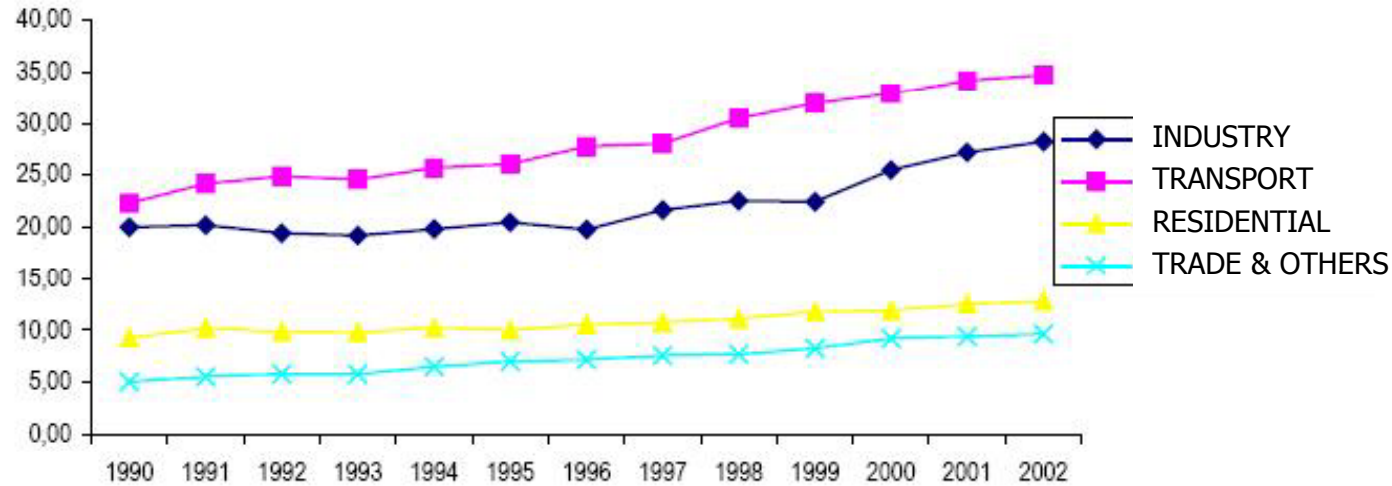
Energy and consumption



Final energy consumption in Spain
2003



Energy consumption by fields. Spain

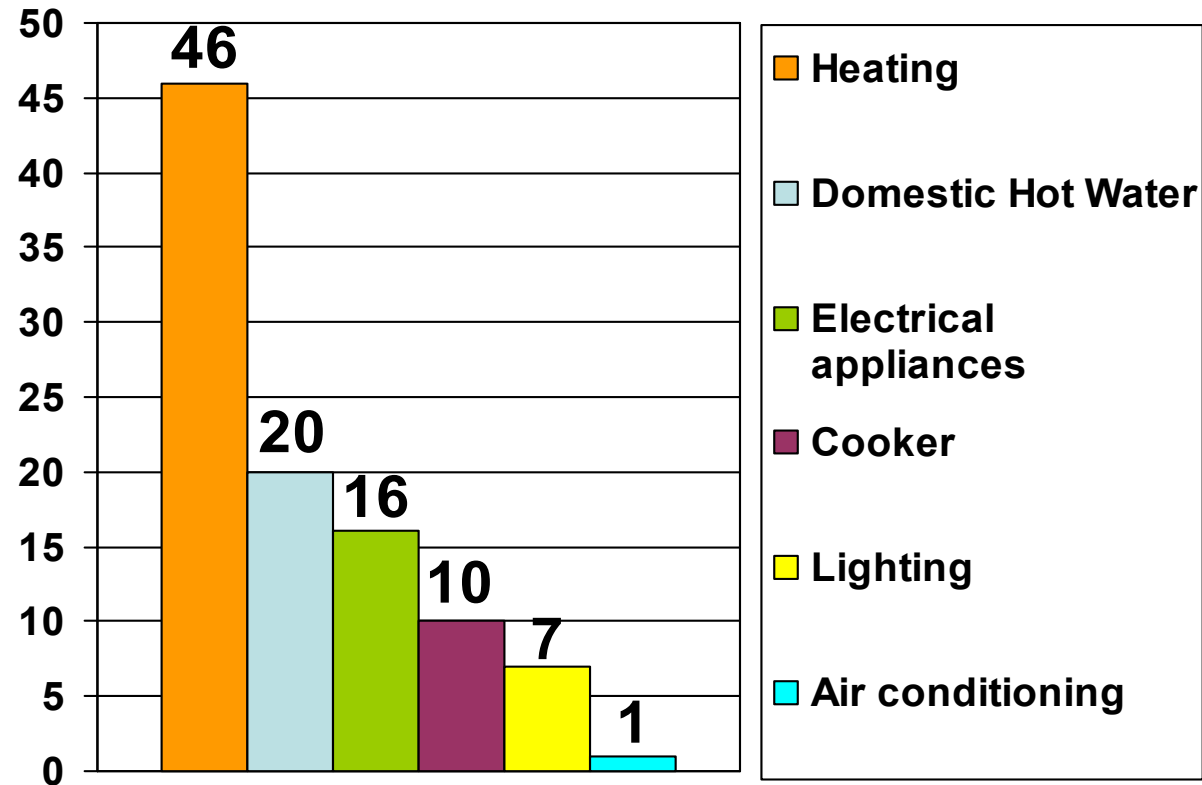




Energy and consumption

Spanish household consumption Year 2000

Source: IDAE





PART II

RENEWABLE ENERGIES



Renewable Energies



➤ Renewable energy is the energy obtained from virtually inexhaustible natural resources, some of them because of the vast amount of energy content and, others, because can be regenerated through natural means.

➤ Types of renewable energy

- Hydraulic Energy
- Solar Thermal Energy.
- Photovoltaic Energy.
- Wind Energy.
- Biomass Energy.
- Geothermal Energy.
- Other types of energy: wave energy, tidal energy.





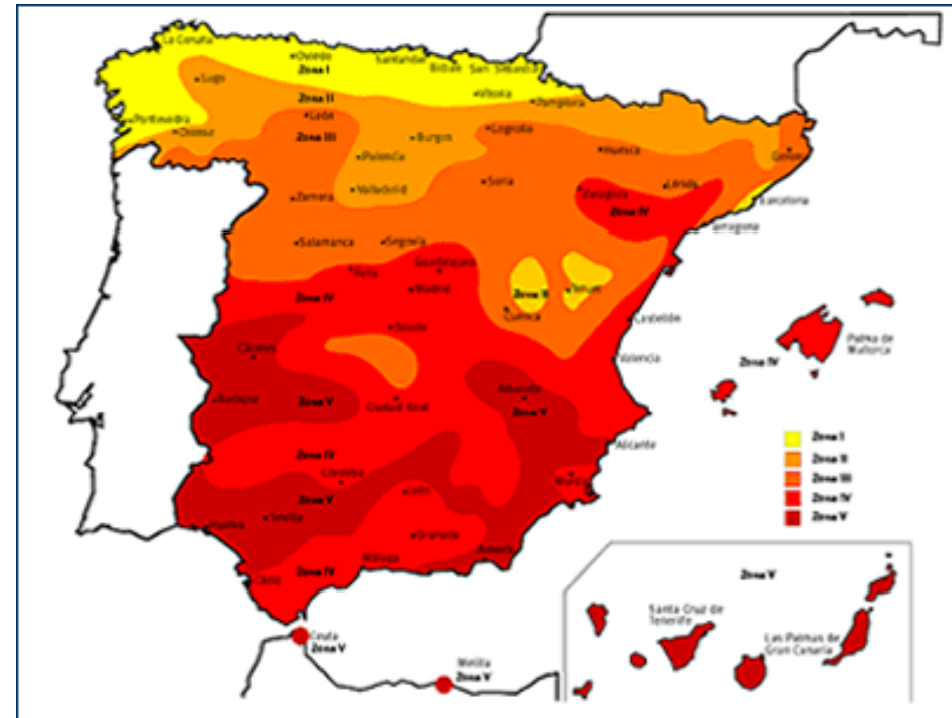
Renewable Energies

Advantages of renewable energies

- Solar energy is unexhaustible
- Generally, they are more environmental friendly
- The resources are present worldwide

Disadvantages

- Their output is uneven, depending on whether it is windy, sunny or rainy.



- Zone 1: $H < 3.8$
- Zone 2: $3.8 \leq H < 4.2$
- Zone 3: $4.2 \leq H < 4.6$
- Zone 4: $4.6 \leq H < 5.0$
- Zone 5: $H \geq 5.0$

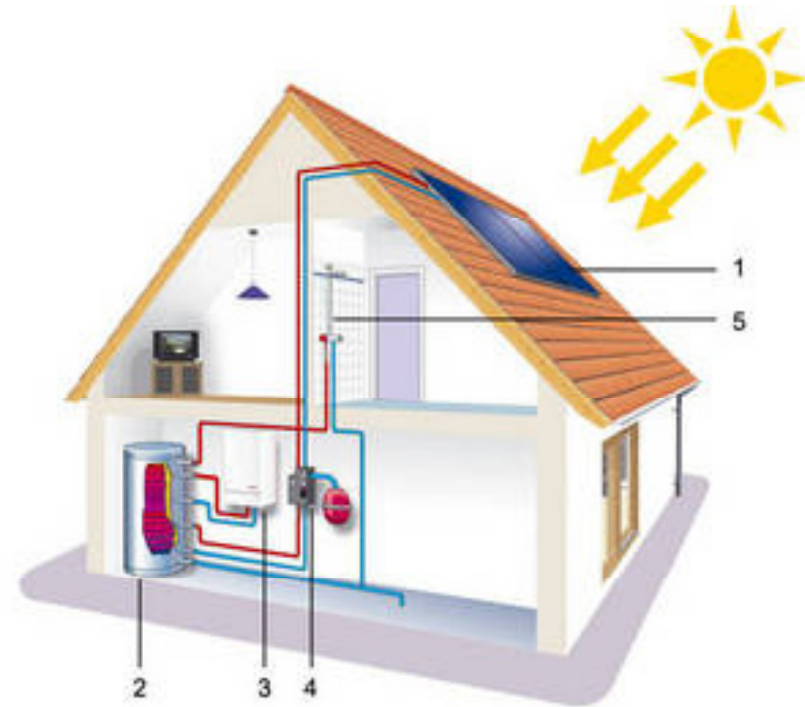
H is measured in kWh/m² per day

Source: INM



Renewable Energies

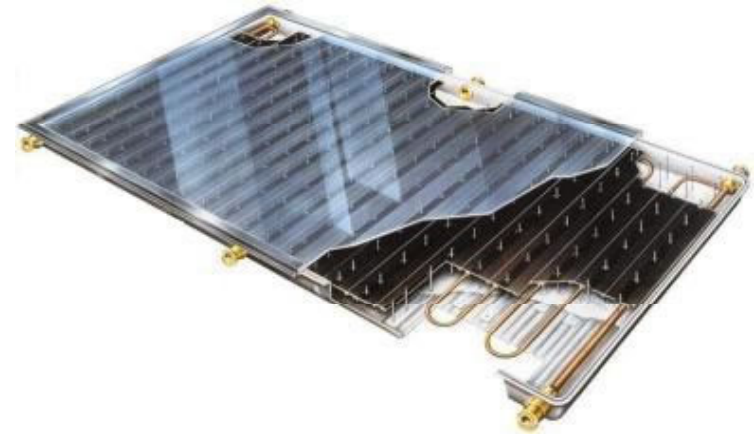
- ❖ **Solar Thermal Energy**
- ❖ The sun's incident energy is captured by one or several collectors with circulating water or other fluid in their inside which is stored in a storage tank for a later use.



1. Collector
2. Solar storage tank
3. Boiler
4. Solar station
5. Hot water consumer



Renewable Energies



☞ Solar Thermal Energy

☞ Advantages

- ☞ Wide variety of uses.
- ☞ Energy saving. Depending on the type of fuel that is being replaced, the payback period can range from 10 to 12 years (gas) or from 5 to 6 years (electricity).
- ☞ Has no CO₂ emissions

☞ Disadvantages

- ☞ The project and installation have to be done by skilled technicians.
- ☞ It requires an auxiliary system for heat contribution.
- ☞ It requires periodic servicing to guarantee a good performance.



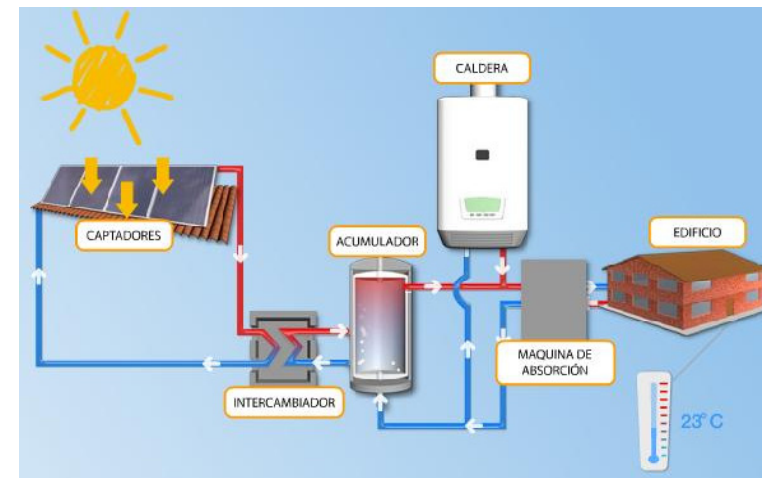


Renewable Energies



Uses of Solar Thermal Energy

- Domestic hot water (DHW)
- Water heating for swimming pools
- Heating
- Water heating for industrial uses
- Food, sludges... dryers
- Desalination plants
- Cooling systems
- Power generation in thermal electric power plants



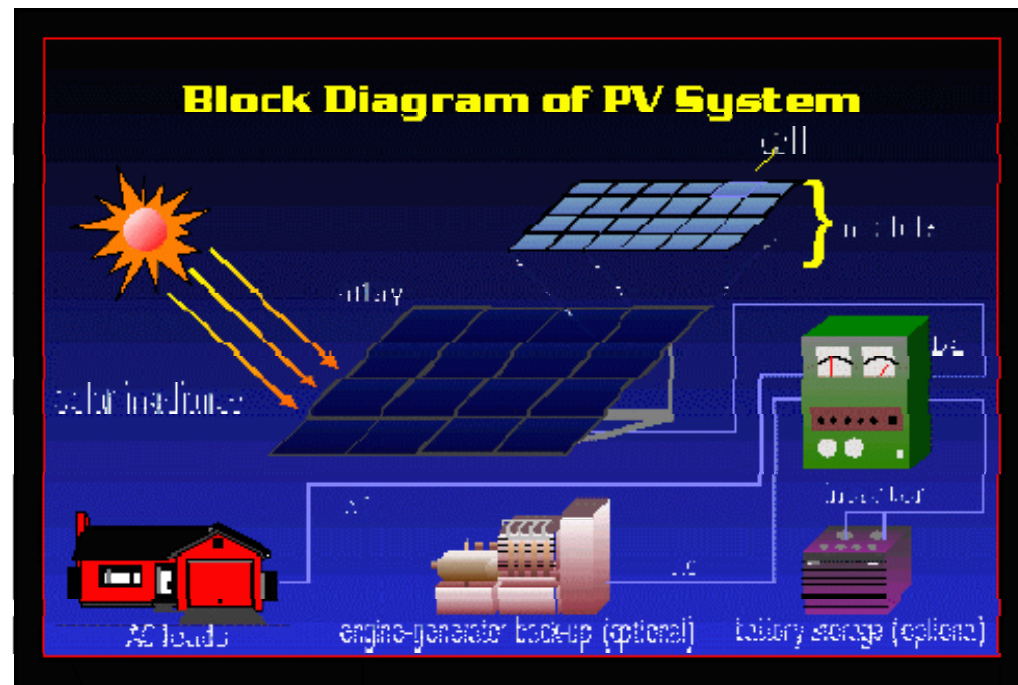


Renewable Energies



♻️ Photovoltaic Energy

- ♻️ Photovoltaic panels, modules or collectors are made up of semiconductor devices that get excited and provoke electronic jumps when receiving solar radiation, thus generating electric current.



Source: Utility Photovoltaic Group

Renewable Energies



❖ Photovoltaic Energy

❖ Advantages

- ❖ They are very simple systems.
- ❖ Low maintenance (except for the batteries).
- ❖ Has no CO2 emissions.

❖ Disadvantages

- ❖ It is expensive.
- ❖ Low performance of photovoltaic modules (approx. 15%).





Renewable Energies



Uses of Solar Photovoltaic Energy

- Electricity generation to be sold to the electric grid.
- Power for remote housing, livestock farms, mountain huts, etc.
- Water pumping.
- Water treatment: desalination, chlorination
- Telecomms: Signal repeaters, mobile and rural phone services
- Transport: solar powered cars, ships
- Aerospace industry
- Others: calculators, toys, watches, ...





Renewable Energies



✎ Wind Energy

- ✎ It uses kinetic energy generated by the effect of air currents.
- ✎ The wind moves the turbine blades and transmits its power to the hub. The rotor hub is coupled to the turbine low speed shaft, which is coupled to the multiplier, that rises the rotation speed to 1500 rpm (50Hz). The multiplier output shaft (high speed shaft) is connected to the power generator, which converts mechanical energy into electric energy.





Renewable Energies



Wind Energy

Advantages

- Economically competitive energy.
- Very tested technology.
- Has no CO2 emissions.
- Possibility to be combined with other energies (photovoltaics) in stand-alone systems.

Disadvantages

- There are not always enough wind resources in the region.
- Visual impact and impact on bird life.
- Wind forecasting.





Renewable Energies



✧ Uses of Wind Energy

✧ Mini Wind Power

- ✧ Power for rural areas or isolated houses.
- ✧ Hybrid systems with solar photovoltaic or mini hydraulic energy.
- ✧ Pumping systems.

✧ Wind Power

- ✧ Grid connected power generation.
- ✧ Desalination.
- ✧ Hydrogen generation.



Renewable Energies



Energy from Biomass

Biomass is all organic matter liable for energetic uses.

Types of biomass:

- Agroforestry waste.
- Industrial waste.
- Urban solid waste.
- Waste from sewage and water-treatment plants, liquid manure from farms.
- Energy crops.



Renewable Energies



✿ Energy from Biomass

✿ Advantages

- ✿ Permits the elimination of organic and inorganic waste.
- ✿ It is considered not to have CO₂ emissions.
- ✿ It can promote an increase of economics in rural areas.

✿ Disadvantages

- ✿ Possible uncontrolled cutting of trees in large areas of Asia and America for energy crops.
- ✿ Interference with prices of foodstuffs (cereals).





Renewable Energies



✿ Uses of Biomass

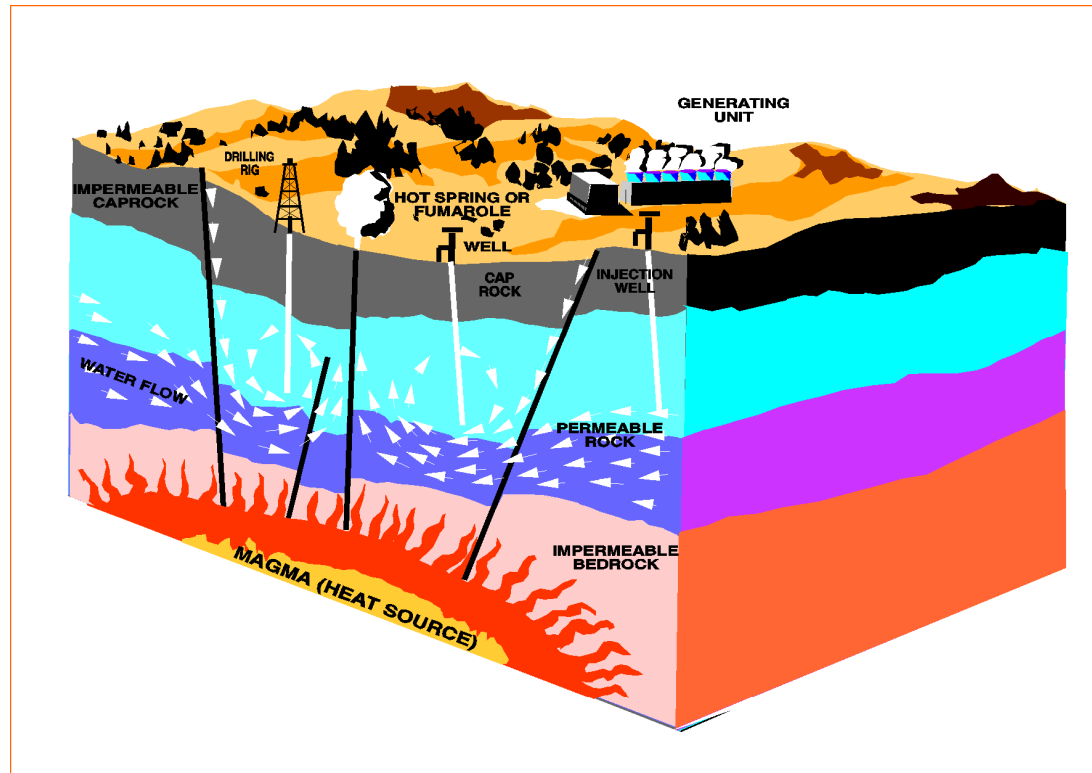
- ✿ Liquid biofuels to replace petrol or diesel oil (bioethanol/biodiesel).
- ✿ Biogas.
- ✿ Pellets or briquettes to be used in heating or DHW.
- ✿ Two kilogrammes of pellets are approximately equivalent to a kilogramme of diesel.



Renewable Energies



- 🌿 **Geothermal Energy**
- 🌿 Is the energy that uses the heat from the inside of the Earth.
- 🌿 Hot water or vapour can flow naturally, through pumping or through impulses of water and vapour streams.





Renewable Energies



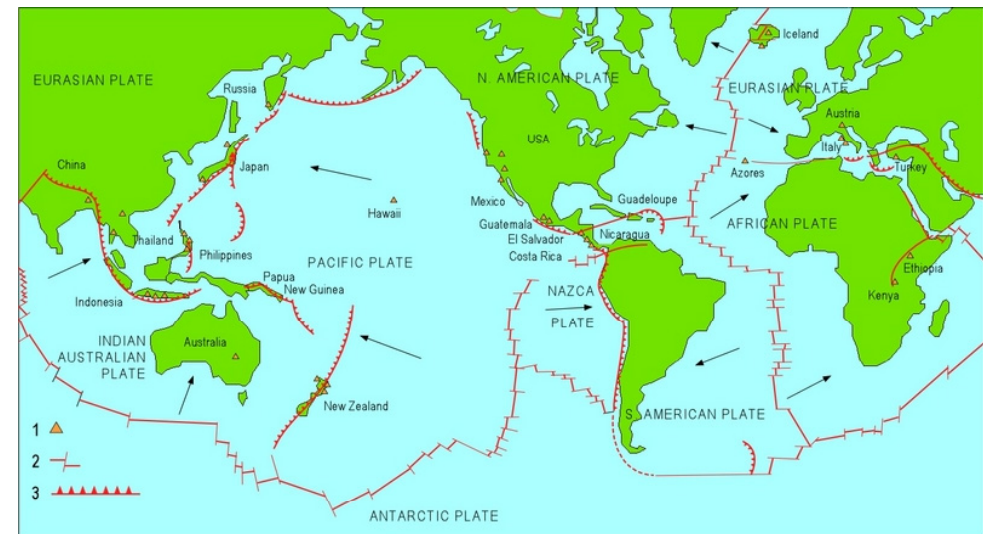
Geothermal Energy

Advantages

- Has no CO2 emissions.
- Constant flow of energy output all year through.

Disadvantages

- Ground extracted hot water is released on the surface, causing thermal pollution to ecosystems.
- Shortage of easy access high temperature reservoirs.
- In very low temperature thermal energy, there is a limitation of the contributed energy in cold periods.

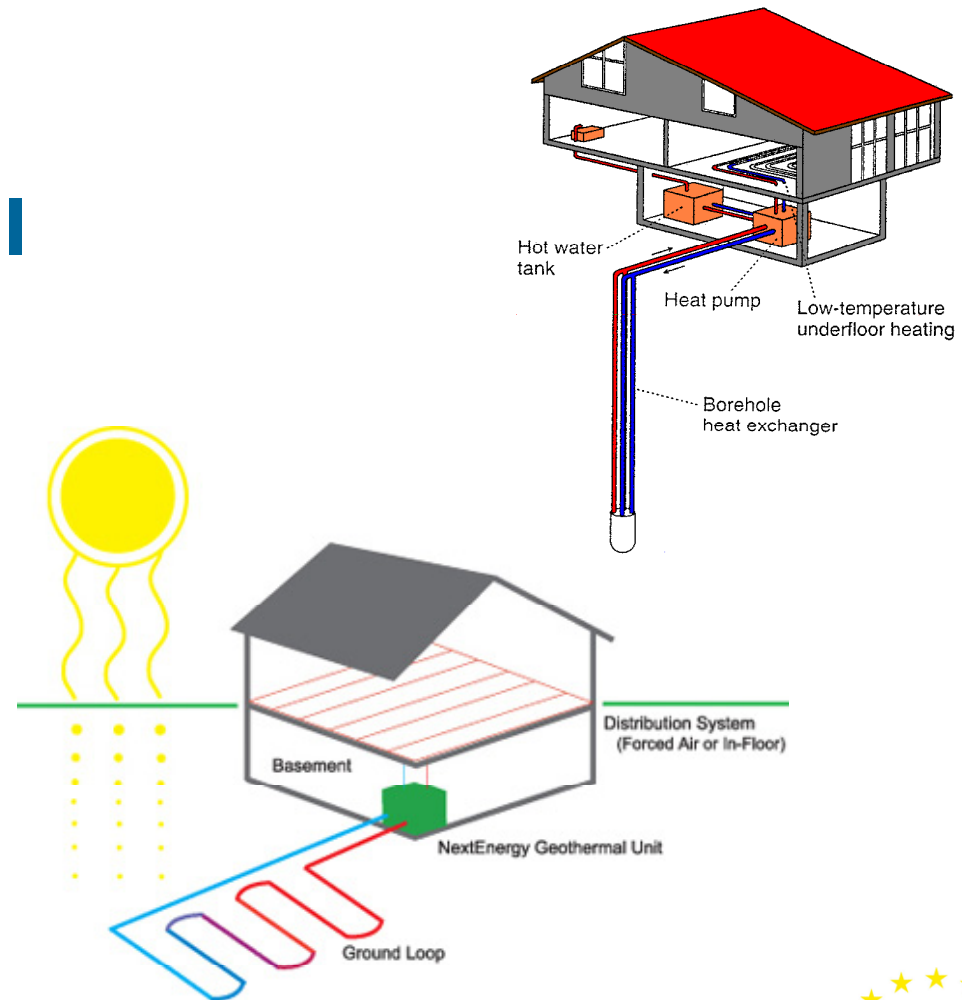




Renewable Energies

Uses of Geothermal Energy

- ❖ Electricity generation.
- ❖ Direct use of heat for industrial uses.
- ❖ Heating and DHW.
- ❖ Absorption cooling.





Renewable Energies



Hydraulic Energy.

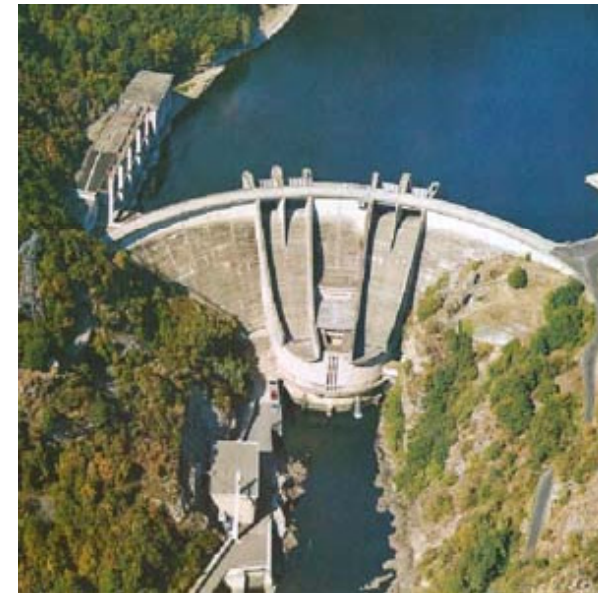
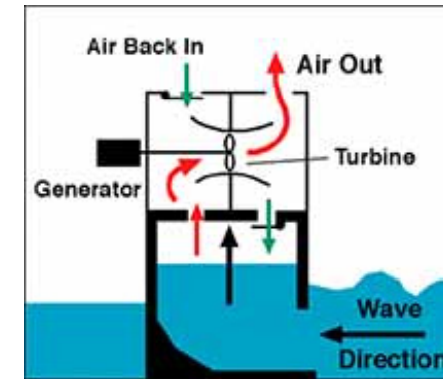
- Consists of using waterfalls for electricity generation from potential or kinetic water energy.

Tidal Energy

- Based on the use of tides to generate electricity.

Wave Energy

- Based on the use of sea swells to generate electricity.





PART III : BIOCLIMATIC ARCHITECTURE



Bioclimatic Architecture



Santorini - Greece





Bioclimatic Architecture



Andalusia





Bioclimatic Architecture



Soria





Bioclimatic Architecture

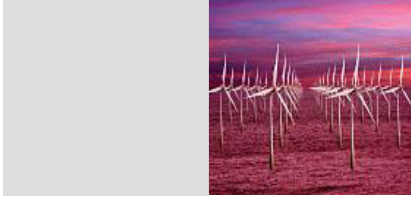


Huesca





Bioclimatic Architecture



Denmark



Bioclimatic Architecture



Burgos



Saragossa

Dudley - UK



BIOCLIMATIC ARCHITECTURE???

Moscow



Pamplona



Caceres

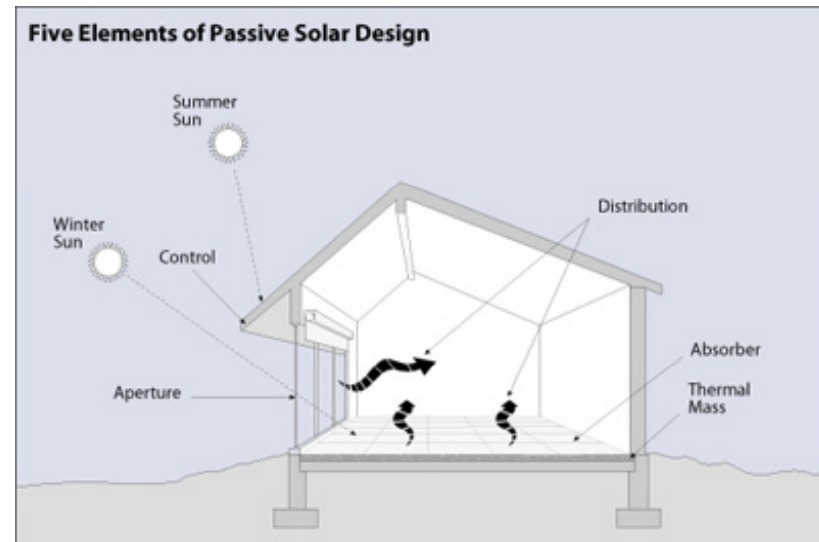




Bioclimatic Architecture



- ✧ It tries to adapt the building to the specific climate conditions of the site, getting the best comfort conditions inside with the minimum support from sources of auxiliary energy.
- ✧ Bioclimatic houses allow us to be fresh in summer and keep the heat in winter.
- ✧ It is based on:
 - ✧ Location
 - ✧ Orientation
 - ✧ Climate
 - ✧ Local vegetation
 - ✧ Use and design of the building





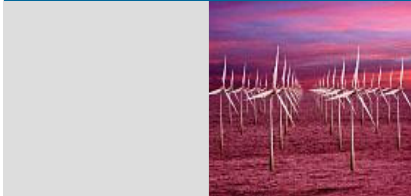
Bioclimatic Architecture



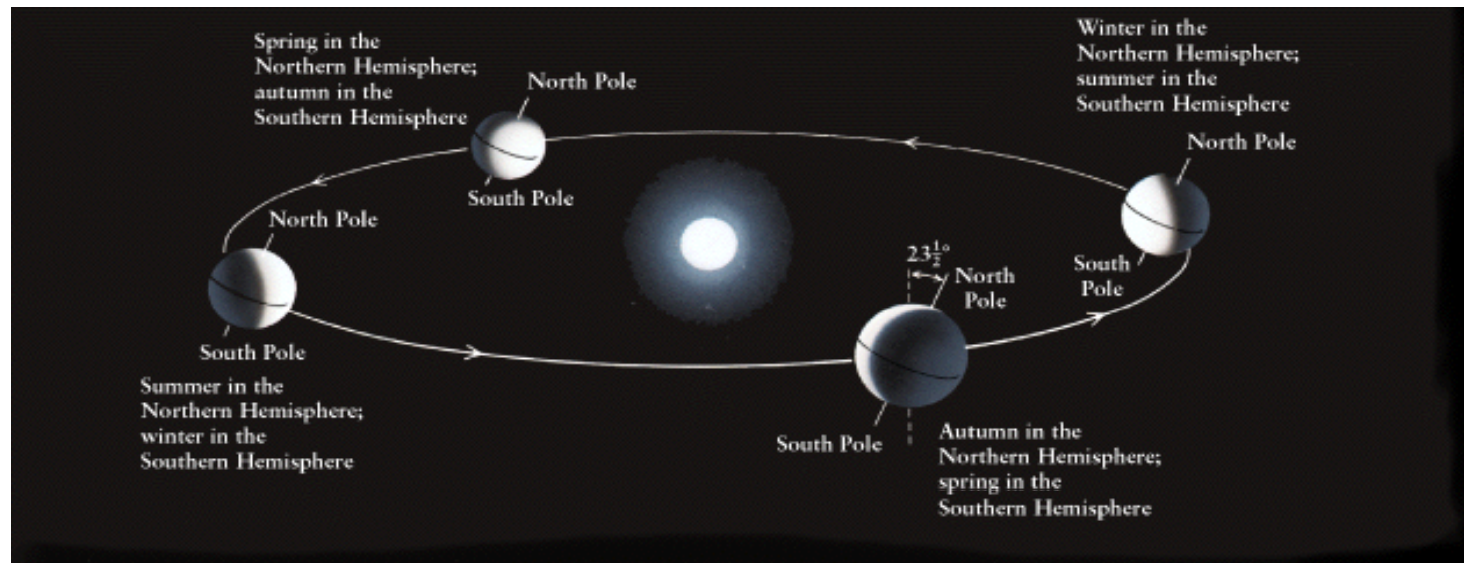
- ✦ Climate determining factors: latitude, altitude, relief, solar radiation, wind, sea tides, proximity to the sea, vegetation.
- ✦ Main climate determining factors for a bioclimatic house design:
 - ✦ Solar radiation
 - ✦ Temperature



Bioclimatic Architecture



- ✦ The Earth's rotation axis is not perpendicular to the plane of the ecliptic. This is the reason for the seasons of the year and the different lengths of night and day times.



- ✦ On the equinoxes (21 March and 22 September), the sun is on the equator plane and the duration of natural day and night is the same in every place in the Earth.
- ✦ Around 21 June (summer solstice), the sun lights the Earth's northern hemisphere more directly, whereas around 22 December (winter solstice) is the southern hemisphere that gets the more light.

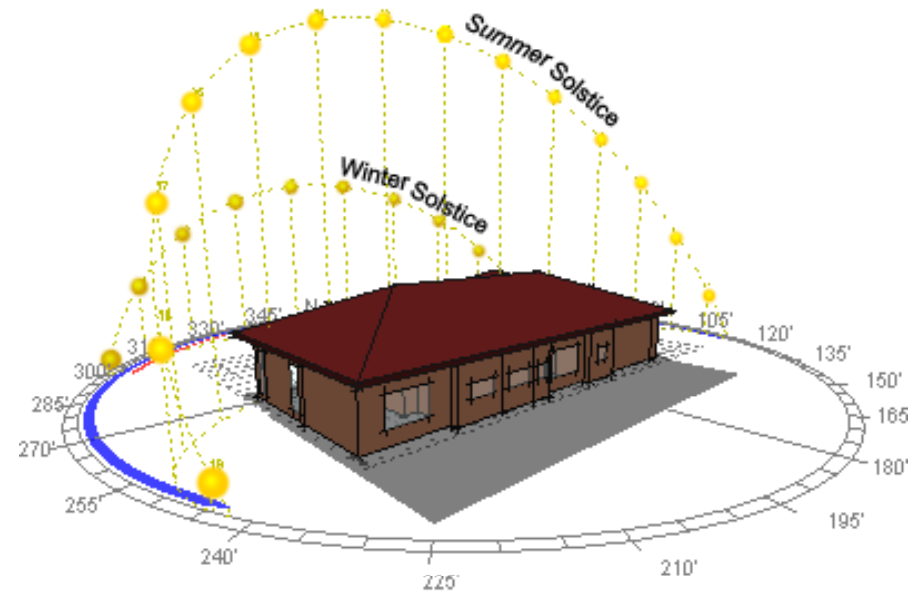


Bioclimatic Architecture



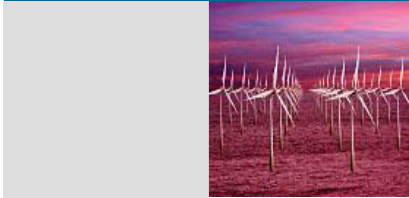
☞ Solar trajectory

- ☞ Depends on the site latitude.
- ☞ Southern façades receive the most of radiation in winter, while other orientations hardly receive any radiation.
- ☞ In summer, southern façades receive less direct radiation, while the sun beats down especially on eastern and western façades during the morning and afternoon.

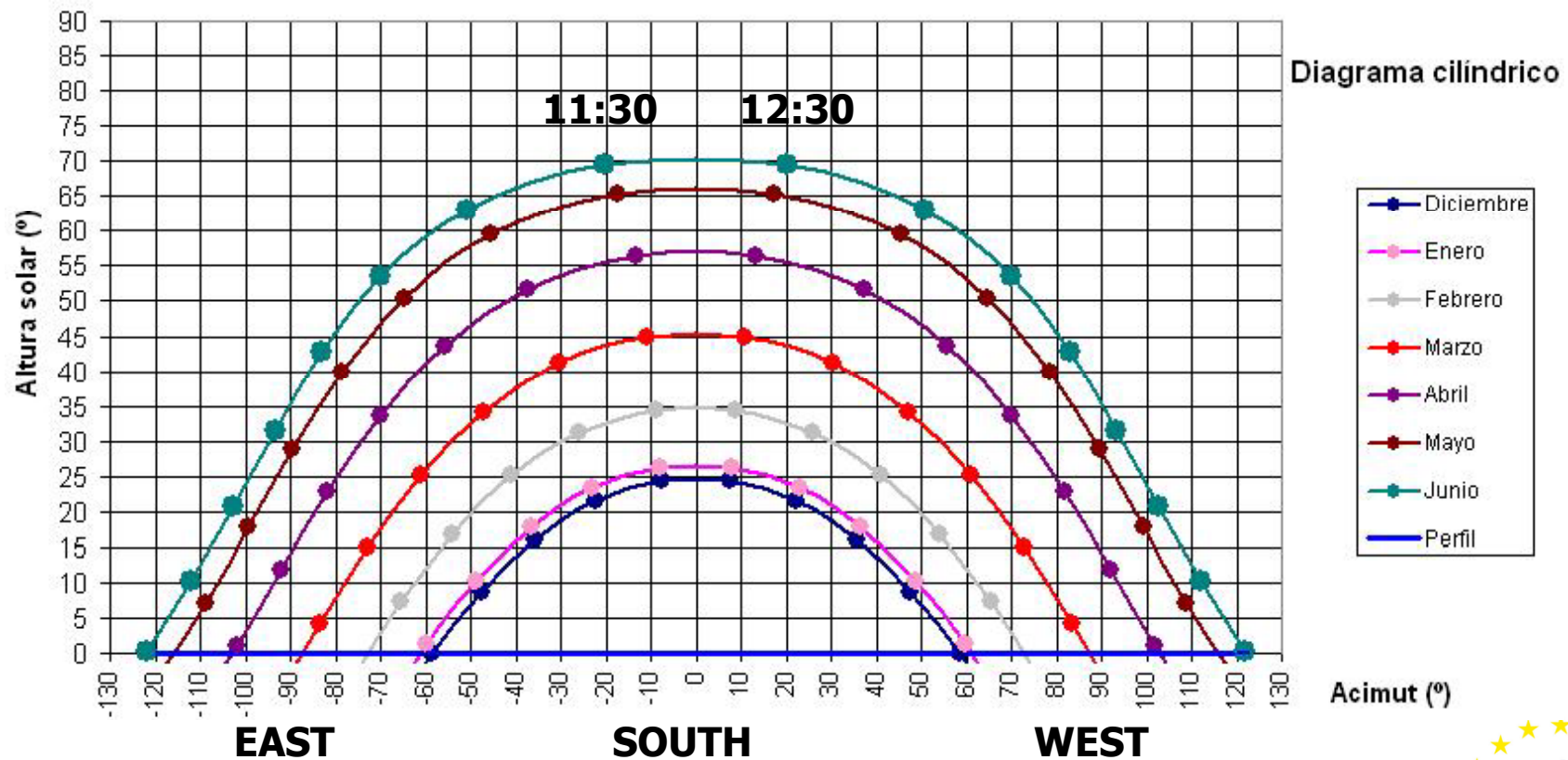




Bioclimatic Architecture



Solar trajectory in Pamplona –
Latitude 42.5° N

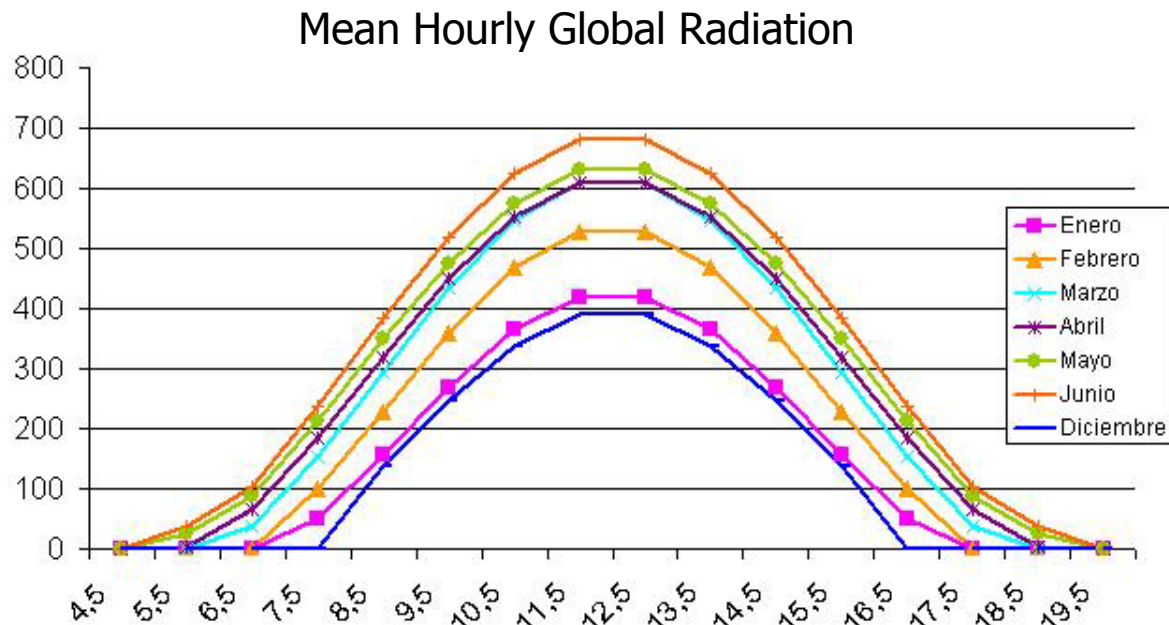




Bioclimatic Architecture



- ✎ Solar radiation reaching the upper atmosphere 1367 W/m^2 and reaching the Earth's surface 1000 W/m^2 .





Bioclimatic Architecture



👉 Mechanisms of heat transfer

- 👉 Conduction: heat transfer through direct contact from a mass with high temperature to another mass with lower temperature.
- 👉 Convection: heat exchange between the air and a mass of material at different temperatures.
- 👉 Radiation: heat exchange takes place by energy absorption and emission through electromagnetic waves, what makes material means unnecessary for the transport of energy.



Bioclimatic Architecture



- Thermal comfort is a person's sensation about a certain thermal environment.
- It depends on a number of external global parameters, such as air temperature, air speed and relative humidity, and other specifically internal like physical activity, the amount of clothing worn or each person's metabolism.
- Range of values for comfort external parameters:
 - Environmental air temperature between 18 and 26 °C
 - Average radiant temperature of place surfaces: between 18 and 26 °C
 - Air speed: between 0 and 2 m/s
 - Relative humidity: between 40 and 65%



Bioclimatic Architecture



Design conditions

- Factor of building shape / consistency.
- Insulation and thermal energy.
- Passive solar collection.
- Natural ventilation.
- Indoor spaces layout.
- Materials.
- Equipment.





Bioclimatic Architecture



- A building shape factor is the ratio between its area and volumen.
- The less shape factor and more compact, the less heat losses in the building.
- Rectangular shaped buildings are more compact than tower buildings or buildings with projecting elements in its floors.





Bioclimatic Architecture



- The reason for thermal insulation is to obstruct heat transfers from the inside to the outside and the other way round to prevent heat losses in cold periods and heat gains in hot ones.



- What should be insulated?
 - Façades
 - Roofs
 - Floors
 - Windows





Bioclimatic Architecture



- Thermal inertia is the mass capacity to keep the thermal energy received and to release it gradually.
- It depends on the mass, density and specific heat of building materials.
- Thermal inertia:
 - diminishes temperature changes in the building.
 - slows down temperature changes in the inside in relation to outside temperature.

- Examples of buildings with thermal inertia
 - Semi-buried buildings
 - Stone or adobe buildings
 - Cave houses



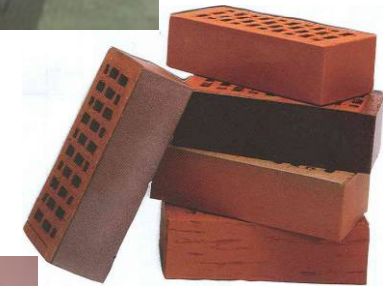


Bioclimatic Architecture



High thermal inertia materials

- ✦ Metals
- ✦ Stone: granite, limestone, slate
- ✦ Clay
- ✦ Concrete



Low thermal inertia materials

- ✦ Insulators
- ✦ Wood
- ✦ Plaster





Bioclimatic Architecture



Passive solar collection

- ✧ Glazing
- ✧ Greenhouses
- ✧ Collecting walls
- ✧ Solar protections
 - ✧ Shutters
 - ✧ Blinds and shutters
 - ✧ Eaves
 - ✧ Slats
 - ✧ Vegetation



Ideal orientation: North-South



Bioclimatic Architecture



Passive solar collection

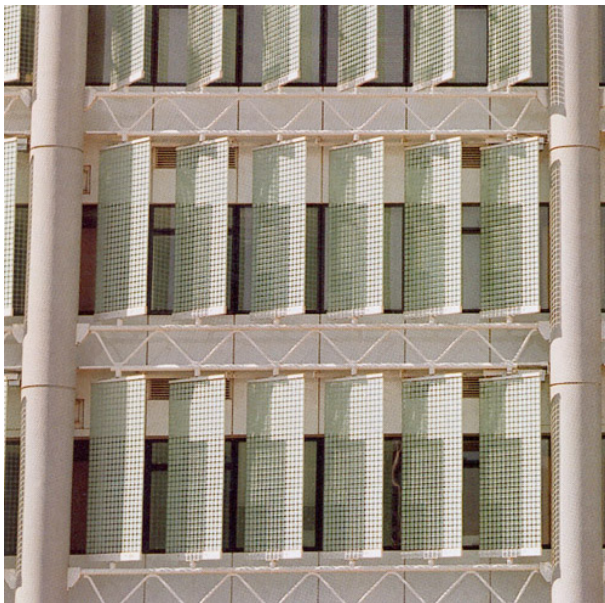




Bioclimatic Architecture



☞ Solar protection



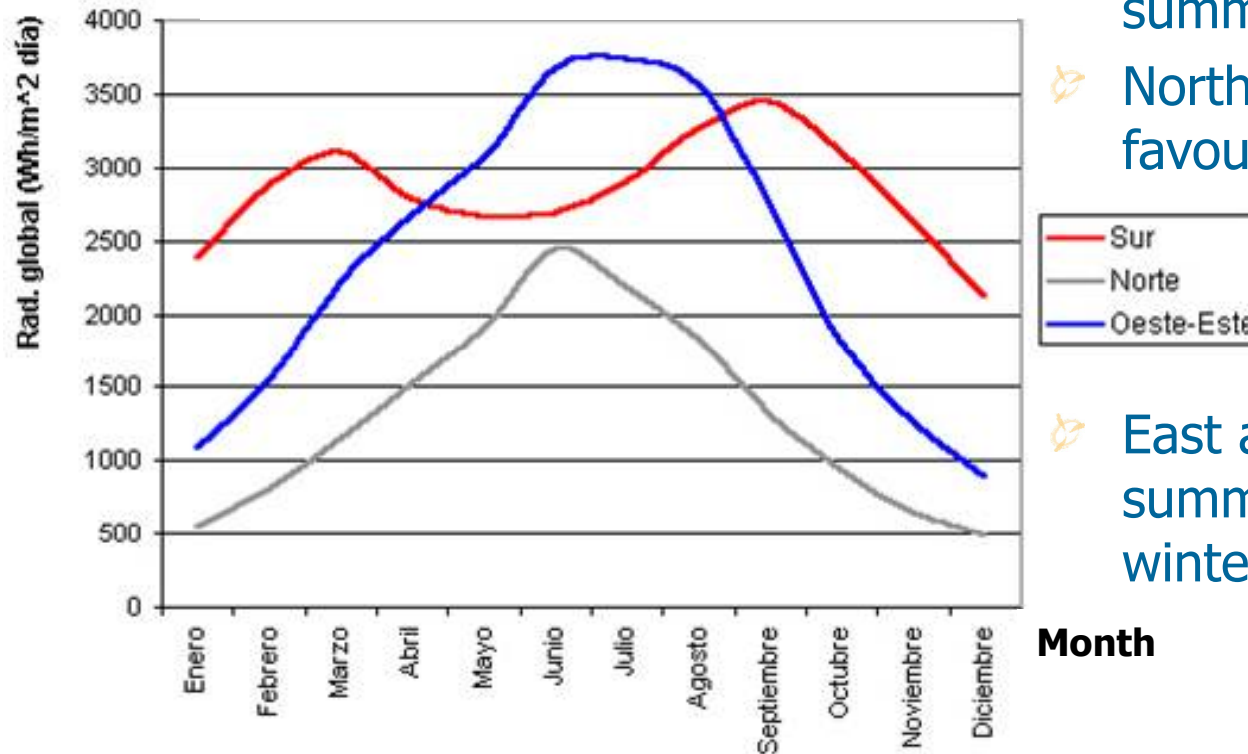


Bioclimatic Architecture



Not all façades interest the same.

Global Radiation over different direction



- South: collection in winter and easy protection in summertime.
- North: unfavourable in winter, favourable in summer.
- East and West: critical in summer and inadequate for winter.



Bioclimatic Architecture



- ✦ **Natural** ventilation is the ventilation obtained without using mechanical devices. It uses the depressions or overpressures created in the building by wind, humidity, sun...
 - ✦ Direct or cross ventilation
 - ✦ Solar chimneys
- ✦ In **forced** ventilation, fans or extractors are used.
- ✦ Si air speed increases 0.2 m/s, heat sensation gets reduced 1° C.



Bioclimatic Architecture



- ✦ Selection criteria for materials
- ✦ Apart from the price, some other aspects should be taken into account such as:
 - ✦ Energy contents of the material.
 - ✦ Extraction, transformation, transport and placing.
 - ✦ Water consumption.
 - ✦ Scarcity of raw material.
 - ✦ Easyness of maintenance, reuse and recycling.
 - ✦ Its toxicity (during extraction/mining, placing or recycling).



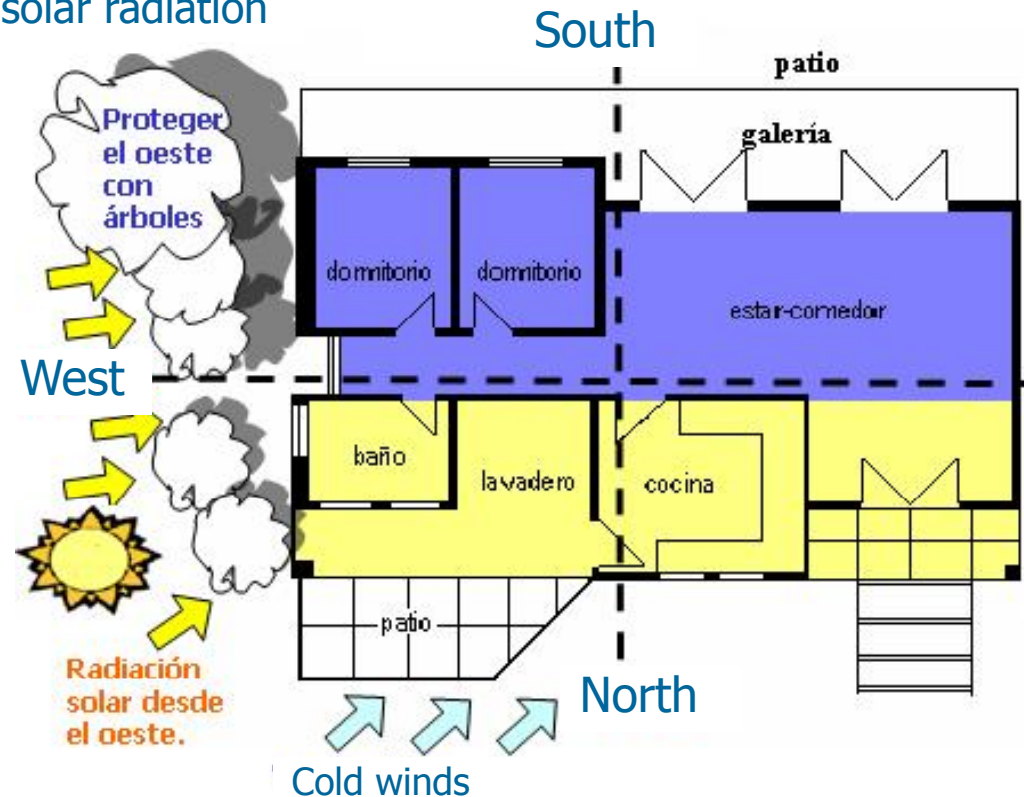
Bioclimatic Architecture



➤ Distribution of indoor spaces

- South façades: living room, bedrooms, study/office.
- North façades: circulation areas (stairways, hallways), pantry rooms, lumber rooms, warehouse, classrooms, workshops, gyms.

Trees protect from solar radiation





Bioclimatic Architecture



- Equipments
 - The efficiency of equipments determine a building energy consumption.
- Heat generation
 - Condensing or low temperature boiler.
 - Heat pumps.
 - Radiant floor heating.
- Electric heating systems are not efficient energy wise.
- The system control and regulation is a key factor for consumption.





Regulations

European

- Directive 2002/91/CE

National (Spain)

- Código Técnico de la Edificación (CTE) (*Building Technical Code*)
- Reglamento de Instalaciones Térmicas en los Edificios (RITE) (*Regulations for Building Thermal Installations*)
- House energy certification





Regulations

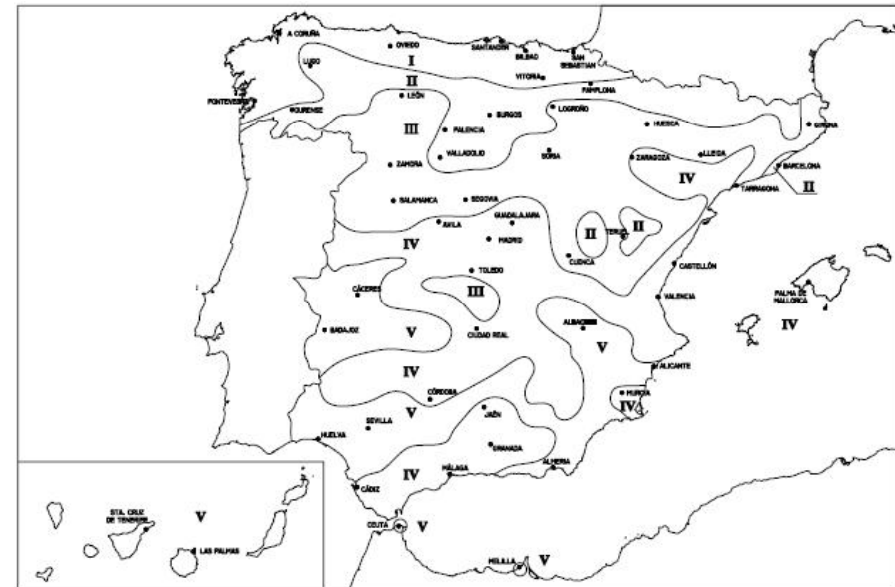
👉 Directive 2002/91/CE

- 👉 It is mandatory for European Union member states.
- 👉 It covers all aspects related to energy efficiency in buildings.
- 👉 It states
 - 👉 Minimum rules related to energy performance for new buildings or existing big buildings subject to big refurbishment.
 - 👉 Building energy certification.
 - 👉 Periodical service of boilers and air conditioning systems in buildings.



Regulations

Climate zones Solar radiation



CTE

- ⌘ Requirements depending on climate zones.
- ⌘ Limitation of energy demand (HE1)
- ⌘ Energy efficiency of lightning (non-residential use) (HE3)
- ⌘ Minimal solar contribution for DHW (HE4)
- ⌘ Minimal photovoltaic contribution (non-residential use) (HE5)

Solar Contribution

Pamplona II	30% minimum
Zaragoza III	50% minimum



PART IV : ENERGY EFFICIENCY AND SAVING



Energy efficiency and saving



✧ At home

✧ In **summer**: Avoid heat accumulation inside the house.

✧ Use of blinds, awnings, shutters, slats, curtains to shade sunny windows.

✧ Ventilation: only if outdoor temperature < indoor temperature

– Night ventilation is desirable.

– Cross ventilation: when two windows are not placed in the same wall.

– Chimney effect: hot air is lighter and goes up and, with ventilation, can be evacuated through highly placed openings in rooms or in the house.



Energy efficiency and saving



✧ At home

✧ In **summer**: Cooling

- ✧ Comfort temperature between 24° C and 26 ° C.
- ✧ For each degree we lower the temperature below 25°C, there is an 8% increase of energy consumption.
- ✧ A difference of more than 12° C with respect to outdoor temperature is not recommended for energy, economics and health reasons.
- ✧ Disconnect air conditioning when there is nobody home or in the room.



Energy efficiency and saving



✦ At home

- ✦ In **winter**: keep the maximum amount of heat inside the house and avoid heat escape.
 - ✦ Favour solar collection by removing obstacles.
 - ✦ Thermally insulated façades.
 - ✦ Change old carpentry framing for good quality ones (with thermal bridge break) and double windows or double glazing.
 - ✦ Use rolling blinds or shutters for protection against winds and night cold.
 - ✦ Ventilation: 10 minutes is enough to renew the air in a room.



Energy efficiency and saving



✧ At home

✧ In **winter:** Heating

- ✧ Between 20° C and 22° C during daytime and 15° to 17° C during the night.
- ✧ Each extra degree consumes from 5% to 7% of extra energy.
- ✧ Do not cover radiators.
- ✧ Switch the heating off when leaving home for more than one day.
- ✧ Avoid electric heating (except for heat pump).
- ✧ Centralized heating with individual consumption control is preferable to individual systems.
- ✧ High efficiency boilers.
- ✧ Radiant floor.



Energy efficiency and saving



👉 At home

👉 **Electrical household appliances**

👉 Choose energy class A appliances

- Energy label applies in all Europa and indicates an electric appliance energy efficiency.
- There are 7 classes, identified by a colours and letters code.

👉 When possible, use cold water and energy saving programs in washing machines and dishwashers. 90% of used electricity goes to water heating.

👉 Use machines with full load.



Energy efficiency and saving



✿ At home

✿ **Electrical household appliances**

- ✿ Pressure cookers consume half the energy than traditional pans.
- ✿ Pans' bottoms must be bigger than the burner/ring and pans must be always covered. Energy savings up to 20%.
- ✿ Once the boiling/cooking starts, power must be lower to minimum.
- ✿ It is very important the cleaning and maintenance of rings, ovens and burners.
- ✿ The use of microwave ovens instead of electric ones, saves 60 to 70% energy.
- ✿ Avoid the use of clothes dryers.
- ✿ Avoid the use of the iron for a single article of clothing.



Energy efficiency and saving



✦ At home

✦ Lighting

✦ A lamp's luminous efficacy is the ratio of emitted luminous flux and the power used in watts.

✦ Incandescent lamps: light is generated by an electric current crossing a metal filament. They only use for lighting 5% of the energy they consume.

✦ Halogen lamps: they work like incandescent ones. Last longer.

✦ Fluorescent tubes: based on some gases luminous emissions when crossed by an electric current. More luminous efficacy than incandescent bulbs.

✦ Low energy light bulbs: they are small fluorescent tubes adapted to the size, shape and lamp-holders of conventional light bulbs.

✦ an incandescent 100 W bulb emits the same light than a 20 W low energy one.



Energy efficiency and saving



Lightning

	Energy saving	Price	Life (hours)
Incandescent lamps:	--	Cheap (0.6 € 100W)	1000
Halogen lamp *	30 %	Medium (4€ 150W)	2000
Fluorescent	80 %	Medium (4€ 36W)	8000 – 10000
Low energy light bulb	80 %	Expensive (9 € 100W)	8000 – 10000

* Energy saving if fitted with an electric converter



Energy efficiency and saving



⚡ **Lightning:** practical case

- ⚡ Traditional 100W (0.60€) light bulb – low energy 20W (9€) bulb
- ⚡ 5 hours work per day (1825 hours per year)
- ⚡ Estimated kWh price: 0,1€
- ⚡ Consumption:
 - ⚡ Conventional bulb: 182,500 Wh year - 18.2 €
 - ⚡ Low energy bulb: 36,500 Wh año - 3.6 €
- ⚡ Annual saving: 14.6 € in consumption
- ⚡ Conventional bulb: its average life is 1000 hours, what means that it will have blown and needed to be replaced along this first year.



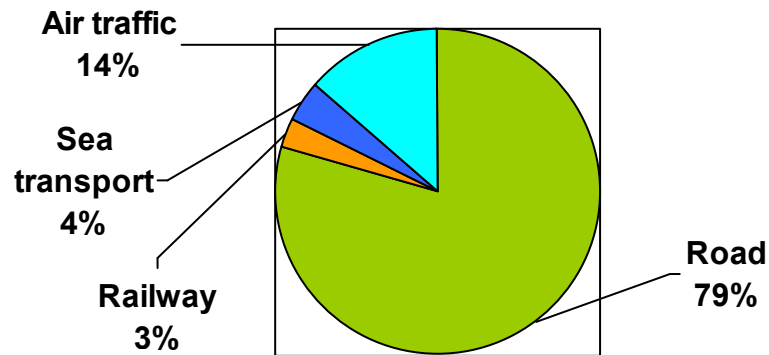
Energy efficiency and saving



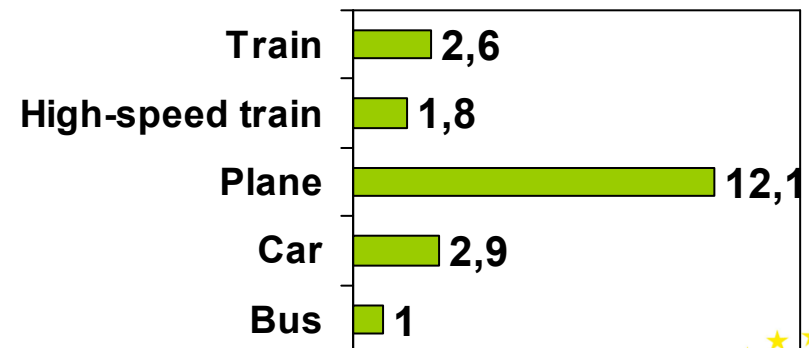
Transport

- More than 75% of urban journeys are made in private cars with a single person.
- 50% of inside town journeys are made to cover less than 3 km.

Energy Consumption by means of transport - 2000



Comparative consumption of different means of transport – energy units per traveller – kilometres










Energy efficiency and saving



Private transport

-  Efficient driving can save up to 15% of fuel consumption.
 -  Fast gear and low rpm driving as much as possible.
 - Petrol engines: 2,000 to 2,500 rpm
 - Diesel engines: 1,500 to 2,000 rpm
 -  Keep driving speed as uniform as possible, avoid sudden braking, sudden acceleration and unnecessary gear changing.
 -  Brake smoothly and progressively and reduce gear the latest the better.
 -  In long lasting stops (more than 1 minute) it is recommended to switch the engine off.



Energy efficiency and saving



✦ Private transport

✦ Other factors to influence consumption

- ✦ Consumption multiplies at speeds over 100 km/h.
- ✦ External accessories (e.g. loaded luggage rack) may increase consumption up to 35%.
- ✦ Air conditioning increases consumption up to 25%.
- ✦ Driving with totally open windows: +5%
- ✦ Lack of engine servicing or inadequate tyre pressure: +3%



More information



- ✦ www.idae.es
- ✦ www.cenifer.com
- ✦ www.crana.org
- ✦ www.agenda21-local.net
- ✦ www.energias-renovables.com
- ✦ www.construible.es