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Spanish National Report from Zero to Hero

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1. INTRODUCTION

1.1. General description on climate change and energy issues in Spain

Nowadays one of the main problems that threaten all the people of the world is climate change, whose consequences can be devastating if we change our dependence, increasingly, with regard to the use of fossil fuels, whose main use is the creation of plastic, and we stop emitting greenhouse gases into the atmosphere.

Among the population there is a great lack of knowledge regarding what climate change is. First of all, two concepts must be highlighted that, because they are closely related, tend to be confused or mistakenly treated as synonyms: global warming and climate change. Global warming is the cause of climate change, that is, as a result of the release of greenhouse gases into the atmosphere, which is caused by human action, there is an increase in temperatures, which in turn causes variations in climate.

The Earth had already undergone continuous changes over time in a natural way, needing millions of years. However, now, as a result of human activity, we are reaching levels that could result in the extinction of the planet we inhabit.

Thanks to the greenhouse effect and the atmosphere, whose gases retain the heat emitted by the Earth, it can maintain the necessary conditions to house life. The problem is when greenhouse gas emissions increase due to human action and the atmosphere begins to retain more heat than necessary, thus causing the temperature of the planet to increase and thus global warming to arise.

This increase in temperatures leads to the melting of the poles, causing in turn the rise in sea level, causing flooding and the disappearance of many coastal areas. In addition, it causes the death of both animal and plant species, fires, droughts, etc. Currently we can perceive these changes, for example, according to the data provided by Greenpeace, in 2016 the temperature of the planet increased 1.1 degrees and it is estimated that the melting of the glacial masses such as the Arctic is also advancing more and more, and consequently the level of the sea. We can also observe the consequences in our society and in our economy, such as, for example, damage to crops, production or even people's health.



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The Ecological Footprint that we are leaving on Earth is getting deeper and deeper. According to the 2016 Living Planet Report, "Spain occupies the 22nd place in the world ranking of the Ecological Footprint". At the same time, several reports linked to the indices and plans of the Sustainable Development Goals 2018 published by the Network for Solutions for Sustainable Development allow us to put in context the urban report present in Spain among the 193 member countries of the UN. It is interesting that, according to this international ranking, Spain presents better results in social objectives than in those regarding environmental sustainability and economic development. With regard to climate action, the most notable data is that of greenhouse gas emissions (not available at the municipal level). A great variety of indicators have been used, the results of which have been very heterogeneous, being one of the Sustainable Development Goals with the worst result in most cities in Spain. In relation to the issue of affordable and non-polluting energies, Melilla is in a worse range due to its geographical situation and its low score on renewable energy indicators, like Ceuta if we talk about the ranking of cities and sustainable communities.

These situations put us away from other countries in our territorial and economic environment. In addition, it raises the problem of the energy dependence of Spain with respect to the exterior, being superior to the EU as a whole, needing to import 77.4% of the energy consumed compared to 50.1% of the other countries. "Being efficient in Spain in terms of energy consumption should be one of the priorities of energetic policy, not only to compete with the countries in our environment, but also to be able to carry out more sustainable policies with respect to the environment and less exposed to the volatility of fuel prices that we have to import," says Fernando Ferrando, deputy president of the Renewable Foundation.

1.2. Definition of physical context (climatic conditions, geography and energy sources)

Each part of the world experiences, in a different way, the havoc that climate change is causing. Among them Spain is not an exception, because it has great possibilities of becoming a desert. The Government has warned that global warming threatens, currently and until the end of the century, 80% of the land in Spain that is in danger of desertification, including even the mountain ranges of the south. Desertification leads to the degradation of arid, semi-arid and dry sub-humid areas originating what we call drylands. Large areas of Spain are located within these dry lands and are on the way to expand more and more. Over the last 50 years, surfaces with semi-arid climates have increased by 3,000 square kilometres. This implies around 6% of the extension of the country with the Ebro valley, Castilla-La Mancha and the peninsular southeast as the



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most affected areas, in areas with Mediterranean climates that have suffered the reduction of rainfall and have been transformed into semi-arid areas. This type of land accentuates and increases the number of fires in Spain. In 2012 alone, 14,050 fires occurred, affecting 190,000 hectares of forests.

Another problem caused by climate change mentioned above is the increase in temperatures. Both the big cities and the Mediterranean coasts are especially defenceless against the effects caused by climate change.

The Mediterranean is one of the most vulnerable regions, but so are the big cities like Madrid. The effect of the heat-concentration island is an increasing temperature phenomenon, that is, higher temperatures are recorded in the cities than in the surroundings because the buildings prevent the accumulated heat from being released. With regard to the seasons, the average temperatures are increasingly higher, although it is appreciated in spring and, especially, in summer, being this one increasingly longer and warmer, and reaching almost nine days per decade. This means that summer now lasts five weeks longer than in the eighties. Heat waves also increase more frequently and longer, while cold temperatures decrease. This, together with the increase in the number of tropical nights, affects the well-being of people and makes it more difficult to sleep, which has effects on health, there is even a correlation between maximum temperatures and mortality. Almost 70% of the population is already affected by the consequences of this crisis. It is predicted that the rains in the Iberian Peninsula could rise between 18% - 42% at the end of the century, while, in northern Spain, snowfall would decrease by 50%. Since the beginning of the 20th century, the glaciers of the Pyrenees have lost almost 90% of their surface. Of the 34 glaciers described in 1982, only 18 remain.

As we can see, there are many problems that are presented to us, and this situation does not improve if we focus on the sources of energy in our country. Since the Industrial Revolution, when greenhouse gas emissions into the atmosphere began to rise, the growth of demand and production of energy through fossil fuels has increased considerably. In Spain, the consumption of energy undoubtedly exceeds the production of this, which causes a great dependence and energy imbalance. The main sources of energy in Spain have been nuclear energy and coal, given the shortage of oil and natural gas.

The degree of self-sufficiency in our country is very low, which forces the realization of very expensive imports and originates an external dependence in relation to the countries that we have to import.



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Oil, natural gas and coal are the main sources of energy that need external supply. In the Cantabrian Mountains, Asturias, León and Palencia, the largest coal production is located. However, in these areas self-supply is not allowed and importation is necessary. It is mainly used to produce electricity in thermal power plants, in addition to being used in industry, especially steel and cement. One of the great disadvantages that it presents is the pollution produced by the sulfur it contains, which causes acid rain.

Firstly, Spanish energy consumption is held by oil, although the price increase since 1975 caused consumption to decrease and energy saving measures to be carried out. In spite of everything later it did not take long to return to its apogee. The national production in general is quite poor. This is located on the coast of Tarragona and Burgos, because they do not allow self-supply, and, therefore, there is a strong external dependence and a very considerable expense. The use of oil is especially for transportation and industry.

Natural gas is another source of energy that has been consumed for several decades in Spain. Its production is concentrated in the areas of the Basque Country and Andalusia, and has had a great growth. In spite of this, the Spanish production does not allow for self-sufficiency, which is why there is an external dependence, especially in areas of Algeria and Libya. Its uses are especially industrial, transformation into electricity and at homes.

Nuclear energy is recent in Spain, as its growth was linked to the crisis of 1975 and, since 1984, its expansion stopped (nuclear moratorium) due to the rejection of public opinion in the face of the risks involved. Its production points are located in Salamanca and Badajoz. It is used mainly in the production of electricity. The main problems posed by this energy source, in addition to your external dependence, is the storage of radioactive waste, which is carried out in Córdoba and the high costs of dismantling the plants that are no longer active and that can be dangerous for both the environment as for the nearest populations.

It should be noted that Spain also uses new sources of renewable energy which offer favourable conditions for Spain, thanks to the diversity of the natural environment and to have an acceptable technological level. This type of energy has many advantages, such as that they are inexhaustible, clean and have great dispersion, which allows their use in areas with low demand, and thus be able to save on equipment. However, production is increasingly close to becoming the main source of energy. The production of hydraulic energy is located in the northern half of the peninsula, that is, the Ebro, Duero, Tajo and northern rivers basins, supplying 100% of



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the national demand for this energy. Although it is a renewable, clean and instantaneous energy it presents some problems, as its production depends on the fluctuations of the rain and which poses a conflict with other water uses (agricultural risk and domestic consumption).

1.3. Environmental Education and sustainable construction

In order to create a harmonious reconstruction of the relationships between individuals, society and the environment, Environmental Education emerges as a proposal and educational response for a development that promotes a sustainable present and future. The idea is to express an environmental education that is not reduced to raise awareness, change behaviour or educate to conserve nature, but to educate to change society, ensuring that awareness is oriented towards human development linked to global sustainability and responsibility.

It is difficult to define exactly what environmental education is, given the diversity of approaches and concrete practices. However, we can start with the response of the International Congress of Education and Training on the Environment in Moscow: "Environmental education is a permanent process in which individuals and communities become aware of their environment and learn the knowledge, values, skills, experience and also the determination that enables them to act, individually and collectively, in the resolution of present and future environmental problems. "

The challenge that environmental education aims to achieve is, therefore, to encourage a new relationship between society and its environment, in order to ensure that current and future generations develop a more just, equitable and sustainable personal and collective awareness that can guarantee the conservation of the environment and resources. So, it is important not to separate education from the environment in which it occurs. It is clearly evident that, by education, we understand not only formal education, but also non-formal and informal education. It should also be noted that it is, above all, education for action. This allows us to expand our knowledge and awareness about the impacts that human activity causes on the environment, with the aim of improving our capabilities to help solve problems.

Thanks to this awareness are developing, for example, sustainable buildings, which not only includes the buildings themselves, but also the environment and how they are integrated to build cities. Sustainable urban development aims to create an urban environment that does not harm the environment, and that can provide sufficient resources, not only in relation to energy and water efficiencies, but also that has a



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greater functionality, so that It is a good place to live. It is true that it is difficult to change the way buildings are built and how they work. Therefore, we must end the habits acquired by the current construction system that has not been aware that natural resources are finite and increasingly scarce. For this, a change in the mentality of the industry is important in order to give greater importance to recycling in order not to extract large amounts of resources and encourage the use of renewable energy and products.

2. National situation of energy in the field of sustainable construction

2.1. Energy supply and energy consumption.

Energy is fundamental for life. We can get energy through many ways such as electricity, piped gas or biomass. The "mix of energy supply of a house must allow cover all the energy demand of the house" so it must meet a number of requirements such as access to it or have enough space. Consequently, if you want to change the type of supply usually requires a large amount of money.

This energy is emitted by a company that distributes and another that invoices, although, sometimes, it is the consumer who has to make the "necessary steps" such as firewood.

But the ultimate goal of having energy supply is to consume it in order to use the energy.

"Energy consumption is the total expenditure of energy for a given process¹. This energy consumption can be produced by consuming renewable energy, which are clean and do not pollute the environment such as solar, wind or biomass. If this is not the case, they can be produced by non-renewable energies that produce waste and are harmful to the environment, fostering events such as global warming or the thawing of the poles. These would be fossil fuels, where we find oil, coal and natural gas, and nuclear energy that generates radioactive waste.

However, as we will see later, energy consumption is inversely proportional to energy efficiency, so when energy consumption increases, energy efficiency is lower and when

¹ Look: Podo. (2018). What is energy consumption? May 13, 2019, from Podo Website: <https://www.mipodo.com/blog/diccionario/consumo-energetico-que-es/>



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energy efficiency decreases it is greater. Knowing this, we can see that when we use renewable energy, we are achieving greater energy efficiency.

And to help the environment we must look at the time to buy any appliance or car in the efficiency they have and in the amount of water and energy they consume. We can find this information by looking at the energy labels.

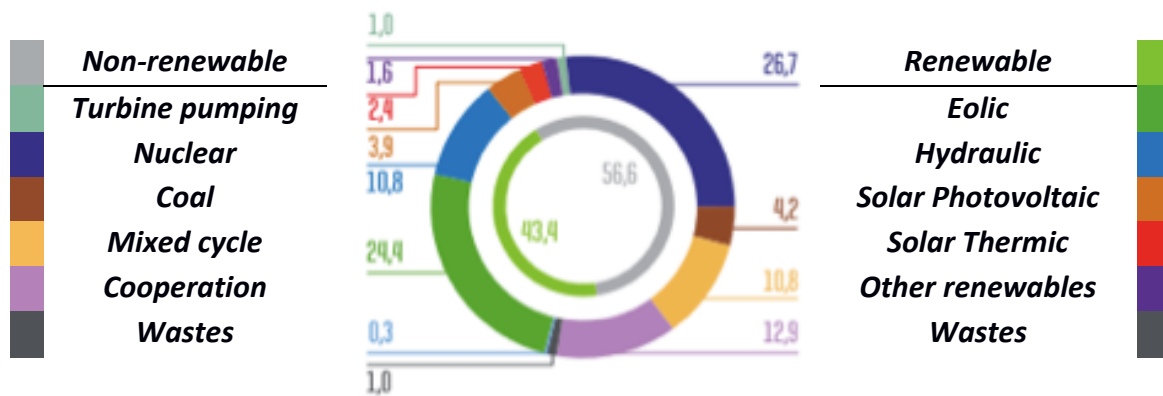
If we divide it by sectors, historically it has been the industrial sector that consumed the greatest amount of energy. But due to globalization, the free market and the "measures of saving that began to be put into practice in the seventies" they have caused this to lose weight before the services and transport sector that occurred from the last decades.

Internet orders, such as clothing, accessories or even food, which can be delivered to the home; the fact that you can bring anything at any time is one of the main reasons why this sector is increasingly increasing.

That is why we must become aware of the importance for our planet of improving energy efficiency by reducing consumption.

Taking into account this, we are going to see the electricity supply and the majority energy consumption in Spain:

STRUCTURE OF MONTHLY PENINSULAR GENERATION%





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As we can see, nuclear energy is the energy supply with the highest percentage in Spain followed by wind and cogeneration. It is curious that, although the first governing energy is not a renewable source, the next one is.

Now, regarding energy consumption we can distinguish between the percentage of consumption in the peninsula and in the non-peninsular ones.

Balance in peninsular electric energy

	March 2019		Annual cumulative ¹		Movil Year ²	
	GWh	% 19/18	GWh	% 19/18	GWh	% 19/18
Hydraulic	2.131	-51,6	6.739	-25,0	31.857	53,6
Turbine pumping ³	189	-48,8	544	-33,9	1.730	-23,9
Nuclear	5.275	17,5	15.083	6,4	54.103	-0,5
Coal	825	-37,1	6.147	-21,4	33.209	-17,0
Combined cycle ⁴	2.129	70,6	7.781	42,7	28.731	-13,6
Eolic	4.823	-37,2	14.439	-18,0	45.784	-9,7
Solar Photovoltaic	769	38,2	1.842	25,9	7.753	-2,0
Solar Thermic	478	104,3	906	57,3	4.754	-11,1
Other renewables ⁵	309	14,3	897	3,5	3.577	-0,1
Cogeneration	2.589	10,8	7.633	8,0	29.546	4,8
Non renewable wastes	201	-6,8	578	-10,5	2.226	-10,6
Renewable wastes	67	2,2	193	-2,3	728	-2,2
Generation	19.786	-14,6	62.783	-4,4	243.999	-2,3
Consumes in pumping	-376	-48,8	-1.012	-26,6	-2.832	-24,2
Peninsula-Balearic Islands ⁶	-122	35,9	-379	37,2	-1.336	9,9
International exchanges balance ⁷	1.392	-	2.650	37,8	11.829	22,9
Demand	20.680	-6,3	64.043	-2,9	251.660	-1,0

Note: All percentages of variation referred to the same period of the previous year.

1 / Assignment of production units according to the main fuel.

2 / Mobile year: cumulative value in the last 365 days or 366 days in leap years

3 / Pure pumping turbidity + estimation of mixed pumping turbine.

4 / Includes operation in open cycle

5 / Includes biogas, biomass, marine and geothermal hydraulics.

6 / Positive value: energy input in the system; negative value: energy output from the system.

7 / Positive value: importing balance; negative value: exporting balance. The increment values are not calculated when the trade balances have a different sign.

As expected, this data is related to the previous one.

Regarding to energy consumption in the peninsular territory we can observe that, in this case, it is the nuclear energy that consumes the most energy being the total energy demand 15,083 GWh. Next and very contrary to nuclear energy we find wind energy with 14,439 GWh.

Finally, we will observe the energy consumption of the non-peninsular systems that are formed by the Canary Islands, the Balearic Islands, Ceuta and Melilla.

Non peninsular electric energy systems Balance/1

	Balearic Island		Canary Island		Ceuta		Melilla	
	GWh	% 19/18	GWh	% 19/18	GWh	% 19/18	GWh	% 19/18
Hydraulic	-	-	0,3	-3,9	-	-	-	-
Coal	141	-29,4	-	-	-	-	-	-
Diesel engines	17	-53,7	161	-8,6	17	-5,6	16	-0,7
Gas turbines	35	-43,4	19	-1,2	0	-79,9	0	104,0
Steam turbines	-	-	209	7,1	-	-	-	-
Fuel/gas	51	-47,2	389	-0,4	17	-5,6	16	-0,7
Combined cycles /2	84	112,8	225	-13,9	-	-	-	-
Auxiliary generation /3	0	-	-	-	-	-	-	-
Hydro wind	-	-	2	22,2	-	-	-	-
Wind Power	1	73,0	97	91,3	-	-	-	-
Photovoltaic Solar	11	10,5	24	-2,7	-	-	0	-13,6
Other renewables /4	0,1	-39,5	1	7,6	-	-	-	-
Cogeneration	3	42,4	0	-	-	-	-	-
non-renewable waste	11	-1,0	-	-	-	-	0,5	2,7
Renewable waste	11	-1,0	-	-	-	-	0,5	2,7
Generation	314	-15,6	738	1,1	17	-5,6	17	-0,5
Peninsula-Balearic Island /5	122	35,9	-	-	-	-	-	-
Demand (b.c)	436	-5,6	738	1,1	17	-5,6	17	-0,5

Note: All percentages of variation are referred to the same period last year.

1 / Assignment of production units according to main fuel.

2 / Includes operation in open cycle. In the Canary Islands electrical system, it uses diesel oil as the main fuel.

3 / Emergency groups that are installed temporarily in certain areas to cover a generation deficit.

4 / Includes biogas and biomass.

5 / Positive value: energy input in the system; negative value: system energy output.

Here we can appreciate that the greatest source of energy is coal and after this the combined cycle, which is formed by an open cycle. In these cases, we can see that there are differences according to the territory.

In the Balearic Islands, coal predominates with 141 GWh followed by a combined cycle with 84 GWh in which diesel predominates (being an open cycle). In the case of the Canary Islands, fuel / gas predominates with 389 GWh and after this the combined cycle with 225 GWh. In addition, in Ceuta and Melilla, all energy sources are fuel / gas and diesel engines with 17 and 16 GWh respectively.

In conclusion, it is the non-renewable energy sources that predominate in these territories.

2.2. General definitions on energy and building issues (relationship between energy and the environment built with the use of statistical data and graphics How buildings use / consume energy in air conditioning, lighting, water consumption, etc.)

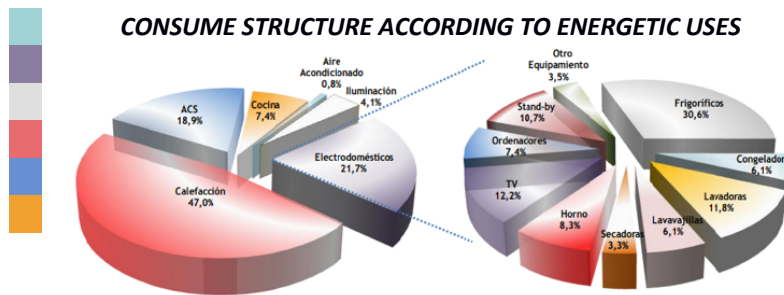
According to IDAE, energy consumption is 17%, referring to residential buildings, with 25% of energy demand.

"The average Spanish household consumes about 10,500 kWh per year, about 0.85 tep per year in line with the approaches previously made from IDAE / MITyC," says IDAE. Those who live in blocks of homes in the Mediterranean part spend less energy 0.53 tep per year while those living on the mainland spend more with 1.69 toe / year.

We must also see that the type of housing affects the amount of energy we consume seeing that: "single-family homes consume 2 times more than apartments"²

Now we are going to separate the climate of Spain into three types: the Mediterranean climate zone (south and east), the continental zone (center and northeast) and the Atlantic zone (northwest).

Air conditioning , 0,8%
Home appliances 21,7%
Illumination 4,1%
Heating 47,05%
ACS 18,9%
Kitchen 7,4%



Refrigerators
Freezers
Washing machines
Dishwashers
Dryer
Oven
TV
Computers
Stand-by
Other devices

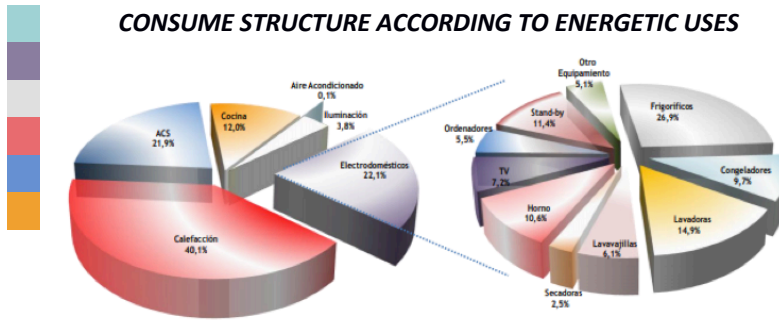
On average heating in Spain is the most used in homes. After this we find the domestic appliances and hot water. Within the appliances are the refrigerators, which with 30.6% are in greater percentage.

² See: Department of Planning and Studies. (July 16, 2011). Analysis of the energy consumption of the residential sector in Spain. 05/23/2019, IDAE Website: https://www.idae.es/uploads/documentos/documentos_Informe_SPAHOUSEC_ACC_f68291a3.pdf

Now, let's compare different types of climate found in Spain to see if the environment where a building is built influences when it comes to knowing how much energy has been spent.

● North Atlantic Zone

Air conditioning
Home appliances
Illumination
Heating
ACS
Kitchen

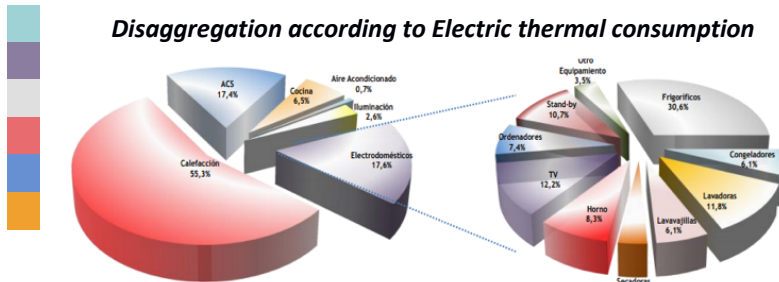


Refrigerators
Freezers
Washing machines
Dishwashers
Dryer
Oven
TV
Computers
Stand-by
Other devices

In this area, the average consumption corresponds to 10,331 kWh per year. We can highlight the similarity with the graph of the average in Spain. The differences are mainly found in heating and air conditioning since there is a "higher temperature smoothness" and the consumption of hot water and kitchen are higher percentages.

● Continental Zone

Air conditioning
Home appliances
Illumination
Heating
ACS
Kitchen

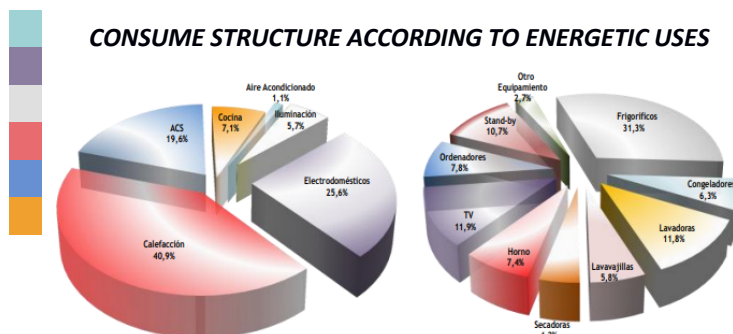


Refrigerators
Freezers
Washing machines
Dishwashers
Dryer
Oven
TV
Computers
Stand-by
Other devices

In this area, the average consumption corresponds to 13,141 kWh per year, being 27% above the average, previously spoken. Because of this we see how the heating has risen drastically reaching 55.3% and the amount of air conditioning has gently fallen with regard to the average.

● Mediterranean Zone

Air conditioning
Home appliances
Illumination
Heating
ACS
Kitchen



Refrigerators
Freezers
Washing machines
Dishwashers
Dryer
Oven
TV
Computers
Stand-by
Other devices

In this area, the average consumption is 8,959 kWh per year, which is 15% below the country average. As we can see, it agrees with the more relaxed climate in winter and having great temperatures in summer because the heating percentage is lower (41%) and the air conditioning much higher (1.1%),

Once we have seen each one individually, we can proceed to compare them among them.

Consumption according to Climate Zones

FINAL USAGE	CLIMATIC ZONE FINAL CONSUMPTION			TOTAL SPAIN
	NORTH ATLANTIC	CONTINENTAL	MEDITERRANEAN	
	TJ	TJ	TJ	
HEATING	30.233	145.374	112.967	288.574
HEALTH HOT WATER	16.535	45.662	54.045	116.243
KITCHEN	9.053	16.976	19.622	45.651
REFRIGERATION	68	1.951	3.130	5.148
ILLUMINATION	2.868	6.848	15.650	25.366
HOME APPLIANCES	16.648	46.299	70.523	133.470
Refrigerators	4.475	14.290	22.069	40.834
Freezers	1.622	2.003	4.459	8.083
Washing machines	2.487	4.997	8.328	15.812
Dishwashers	1.019	2.950	4.113	8.083
Dryers	418	1.058	2.993	4.469
Oven	1.759	4.056	5.207	11.022
TV	1.206	6.642	8.416	16.263
Computers	912	3.504	5.491	9.906
Stand-by	1.906	4.815	7.572	14.292
Other equipment	844	1.987	1.876	4.707
TOTAL CONSUMPTION	75.405	263.110	275.937	614.453



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We can see that in the Mediterranean area there is a lot of use of both heating and air conditioning due to the humidity of that area.

However, the one that consumes the least amount of energy in all the spoken areas is that of the Atlantic zone, while the one that consumes the most is the Mediterranean area. In this way we can see that climate affects energy consumption. In conclusion, the environment in which you build a building affects the amount of energy consumed.

But it is not only the climate that affects the consumption of energy, there are other factors such as:

- How buildings use / consume energy in air conditioning:

Air conditioning is the establishment of "conditions of temperature, humidity and air hygiene"³ appropriate to live in well-being in a building. This is divided into: Heating (emits heat) and Refrigeration (emits cold).

With the passage of time the way to build buildings has been changing, making the factors change when designing. The most current buildings have a large thermal load due to⁴:

- Outside temperature: The heat goes from the hottest environment to the coldest because they are not insulating.
- Solar Radiation: The use of glass allows the temperature to increase, which is favorable in cold environments and seasons.
- Ventilation: Allows to change the temperature of the construction.
- Occupation: The number of people in a construction increases the amount of temperature.
- Office: Household appliances and electrical or electronic devices also increase the temperature.
- Lighting: This factor also increases the thermal energy considerably.

However, although the buildings use air conditioning as a means of well-being within a

³ Constrictive Air conditioning. May 12, 2019, of Construmática Website:
<https://www.construmatica.com/construpedia/Climatizaci%C3%B3n>

⁴ Constrictive Air conditioning. May 12, 2019, of Construmática Website:
<https://www.construmatica.com/construpedia/Climatizaci%C3%B3n>



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building, it has a great disadvantage, its high energy consumption (66% of the energy consumption of these).

This large energy consumption considerably increases the economic outlay and seriously reduces energy efficiency affecting the environment.

This consumption would be reduced if the building were isolated and favors the absence of mold or humidity.

- How buildings use / consume energy in lighting

The lighting in a building can be caused by artificial light or natural light. Natural light is caused by solar radiation, which as we said before, by using a glass or a skylight reaches the building increasing its temperature. But this energy can be harnessed and used by photovoltaic panels, thus using solar energy to be converted into electrical, heat or light energy. In this way, energy consumption is lower and energy efficiency is much higher.

However, artificial light can come through renewable sources and non-renewable sources. If the source is renewable, its consumption is lower, with higher efficiency, consuming in Spain in March 2019 according to IDEA 1,247 GWh. In case the source is not renewable, as in the case of fossil fuels or nuclear energy, its consumption is much higher, so that energy efficiency will be much lower.

- How buildings use / consume energy in water consumption.

Water is one of the substances that has more uses and construction is not far behind, it includes tasks such as eliminating waste in toilets to be added to cement powder to be able to use it.

However, water and energy are linked since all energy sources need the help of water either for tasks such as making biofuels or for the movement of turbines. In addition, energy is necessary for water to be used or for human consumption. In fact, buildings consume 15% of the water in Spain.

The imminent concern about possible climate change requires increasing levels of efficiency in the use of water and energy resources. Global warming causes the amount of water to be reduced. In addition, taking into account that resources are decreasing, along with hydroelectric energy, and the increase of energy consumption



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in buildings for climate control that fosters climate change, we are thus in a cycle with which we must finish. And because of this, we have to adopt the "sustainable use of water".

So taking all this into account, water consumption leads to energy consumption. Being able to affirm then, that while the construction consumes more water it will be consuming more amount of energy, greater will be the energetic cost and, with this, greater economic expense.

2.3. Identification of problems (impacts caused by construction (climate change, destruction of natural resources, carbon emissions, greenhouse effect, etc.)

From the beginning we humans have modified our environment for our survival, initially, and later, to improve our quality of life.

Our desire to maintain a higher standard of living based on having the most possessions is not only affecting people all over the world, but it is also affecting our environment.

The natural environment, in the face of the growing presence of man and the need to build ever more major infrastructures, due to the number of inhabitants, are deleteriously altering the environment with roads or other works.

It is difficult to hide that, with the demographic growth rate that we observe today, although we are achieving improvements, we maintain a speed that could double the world's human population before reaching the middle of the century. Consequently, the use of natural resources and the environment will mean the reduction of these resources for the following generations.

"Phenomena such as climate change, the deterioration of the ozone layer, acid rain, deforestation or loss of biodiversity, seem to be caused by current industrial and economic activities"

But in addition to them, we have to take into account the construction sector since, although first hand we do not realize, it is a sector that can produce great problems to



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the environment either by the natural resources that they consume, the large amounts of energy They need to manufacture construction products such as cement and the installation of the work.

That place we call home, that environment in which we are most of our lives and live most of our memories are partly to blame for the pollution of the planet.

"Buildings consume between 20% and 50% of natural resources"⁵ But that percentage goes down or up depending on the environment where they are and, let's remember, they consume natural resources such as wood, water and even minerals or fossil fuels that we do not appreciate at first sight.

These have geological costs that are produced by the extraction of minerals in the mines or quarries or even the waste originated in the manufacture of the materials that are needed for the construction of buildings or in the installation in which we can find both "toxic emissions to the possible contamination of surface water by landfills and groundwater by leachate from landfills "⁶.

Similarly not only pollute during the construction process, after its construction also pollute due to the emissions produced or the impact on the territory at the same time that pollute indirectly by the consumption of energy and water they need to operate. The buildings will originate waste even at the end of its useful life.

This pollution caused by building can cause, along with other factors, serious problems:

- **Climate change**

Since the eighties of the twentieth century human aspects have greatly increased the risk of "climatic hazards". The increase in this risk is not so much in the danger but more in the exposure and vulnerability of atmospheric episodes due to a greater amount of "housing stock" in some parts of Spain.

The "real estate boom" that occurs every so often, especially in the Mediterranean coast, as traditionally holiday spots, is one of the main causes of this risk because many areas have been replaced by buildings eliminating many green areas. In addition, these

⁵ Alavedra, P., Dominguez, J., Gonzalo, E., & Serra, J. (1997). Sustainable construction: the state of the question. Construction Reports, 49 (451), 41-47.

⁶ Ecoindustria. (2018). What is sustainable construction? May 15, 2019, ecoindustria Website: <http://ecoindustria.net/2018/01/19/que-es-la-construccion-sostenible/>



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constructions are not always located in permitted places, either because they are built in areas exposed to possible flooding, maritime storm, etc.

An example of this would be the hotel "El Algarrobico" located in Almeria, in the Cabo de Gata Natural Park, where there are 20 sentences that prove that it is illegal but that it has not yet been demolished.

The building constitutes a great risk and can cause climate change (with the help of the industry) since it is partly to blame for global warming. The large number of buildings causes, not only the decrease of green land, but each construction needs natural resources and a large amount of energy coming mainly from fossil fuels or nuclear power plants whose waste is radioactive.

As stipulated in the Global Vision Area of World SB 2014 Barcelona referring to the construction sector: "this sector must reduce its greenhouse emissions by 23% until 2050 to avoid consequences on the population."

• **Destruction of natural resources**

The large number of buildings that are being built is causing the destruction of natural resources, not only because they need them to build them, but also because of the growing need for the land needed to build them.

The "A Toda Costa" study conducted by Greenpeace and the Observatory of Sustainability. This stipulates in a report that "80% of the natural resources that supply the coast is degraded by massive urbanization," says Greenpeace. In fact, only in the last three decades the surface area of the coastline that has been built has doubled, reaching from 240,000 to 530,000 hectares. With these figures we can affirm that in the figures we find a large gap between the urbanized part within the interior of Spain (2%) and the coast (13.1%).

Greenpeace believes that coastal ecosystems provide environmental goods that are necessary for "economic and social development, ranging from food security, tourism or R & D." While they help us with climate change, for example, they produce rain when there are droughts or they help soil erosion does not spread too much. In this report we also find that the areas with the greatest number of constructions meet with a percentage of 17.4% the Mediterranean (which we have named before) and the South Atlantic. Within these we see: Barcelona with almost 41%, Alicante with 28.5% and then Málaga with 26.2%.



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We found that 36.5% of the beach line in Spain is occupied by buildings, which is causing more than a third of the ecosystems in the area to disappear. Those areas that do not suffer these consequences are protected areas such as national or natural parks.

This massive construction in beach areas also affects salt extraction, precipitation and air quality.

But in order to prevent this problem from going further, Greenpeace suggests measures such as increasing the number of protected areas on the coast or creating buildings that clean wastewater.

• Carbon emissions

All directly or indirectly we release gases that are greenhouse gases, whether they are animals or buildings..., either as a result of activities or simply because of our mere existence.

Since the Climate Conference in Paris in 2015, many countries have pledged to fulfill the "first legally binding global climate agreement". The Agreement establishes a project to avoid climate change by restricting global warming. One of the most disturbing greenhouse gases is carbon dioxide, so measures must be taken to reduce their emissions.

Construction is one of the sectors that most concern for the large amount of consumption of raw materials that entail. The cement sector causes 5% of the amount of carbon dioxide that is emitted. In fact, concrete, with 1.6 trillion tons per year, is the most used material in construction. A ton of cement when manufactured causes the emission of one ton of carbon dioxide. To this must be added the carbon dioxide produced by the machines that are necessary when a building is being built and the amount of this for the transport of materials that is usually between 6% and 8% of the emissions produced during a construction.

"The commercial and residential construction sector represents 39% of the carbon dioxide (CO₂) emitted into the atmosphere while generating 30% of solid waste and



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20% of water pollution"⁷. Demonstrating that 50% of the carbon dioxide expelled has to do with the infrastructure construction sector during all its phases, both during construction and during its use and demolition. Because of this, it does not sound difficult to believe that this sector needs to reduce the amount of emissions of this gas. Finally, in relation to this reduction, it is necessary that we start using materials that do not need fossil fuels for their production or cause large carbon emissions.

• Greenhouse effect

The greenhouse effect is necessary for life. However, when it increases in levels as it currently is one of the most important problems due to the increase in temperature that is occurring in the atmosphere and the surface on which we live. The cause is mainly the result of human actions such as deforestation or sea pollution. "Greenhouse gas emissions from the construction sector have almost tripled since 1970 and the industry currently employs about a third of global energy consumption"⁸. This leads us to think that one third of the global carbon dioxide emissions that have to do with energy correspond to this sector.

It is thought that between now and 2050 buildings will increase the amount of energy they need by 50% and that construction will spend 12% of the world's water, which is increasing.

Throughout the world, each year construction uses 3,000 million tons of raw materials found in nature to create products and construction components.

Most of the elements that are discarded in the construction are not reused, so they must invest in the research and subsequent acquisition of technologies that recycle them.

2.4. The concept of constructions "Zero emissions" (energy efficiency).

The zero energy balance buildings or "Zero Energy Buildings" are those whose energy consumption is very limited" (Quintero Fernández, P. (2013).) Zero energy buildings: reality or fiction?: study of the state of the art of energetically self-sufficient buildings, regulations and example (Bachelor's thesis)), since they enjoy great energy efficiency

⁷ Admin (May 30, 2017). Construction and CO2 emissions into the atmosphere. May 12, 2019, from GROWING BUILDINGS Website: <https://growingbuildings.com/construccion-y-emisiones-co2-a-la-atmosfera/>

⁸ CTR Mediterranean. (May 17, 2017). Greenhouse gas emissions from the construction sector have almost tripled. May 15, 2019, from CTR Mediterráneo Website: <http://www.ctrmediterraneo.com/noticias/las-emisiones-de-gases-de-efecto-invernadero-del-sector-de-la-construccion-casi-se-han-tripled/>



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in their facilities and are supplied by renewable energies. These buildings generate the same amount of energy that they can consume, so "the balance of CO2 emissions is zero during operation".

- **Demand reduction / bioclimatic architecture**

With this type of construction, we need not only to reduce the energy demand of buildings, but also to make renewable energies effective.

The reduction of energy demand can be achieved by getting these buildings to acquire bioclimatic characteristics. For this we find bioclimatic architecture.

Since we have begun to realize the damage we are doing to our planet, alternatives arise to be able to "help" to try to "fix it". From this arises this type of architecture.

Natural resources provide sources of energy that can be very useful so we can say that the bioclimatic architecture is committed to taking into consideration the climatic conditions of its environment and take advantage of all natural resources such as the sun.

Now, to have a building with bioclimatic characteristics, you have to consider ⁹:

- Ventilation correct and insulation of the walls, achieving a great efficiency with respect to the temperature of the building)
- Integrate renewable, non-fossil energies that are harmful to the environment
- Orientation of the construction achieving greater efficiency in lighting
- Use of natural and local materials which will facilitate their transportation
- Try to recycle waste
- Fix us in the distribution of the holes in the house
- External elements can be very helpful
- The colour, using clearings to refresh the area and dark for heat
- If we have a garden, with deciduous trees, they shelter us in the summer from the heat and in the winter from the cold.

⁹ Sustainability for All. Bioclimatic Architecture: Houses that Save. May 15, 2019, Sustainability for All Website:
<https://www.sostenibilidad.com/construccion-y-urbanismo/arquitectura-bioclimatica-casas-que-ahorran/>



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• Consumption saving / energetic efficiency

With the constructions of "Zero Emissions" we also intend to save energy consumption and taking into account the inversely proportional relationship previously mentioned, we must achieve great energy efficiency.

Energy efficiency could be defined as "the efficient use of energy"¹⁰. We know that when an installation or any other is efficient when "consumes an amount less than the average energy to perform an activity"¹¹. It is sought to consume the precise, without abusing the amount of energy available thereby achieving a decrease of carbon dioxide expelled into the atmosphere.

In fact, it is intended that by 2020 you save 20% to increase energy efficiency considerably.

If we want to achieve that goal it is necessary to adopt a series of measures such as ¹²:

- Insulate floors and walls of buildings well to avoid losing power in the air conditioning
- Change the windows betting on a double window glass trying to get more natural lighting
- Replace old appliances with more efficient ones by checking before buying one by checking the labelling.
- Place water saving systems. We can find some types of faucets that save large amounts of water
- Hot Water and energy savings
- Revise your air conditioning systems ensuring that they do not have failures that could waste energy
- Your house with the right temperature avoiding energy losses due to poor air conditioning
- Small lighting changes. The orientation of the house is a fundamental feature in saving energy both light and air conditioning

¹⁰ Energy factor. (February 6,2017). What is energy efficiency?. May 15, 2019, from Power Factor Website::
<https://www.factorenergia.com/es/blog/eficiencia-energetica/que-es-la-eficiencia-energetica/>

¹¹ Energy factor. (February 6,2017). What is energy efficiency?. May 15, 2019, Factor Power Website:
<https://www.factorenergia.com/es/blog/eficiencia-energetica/que-es-la-eficiencia-energetica/>

¹² Geteco (April 18, 2018). How to make your house more energy efficient? May 13, 2019, of Geteco Website:
<https://www.geteco.es/como-hacer-eficiencia-energetica-vivienda.html>



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• Renewable energies / renewable production

For the operation of these buildings it is necessary to increase the capacity of renewable energy sources as much as possible so as not to need sources of energy that pollute mainly from fossil fuels, thus generating a totally renewable energy production. We call renewable energy sources those that are generated faster than they take to be consumed. These are the ones that have a lower environmental impact and are indigenous.

We can find several types of renewable energies¹³

➤ Solar Energy:

It is that coming from the Sun. With it you can acquire both heat and electricity. We can find three types:

- **Photovoltaic Solar Energy:** Solar energy is used to be transformed into electricity. This can be either stored or directly consumed. If necessary, it would be adapted to the electricity network.
- **Solar Thermal Energy:** With it we obtain, through solar energy, thermal energy for the air conditioning of buildings or other uses.
- **Thermoelectric solar energy:** It is produced in thermo solar power plants where "a fluid that generates water steam under pressure that produces electricity" is heated. This can be administered to the electrical network.

Both wind and solar energy if they cannot consume it immediately are passed to the electrical network (self-consumption)

➤ Wind energy.

In this case, it is the wind energy that is used through the wind turbines and mills turning into electrical energy. The wind turbine is the essential component for the operation of wind energy. We find mini-wind installations and wind power plants. The mini-wind power installations are not within the electrical network, so they use batteries to store the electricity. These have less power so it is usual to complement them with others such as solar energy.

¹³ Responsible consumption. Renewable energies: characteristics and types. May 11, 2019, of Responsible Consumption Website: <https://www.consumoresponde.es/art%C3%ADculos/energias-renovables-caracteristicas-y-tipos>



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➤ Biomass.

It consists in using organic matter that comes from activities related to agriculture, fishing or forestry becoming biofuels. And these can be converted into thermal, calorific, electrical or mechanical energy

➤ Biofuels.

They are renewable fuels that can be used as substitutes or additives of other fuels. We can find two types:

- **Biodiesel:** They are created by produced oils and fats of vegetable and animal origin that become fuel similar to diesel.
- **Bioethanol:** alcohol of vegetable origin that is produced through the fermentation of sugary substances.

➤ Geothermal energy.

It is a renewable energy in which the accumulation of terrestrial heat is harnessed and in this way, energy is produced.

➤ Hydroelectric or hydraulic energy.

In this case, the potential energy of the water is used, thus obtaining the electrical energy.

➤ The marine energies.

Through the force that we find in the sea like waves or marine currents, energy is obtained.

• **Environmental benefits / bioconstruction.**

Building buildings of "Zero emissions" we hope to improve the environment, try not to get worse than we currently are.

Taking into account that our ultimate goal is to obtain the least damage to the environment, it is normal to think that we are facing a bio construction event.



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"The bio construction is a building system with the least environmental impact, both in its construction and in its functioning as a home."

The ecological construction uses those materials that do not harm the environment and when it comes to managing energy.

In addition, they try to make the most of the area and make it adapt as well as possible to the environment. In fact, they have the most innovative forms of energy management to have the best possible performance.

Now, the advantages that we can find as a result of bio construction are:¹⁴

➤ Energetic saving

They have less air conditioning costs due to their high insulation saving a lot of energy. They are usually supported by renewable energies.

➤ Water saving

Appliances are used that reduce the expense of water or that use rainwater to water plants or shower.

➤ Economic saving

The aforementioned are to save not only energy but also money, saving at the time of facing the bills since renewable systems such as solar panels do not require a large amount of maintenance allowing more monetary aid.

➤ Recyclable material

It uses recyclable materials getting that nature is not exploited so much and giving a new life to these materials, at the same time that they do not originate so many residues.

➤ Healthier homes

The materials used when building zero-emission buildings are healthier with fewer allergens. They have lower amounts of dust or others that may cause problems for some people because they are allergic or have respiratory diseases.

¹⁴ In good hands. Bioconstruction May 16, 2019, of En Buenas Manos Website: <https://www.enbuenasmanos.com/ecologia-y-medio-ambiente/casa-ecologica/bioconstruccion/>

2.5. What benefits does Spain obtain with the construction of "Zero emissions" buildings? (Provide statistical data). Examples and photos of buildings.

First of all, we must remember that with these buildings we would be saving around 52% in energy compared to the consumption generated by buildings normally. In addition, the energy sources used are renewable and have great energy efficiency.

These benefits are not only obtained through active techniques, such as the use of renewable energy sources, but also through passive techniques such as building orientation.

In Spain, we do not find a large number of these buildings; either because of the initial investment or because of the lack of knowledge that may have been that it is an architectural technique, bioconstruction, fairly recent. Even so, we can find examples of these buildings:

The most important would be the Acciona Solar headquarters that we found in the City of Innovation near Pamplona, Navarra. This place is intended for renewable energy, so it is not surprising that a building that generates zero emissions is there.

This building arises as a result of wanting to avoid CO₂ emissions into the atmosphere by the construction sector because, as we said before, they produce a third of it. With this building we are avoiding "116 tons of CO₂ into the atmosphere"¹⁵.



¹⁵ ACCIONA. (November 18, 2010). Headquarters of ACCIONA SOLAR, the first "zero emission" building in Spain. May 16, 2019, by ACCIONA Website: http://www.pvdatabase.org/pdf/Acciona-Solar_Building_en.pdf

Another example that we could find of the "Zero emissions" building would be the headquarters of the German elevator and escalator hallmark, Orona Ideo, which is located near Gipuzkoa, Basque Country. This building was awarded for "the best building structure".



Once having demonstrated the presence of "Zero Emissions" buildings, we can ask ourselves what would be the benefits of Spain acquiring more buildings such as those presented till now.

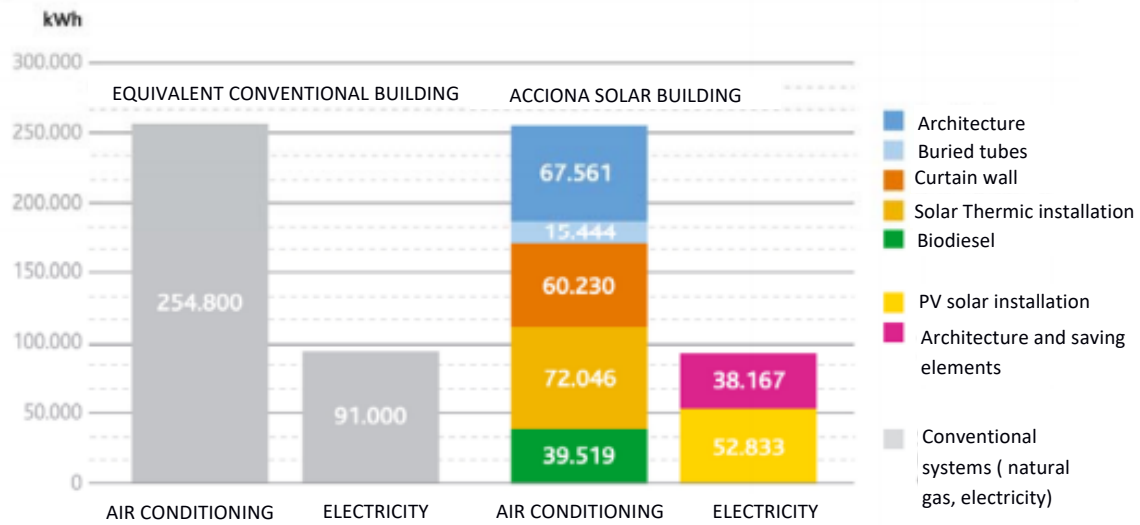
In the first place, it is true that each building according to the environment in which it is located may have higher or lower energy needs. However, comparing the need for a "conventional" building and a "Zero Emissions" building, using the Acciona Solar building as an example.

Every year the ACCIONA Solar building needs 345,800 kilowatt hours of energy for its operation, mostly for air conditioning that consists of 74%. Now, in case this building does not have zero emissions we could check that it would emit 116,343 kilograms of CO₂ per year.

However, this building currently saves 52% due to the systems it presents and the rest through renewable energies being not harmful to the environment.

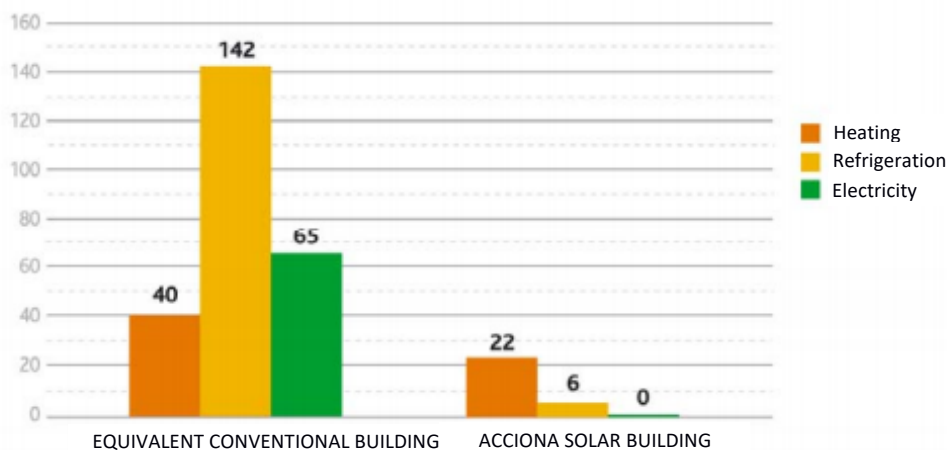
Through the following table we can see how it would be profitable for Spain to have buildings of this type because the savings and energy efficiency that they present have an impact on the amount of carbon dioxide expelled, which is important when complying with the Agreement of Paris of 2015 to avoid climate change.

Energy contribution for air conditioning and electricity consumption



Secondly, they can also favour Spain by not needing energy through an "external contribution", producing 89% of the energy, with biodiesel being the remaining percentage. Since, in this case, as in the previous one, we are not emitting greenhouse gases in order to comply with the agreement signed by the EU, which needs to reduce carbon dioxide emissions by 26% in Spain.

External energy inputs / m²

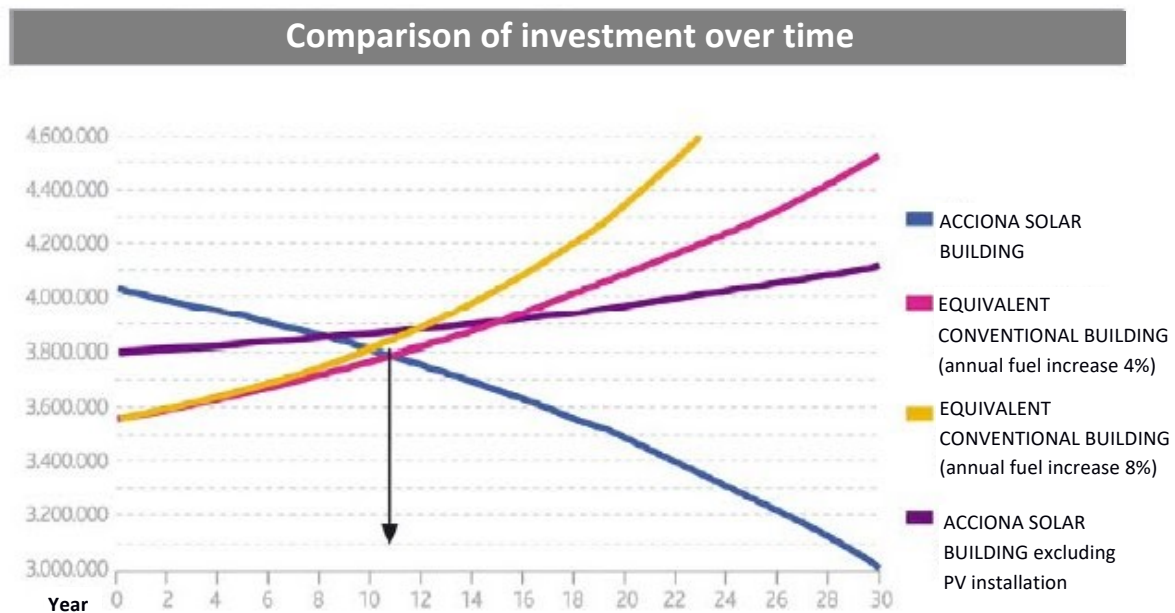


TOTAL kWh/ year per m2	247	28	Lower external contribution	89%
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Finally, although at first it can be a very high investment of money in 10 years, in case of having solar energy, and 16 years in the absence of this. This is so due to the saving that takes place in fuel by renewable energies.

In case of having solar energy, it can transmit energy to the electricity grid thus generating income.

So, finally, it would be beneficial for Spain because we would be reducing CO2 and, in addition, it would be economically profitable in a relatively short period of time.



3. National policy and strategy for energy efficiency in general

3.1. Primary energy sources and sustainable energy supply.

The primary energy sources are all those forms of energy that are found as they are in nature before being transformed. This energy is subsequently modified into a secondary energy source so that it can be used. Electricity is one of the main forms of energy consumption.

There can be distinguished two types of primary energies, renewable and non-renewable. We refer to non-renewable energies when they come from finite resources, that is, those that are exhausted due to their formation of thousands of years. They are mostly fossil fuels such as



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coal, oil and gas. The problem with the production of this type of energy is that it causes a series of greenhouse gas emissions that considerably increase climate change.

Renewable energies have their origin in resources that we can easily dispose of and are unlimited, such as wind, sun, biomass or water from rivers and seas. Another source of energy, also considered renewable, is waste, both agricultural and urban or from sewage treatment plants.

These primary energies once obtained are later transformed into a final energy, the clearest example is that of electricity, produced from oil, coal, natural gas, biomass, hydroelectric, wind, etc.

There are other uses that can be given to this type of energy as is the case of crude oil that can be refined in fuels such as gasoline, diesel, etc. These can be transformed into thermal energy, for example, diesel can be used for the operation of the heating system or to move transport vehicles.

In our country, renewable energies represent 13.9% of the energy used. The remaining percentage affects the use of fossil and nuclear fuels, 74% and 12.4 respectively. In 2016, renewable energies accounted for 39.7%, with wind power accounting for 19.2%, hydroelectricity for 14.1%, solar photovoltaic technology for 3%, solar thermoelectric technology for 2%, and biomass for 1.4%.

In order to satisfy our needs without compromising future resources and capacities, we must implement and replace fossil fuels with other, more sustainable energies.

Lighting, thermal comfort, cooking, communications and mobility are essential energy services for both social and economic goods. In these cases, the use of fossil fuels to meet these needs can lead to an increase in greenhouse gas emissions, becoming a danger to our health and the environment. However, the greatest risk is not ours but the countries and the underdeveloped populations of the most vulnerable areas, which are conditioned by extreme poverty and without the possibility of accessing an energy that is economically beyond their means.

In 2015, the United Nations adopted the Sustainable Development Goals (SDGs), among which is the 7th objective in favor of more sustainable energy, which proposes "guaranteeing access to affordable, reliable, sustainable and modern energy for everybody. "

In addition, SDG 7 also aims to increase the energy that comes from renewable sources and promote technologies with greater energy efficiency. Therefore, it encompasses objectives for all people to have access to energy, increase the demand for renewable energies, create an improvement in energy efficiency, create an international cooperation for the construction of infrastructure for sustainable energy and improvement technological

On several occasions these objectives are intertwined and consolidated among themselves. For example, in some renewable energy technologies, prices are lowered so that small consumers can afford access to energy services even to relatively small electricity consumers, since for example in photovoltaic solar energy the cost of investment or even The smaller solar



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panels are compensated without implying efficiency. The devices that allow to increase the energetic performance improve the value of the service. Therefore, the goals that SDG 7 intends to carry out can promote sustainable growth.

This new incorporation of SDG 7 takes place at a time when the world presents serious differences in the topic of energy development. Around 1.000m people in the world do not have the possibility of accessing electricity and approximately 85% of the world's energy comes from non-renewable sources. So, it is important the increase of the efficiency, affordability and reliability of these systems, in a quick and efficient way, to achieve SDG 7.

It should also be highlighted as a point in favor that in Spain the congress is developing sustainable energy supplies for buildings with energy sources that include electricity, heat and cold produced by biomass, solar energy, and geothermal heat, which is a big step in the objectives previously raised.

3.2. Legislation and regulations on energy performance of buildings

The Ministry of Development regulates and promotes building quality in order to solve the growing social demand in this area and the requirements of related national and European policies, contributing to the promotion of innovation.

The promotion of energy efficiency and sustainable development, the improvement of accessibility so that there is no discrimination against people with disabilities and enabling their mobility, and the impulse towards new innovations and new technologies are some basic criteria that guide these actions and define the main areas in which it is developed.

Law 38/1999 of November 5, Building Regulation (LOE) is a fundamental base because it sets the basic requirements of buildings. In addition, it is responsible for updating and completing the legal structure of the agents involved in the building process, setting the obligations it presents and establishing the responsibilities and guarantees that come with the protection of those of the people.

The regulatory framework that establishes the demands that buildings must meet in relation to the basic safety and habitability requirements established in the LOE are reflected in the Technical Building Code.

The buildings must satisfy basic quality requirements in terms of safety matters, ie structural safety, fire protection, safety of use, as well as ensuring accessibility and habitability, such as, for example, sanitation, protection against noise and energy saving.

The aim of the Technical Building Code is to provide solutions in order to improve the quality of the building, while at the same time seeking to improve consumer protection and promote sustainable development. Increasingly the CTE is applied to new buildings under construction and is intervening in the existing ones.

Regarding the regulatory framework of the building, it is essential to comply with other regulations of a basic nature, such as the Regulation of Thermal Installations of Buildings, the



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earthquake resistant construction standard, the EHE Concrete Instructions, RITE, other industrial safety regulations. etc., that coexist with the CTE and that are external references to it.

As established by the LOE, the CTE may be supplemented by the requirement of other regulations that are issued by the competent authorities (the regional and local regulations applicable in each circumstance).

The European Directives dedicated Energy Efficiency of Buildings are justified in the reduction of the bill of imports of gas and oil, and the reduction of carbon dioxide emissions.

The objective of Directive 2010/31 / EC of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings, which repeals Directive 2002/91 / EC, is to promote energy efficiency of integrated buildings of buildings or building units. This Directive requires the adoption, by the Member States, of a methodology for calculating the energy efficiency of buildings, at national or regional level, taking into account certain aspects, such as, for example, the installation of heating and hot water; air conditioning facilities, the thermal characteristics of the building

We must also take into account other elements such as solar lighting, energy production by cogeneration and cooling and heating systems both urban and collective.

In order to achieve optimum levels in terms of costs, Member States should be obliged to establish minimum requirements in terms of energy efficiency. The level of these is controlled every five years and comparisons can be made between new and existing buildings and between different types and categories of buildings.

The new buildings in the construction have to respect these requirements and, before construction begins, it should be studied if the installation of renewable energy supply systems, heat pumps, urban and collective heating and cooling systems and cogeneration systems are viable Existing buildings that are subject to major renovation should aim to improve their energy efficiency in such a way that they can satisfy the minimum requirements established, except for protected buildings officially, the buildings used as places of worship Those that are of new installation will have to replace or modernize the technical systems that present the building such as air conditioning, heating, ventilation installations, hot water, etc. Always following the established requirements in terms of environmental efficiency.

When the replacement or improvement of the elements of a building begins and has a transcendental influence on the energy efficiency of the building and its envelope, the Member States must take the necessary measures to ensure that minimum energy efficiency requirements are established in order to achieve unbeatable levels of cost effectiveness.

Each time a building is renovated, this directive introduces intelligent systems that allow the measurement of energy consumption. The Directive also requires the continuous inspection of heating installations. So that an inspection report will be written at the end of each inspection of the heating and air conditioning installations, where recommendations will be offered to improve the energy efficiency of the facility inspected in terms of cost effectiveness.



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One of the main objectives of this directive is to reduce energy consumption of these buildings to almost zero, that is, to create buildings with a very high level of energy efficiency, whose low energy costs are mostly covered by energy from sources renewable. As of December 31, 2020, all new buildings must have an almost zero energy consumption.

In the last year the Directive (EU) 2018/844 has been published, which modifies the Directives 2010/31 / EU. Its objective is to accelerate the renovation of existing buildings by introducing building control and automation systems, replacing physical inspections. Other objectives are to obtain the certificate of energy efficiency and facilities for the recharging of electrical buildings, in addition to the fight against energy poverty.

3.3. Regulatory frameworks: laws, regulations and performance standards in relation to energy performance.

During the last years up to now, energy efficiency has basically been related to the care of the environment and Corporate Social Responsibility, it has become part of the business strategy of many companies. have contributed to this the entry into force of regulations, both European and Spanish, relating to energy efficiency.

At an European level, Directive 2009/72 / EC of the European Parliament and of the Council of 13 July 2009 on common rules for the internal market in electricity and repealing Directive 2003/54 / EC and the Regulation (EC) No 714/2009 of the European Parliament of the Council of 13 July 2009 on the conditions of access to the network for cross-border trade in electricity and repealing Regulation (EC) No 1228 / 2003.

At a national level, since 1998, the Spanish electricity sector has undergone an important transformation along with the regulatory changes developed in our country after the approval of Directive 96/92 / CE, whose fundamental objective was to provide the first Steps for the creation of an internal electricity market in the European Union from the liberalization of electric power generation and commercialization activities.

By means of Law 54/1997, of November 27, of the Electricity Sector, the mentioned Directive was transposed to the Spanish legal system, modifying the regulatory framework in force up to that moment. The objective of this law is to establish the regulation of the electric sector, with the triple and traditional objective of guaranteeing the electrical supply, guarantee the quality of said supply and guarantee that it is carried out at the lowest possible cost, all this without forgetting the protection of the environment . The regulatory principles on which the reform introduced by the LSE is based are: the separation between regulated activities (transport and distribution) and those that can be developed under free competition (generation and commercialization), the progressive liberalization of contracting and choice of the supplier of the final consumers, freedom of access to the transport and distribution networks through the payment of tolls and the creation of the figures of the system operator in charge of technical management and the market operator in charge of the economic management of the system.

In 2003, with the approval of Directive 2003/54 / EC, the European institutions gave new impetus to the process of liberalization of the electricity sector. Law 17/2007, of July 4, transposed the mentioned Directive into Spanish legislation, although the truth is that a large



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part of these measures were already incorporated beforehand. The most relevant modification of Law 17/2007 refers to the elimination of integral rates and the introduction of the activity of Last Resource Supply.

The 2012 and 2013 were a few years with many regulatory changes in the electricity sector, while some measures aimed at reducing system costs, Law 15/2012 seeks, through fiscal measures, the activity of generating electricity, the collection of new revenues for the system. All these initiatives sought to solve the serious problem of the tariff deficit of the Spanish electricity system.

Royal Decree-Law 1/2012 abolishes the registration procedure in the pre-assignment register, and therefore the economic incentives for all the installations of the special regime that were not registered in said registry. In addition, it indefinitely suspends the registration procedures in the pre-assignment registry for remuneration provided for in Royal Decree-Law 6/2009 and in Royal Decree 1578/2008, for photovoltaic solar energy installations, and leaves the celebration without effect. of pre-assignment of retribution calls for the years 2012 and successive.

Royal Decree-law 13/2012 of March 2012 is also a relevant normative package, which affects all the activities of the energy chain: generation, transport, distribution, commercialization and consumption, as well as modifying some responsibilities and related aspects with the operation or remuneration of organisms or agents such as the National Commission of Markets and Competition (CNMC), the Institute for Diversification and Saving of Energy (IDAE) or the Operator of the Electric System. It imposes new measures with the objective of reducing system costs and reducing the rate deficit after 2013.

In December 2012, Law 15/2012 on fiscal measures for energy sustainability was approved. This Law stands out for the creation of three new taxes: the tax on the value of the production of electric power (7%), the tax on the production of spent nuclear fuel and radioactive waste resulting from the generation of nuclear power and the tax on the storage of spent nuclear fuel and radioactive waste in centralized facilities. Additionally, it creates a royalty for the use of inland waters for the production of electric power, recently increased to 25.5% in Royal Decree-law 10/2017; the tax rates established for natural gas and coal are modified, and the exemptions foreseen for energy products used in the production of electricity and in the cogeneration of electricity and useful heat are also eliminated. In addition, this Law establishes that the General State Budgets (PGE) of each year will allocate an amount equivalent to the estimate of the annual collection of this law to finance the costs of the Electric System, as well as the estimated revenues from the auction of rights of CO2 emissions (with a maximum of € 500 million).

2013 also began with new urgent measures approved by the government in Royal Decree-Law 2/2013 on urgent measures in the Electricity System and in the financial sector, where new adjustments are established in costs of the electricity sector.

For those facilities that, at the date of entry into force of RD-I 9/2013, were entitled to a primary economic regime, the reasonable profitability will be converted, before taxes, to the average yield in the secondary market of the State's Obligations. 10 years increased with a differential of 300 basis points. We proceed to the elimination of the complement for efficiency for the facilities that were receiving it and the reactive energy bonification.



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At the end of 2013, the new Electricity Sector Law was published, Law 24/2013 as a consequence of all the changes that have occurred in the sector since 1997, the impossibility of guaranteeing the financial balance of the electricity system and the recent regulatory dispersion. Law 24/2013 establishes the regulation of the electricity sector in order to guarantee the supply of electric power and to adapt it to the needs in terms of safety, quality, efficiency, objectivity, transparency and at minimum cost for consumers.

The Law 22/2013 of General State Budgets for 2014 includes the following items to finance the costs of the electricity system: 903 million euros to meet the extra cost of generation from the extra-peninsular system, 2,907 million euros from the collection of the taxes of the Law 15/2012 of fiscal measures for the energetic sustainability and 343,8 million by the estimated income by the auction of the rights of emission of gases of greenhouse effect.

In June 2014, Royal Decree 413/2014 was published, which establishes the methodology of the specific remuneration regime, which will be applicable to production facilities based on renewable energy sources, high efficiency cogeneration and waste to which they are subject. Subsequently, Order IET / 1045/2014 was published, approving the retributive parameters of standard installations applicable to certain installations for the production of electricity from renewable energy sources, cogeneration and waste.

In October 2015, Royal Decree 900/2015 was published, regulating the technical and economic conditions for the supply of electricity with self-consumption and production with self-consumption. With this Royal Decree, the Administrative Record of Self-consumption is created, in which all the facilities must be inscribed, except isolated ones, which remain out of the competence of this Royal Decree and two types of consumers are established.

In 2016, Royal Decree 56/2017, of February 12, was approved, transposing Directive 2012/27 / EU of the European Parliament and of the Council, of October 25, 2012, relating to energy efficiency, in Regarding energy audits. The main objective to be achieved with this Royal Decree is to promote and promote a set of actions to be carried out within the energy consumption processes that can contribute to saving and efficiency of the primary energy consumed.

In October 2015, Royal Decree 947/2017 was approved, establishing a call for the award of the remuneration system to new installations for the production of electricity from biomass in the peninsular electricity system and for wind power installations with a maximum capacity of 700 MW, of which 200 MW were for biomass installations and 500 MW for wind technology. Later, in March 2017, the call for the holding of the second renewable energy auction convened under Royal Decree-Law 359/2017 for the allocation of 3,000 MW of installed power was passed. Subsequently, in April, the order ETU / 315/2017, of April 6, was passed, which regulates the procedure for assigning the specific remuneration regime in the call for new installations for the production of electrical energy from renewable energy sources. . The result of the second auction held on May 17, 2017 resulted in the award of 3,000 MW of renewable facilities, the maximum expected and without any cost to the consumer as the bidders offered the maximum possible discount. Of these 3,000 MW, 2,979 MW were awarded to wind farms, leaving only 1 MW for photovoltaic and 20 MW for the rest of the technologies, mainly biomass.



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Lastly, in June 2017, Royal Decree 650/2017 was approved, establishing an initial quota of 3,000 MW of installed power, of new installations for the production of electricity from renewable energy sources, which was later expanded to 5,000MW. The auction concluded with 3,909 MW granted to the photovoltaic and 1,128 for the wind, closing the day with a total of 5,037 MW of renewable energy.

Finally, on October 6, 2017, the Government approved Royal Decree 897/2017, which regulates the figure of the vulnerable consumer and other measures to protect the domestic consumer. Two types of consumers are distinguished: vulnerable consumer, to whom a discount of 25% is applied on the PVPC of 25%, and the severe vulnerable consumer, to whom 40 a discount of 40% on the PVPC is made, introducing the income criterion for the first time to access the social bonus.

3.4. Initiatives of non-governmental organizations; for example, Acciona, Energy. (and more)

Businesses, regional and local authorities, NGOs and civil groups also play an important role and are taking a series of actions, independently of government authorities, to reduce greenhouse gas emissions. The reasons why companies perform independent actions include the desire to influence or prevent the actions of governments, create financial values and to differentiate a company and its products. The actions of local, regional and state governments include renewable energy standards, energy efficiency programs, emission registries and sectoral mechanisms of maximum limits and emissions trading. These actions are carried out to influence national policies, solve the problems of the parties, create incentives for new industries or create joint benefits. NGOs promote programs to reduce emissions through public promotion, litigation and dialogues with the parties. Many of the above actions can reduce gas emissions, stimulate innovation policies, encourage the application of new technologies and stimulate experimentation with new institutions, but on their own it has a limited impact. Even so, they are a great help for the environmental movement.

Faced with the Energy Saving Plan, published by the Ministry of Industry, social organizations are convinced that Spain has a greater potential for efficiency, especially in a period of economic crisis like the current one. The Plan, to which the NGOs have already presented their allegations, is part of the European directive that obliges the Member States to elaborate a strategy of measures that contribute to achieving the European goals of saving 9% in 2016 and 20% in 2020. For NGOs, the new Plan must contemplate a change in the culture of production and energy consumption, incorporating parameters of saving and containment, and encouraging greater development of energy efficiency, with the horizon in 2050, which serve to simultaneously increase the environmental, economic and social benefit of the country.

Among their requests, the organizations highlight the need for a binding and absolute objective of at least 20% reduction in energy consumption by 2020, referring to a base year (example 2005) that entails the establishment of the legislative bases, economic and social needs. In the drafting of the current document, NGOs highlight the absence of structural measures to achieve effective energy savings. The proposals in the opinion of the signatories are clearly insufficient, since they are part of a general scope of increased energy consumption.



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On the other hand, according to the NGOs, there are no regulatory measures to avoid wasting energy. A concrete example is the service sector (hotels, shopping centers, leisure centers ...), where the dominant trend is the increasingly widespread installation of heated terraces or open-door shops, with the associated waste of heating in winter and cooling in summer. In addition, the absence of obligation of energy audits in the industrial sector means the loss of an important opportunity to save in a sector that shows the second highest demand in terms of final energy with a distribution of 30.2% of the total consumption of Spain.

These organizations advocate the establishment of ambitious fiscal measures aimed at making visible the economic advantages of any measure of efficiency and energy saving. For example, the reform of the road tax based on CO2 emissions. Also, the reform of Value Added Tax for aviation, as well as favoring sustainable production, taxing the most polluting.

The NGOs request that a National Energy Efficiency Fund be established within the National Energy Efficiency Plan, as a key aspect of a "one-stop shop" structure, incorporating funds from different sources (for example, the penalization of energy sector companies that do not meet the objectives of the mandatory action plans), that guarantees maximum private investment, that groups projects to make them more attractive to investors and that promotes awareness, information and technical assistance to suppliers and potential customers. Thanks to the European Alliance for Energy Saving, DEXMA, and other European energy efficiency companies, a petition letter has been created for the European Union that will be launched later this week.

The purpose of this communication is to explain to Donald Tusk, President of the European Council, and Minister of Infrastructure and the Environment in the Netherlands, the importance of continuous efforts to achieve the objectives and plans agreed at COP21.

It is especially important to understand that, according to Eurostat, fossil fuels still account for 72% of the European Union's energy mix , although there have been major efforts by some leading EU countries to promote renewable energy.

The national production of fossil fuels, importing more quantities from abroad. These numbers do not do anything good to energy dependence.

The European Alliance for Energy Saving proposes to reduce the importance of energy, at the same time it increases the commitment to renewable energies and, of course, to establish more programs in favor of energy efficiency.

The sum of energy efficiency, renewable energies, together with a lower dependence on foreign energy results in a better future and a potential achievement of the proposed framework for 2030.



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4. Knowledge and awareness in the country.

4.1. Study plan on energy and energy efficiency in efficient buildings

The ultimate goal of energy efficiency in buildings is, as has been said, to reduce the consumption of primary energy, and the CO₂ emissions into the atmosphere due to the constructive activity and, above all, to the use and exploitation of buildings. To achieve this goal of reducing energy consumption, it is necessary to understand a concept in which the building exceeds its role as energy consumer to become an urban energy infrastructure, capable of generating, receiving, storing and distributing thermal and electrical energy in a smart, reducing the energy and environmental impact caused by the fact of building. And this without renouncing aesthetics, transparency, lightness, or other technical, spatial and formal constraints characteristic of architecture.

Indeed, today the achievement of an adequate level of comfort in buildings is usually relied on, conventional air conditioning systems and hardly any importance is given to the influence of the architectural form. The energetic efficiency in the edification demands to alter the order of these strategies and to propose an inverse scheme, where the greater part of the comfort is obtained thanks to the form, the proportion and the materials and the direction chosen. To a lesser extent, to passive systems, which take advantage of the climatic conditions of the environment, and, finally, to active systems of high efficiency fed with renewable energies. Based on these principles, the methodology that must carry a design that wants to be energy efficient should follow the following ecological:

- A comprehensive climate study, with analysis of all the hygrothermal variables temperature, humidity, solar radiation, speed and direction of prevailing winds, which affect the project, so that from the first moment data is available on which can be, priori, the variables that will have to be protected, and those that have a potential for energy use.

- From the joint analysis of these data and the rest of constraints, the first idea of how to adapt the program, form and place should arise. From this first phase will come ideas that thanks to the understanding of the climate and simply with a sensitive response to it, will lead to projects of low energy demand.

- From this point on, demand reduction strategies are achieved with passive measures, specific bioclimatic solutions that must be incorporated naturally into the design of the building.

- The next step must be to seek maximum efficiency through active ventilation measures and in air conditioning systems. In this way we guarantee the minimization of energy consumption.

- Finally, after having designed a volume with very little energy demand for its operation and having foreseen the most efficient active systems for each situation, the local sources or resources and the demands to capture the maximum of the necessary energy from renewable sources minimizing fossil energies with criteria of maximum efficiency.

The energy demand is supplied by a system by a system that has a determined performance and, therefore, the energy that is supplied to the system does not have to coincide with the



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energy consumed. Unless exceptions, more energy is consumed than strictly required by the system to supply the demand.

The ultimate goal of energy efficiency is to reduce energy consumption in buildings, then we can reduce demand, increase system performance and act simultaneously on demand and systems.

Therefore, it is much more efficient to decrease the demand of the building than to increase the performance of the equipment (the optimization would be achieved by performing both actions simultaneously).

In buildings the demand for energy varies considerably depending on its function, so a commercial building presents a very different demand, both in quality with the temporary distribution, to that of a house. It also varies depending on several factors such as location, key in the behavior of a building, since it determines the climatic characteristics that influence it, affecting the demands of heating, cooling or lighting. The final use of a building conditions logically its energy demand. An office building will have very different needs in quality and quantity of energy than a house, a hotel or a hospital. Demand will also vary in a different way throughout the day. The design of the building also has a great impact on its energy demand. It is crucial to look for solutions that guarantee minimum energy demands covered by artificial air conditioning and that take maximum advantage of natural lighting and solar radiation. The shape of the building influences the contact surface between the building and the exterior, its resistance to the wind and its orientation so that it receives the greatest amount of natural light during the day. It is evident that the quality of the construction (thermal insulation, air tightness ...), will determine the transfer of energy between the building and the environment, and therefore, its energy demand. It is also important the habits that have different users because it leads to large differences in energy consumption.

All these factors will cause variations in the energy demand of the building, both in the amount of energy and in the time distribution throughout the day.

When the objective is to reduce the demand for heating in buildings, strategies are carried out that consist of capturing as much solar energy as possible, and in this way store and distribute it throughout the building, so that, finally, they can be stored during the hours in those that there is no sun. The action that produces the greatest results when it comes to reducing energy demand is to make the most of the daylight hours. The architect must build buildings that allow sunlight to enter inside, and also the thermal envelope must guarantee, through the isolation of facades, adequate glass and quality in carpentry, that the energy losses are as small as possible.

Thermal insulation, materials that have high resistance to the passage of heat, is decisive to obtain energy-efficient buildings. If we had some levels of insulation greater than the current regulations, we could save a lot of energy in buildings, especially in those with high heating demand. It is also interesting to use low-emission or Low-E glass, being a glass used to reduce heat losses outside.



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Another measure that can have a great impact on the energy saving of both cold and warm climates is the installation of a heat recovery system, which will allow the renewal of indoor air and recovering the energy used to air-condition this air.

In climates such as the one we are in Spain; thermal energies are usually demanded for both heating and cooling. In winter, the strategy used was to capture the maximum amount of solar energy, store it and conserve it. However, in summer, the strategy is to avoid the overheating of the building by producing less solar radiation on the glass of the facade, ventilating and cooling the building when outdoor temperatures decrease.

The solar protections of the glazed recess are undoubtedly one of the most efficient and cost-effective measures to reduce the energy demand in terms of cooling. The architects must design a solar protection that reduces the incident radiation in summer, but that allows the capture of the energy in winter. For this there are two types of protections, fixed or mobile. In orientation, horizontal fixed elements integrated into the design are effective. However, this type of protection is not effective in the east and west orientation, due to the solar height in these orientations. In this type mobile or fixed vertical slats should be used.

One of the strategies that can be interesting when reducing cooling loads is the use of ventilation in buildings. The air intake in the interior that is lower than the comfort allows the dissipation of heat in the thermal mass. This favors the building to be thermally discharged and increasing evapotranspiration.

Last but not least, a good optimization in the use of natural light (as we have said several times) entails a very important energy saving. The Technical Building Code requires us to take advantage of natural light, through the use and installation of control and regulation systems, in areas where the contribution of sunlight allows it ... so now it is not a choice designer but a normative obligation.

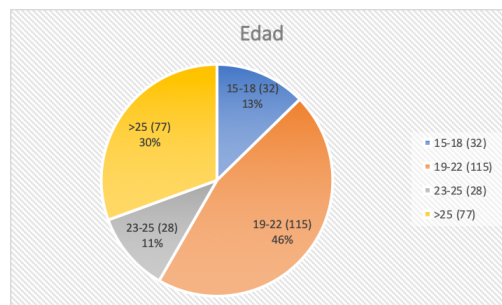
4.2. Survey Results Showing the Awareness Level of Young People

AELV with collaboration of Pablo Olavide University in Seville has collected 252 surveys, students of the Environmental Sciences class has been responsible for 10 surveys

SOCIO-DEMOGRAPHIC PROPERTIES

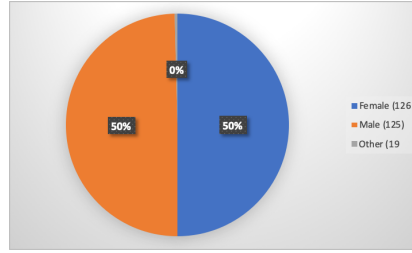
Age

- 15-18
- 18-22
- 22-25
- upper 25

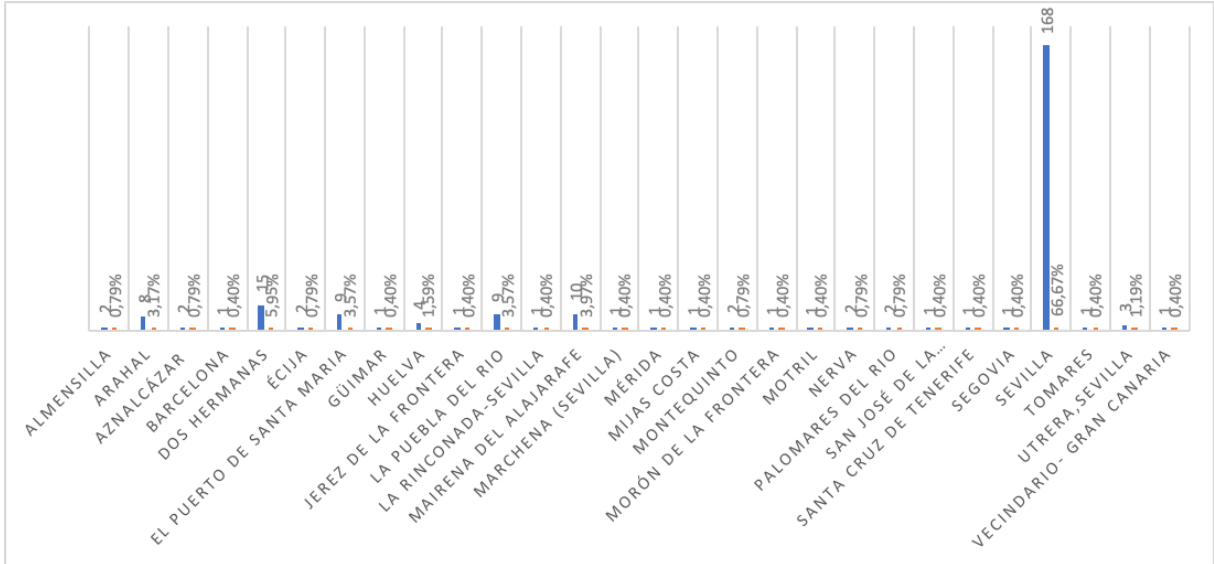


Gender

- Female
- Male
- Other

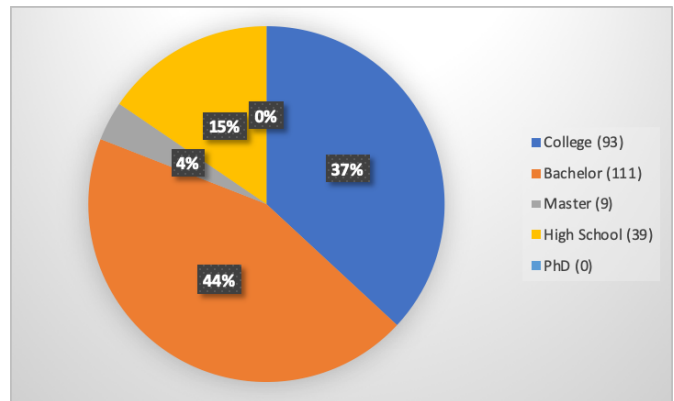


City you live in



Education level

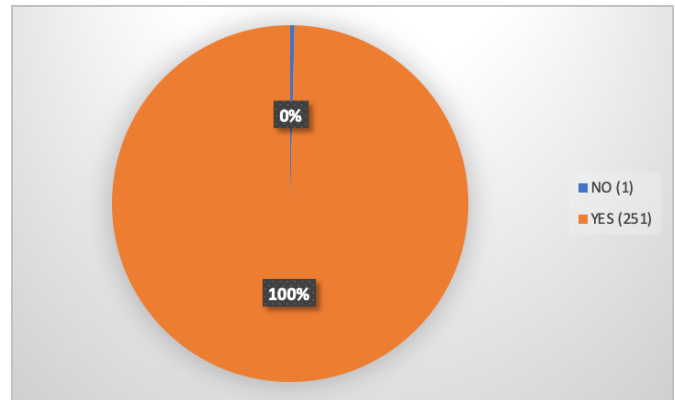
- College
- Bachelor
- Master
- High School
- PhD



CLIMATE CHANGE

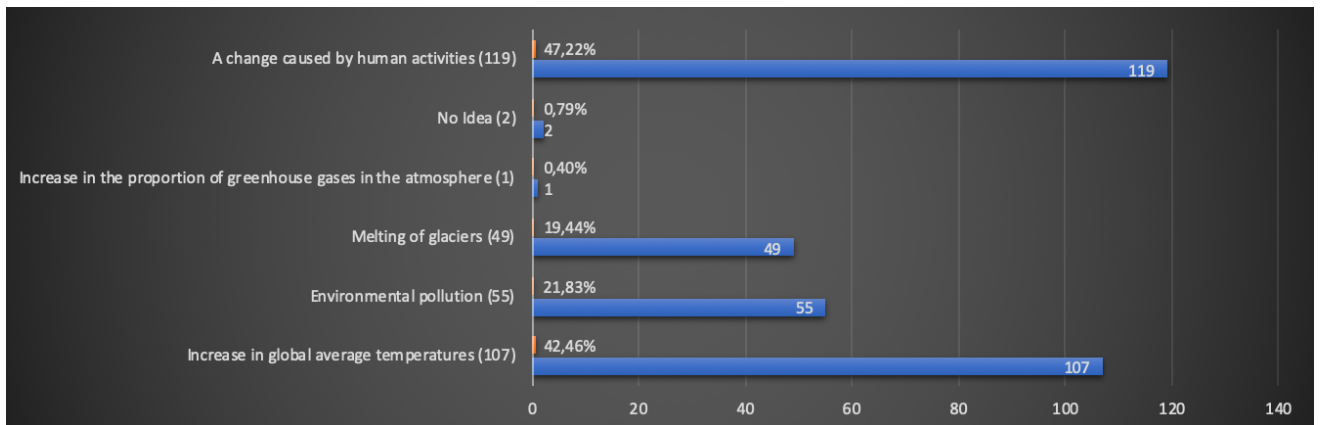
Have you ever heard about climate change?

- Yes
- No



What is "climate change" is?

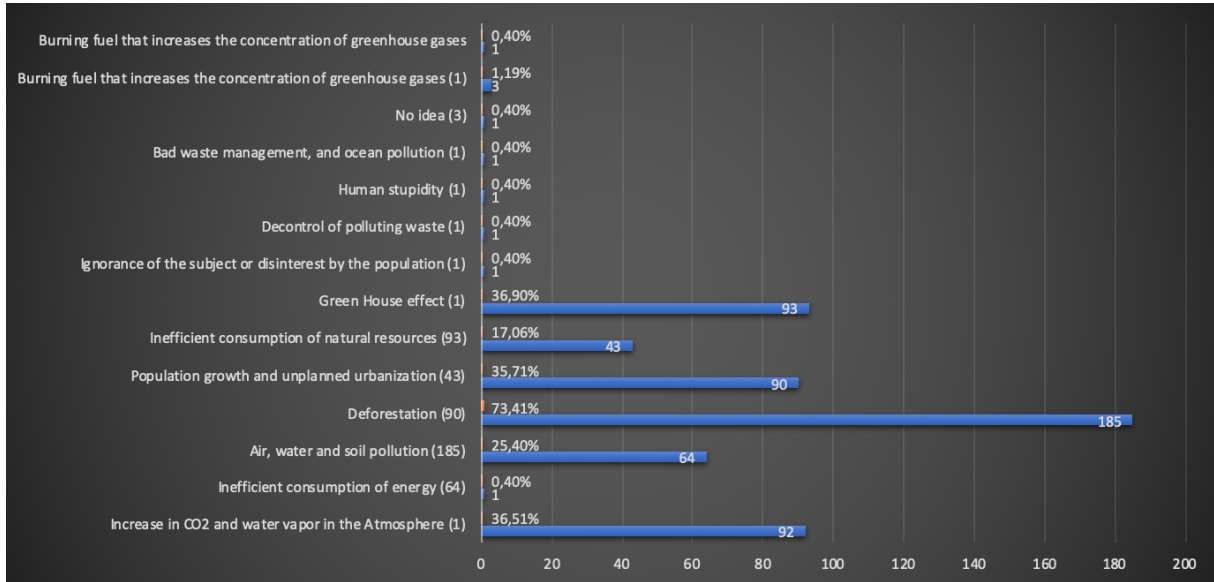
- a change caused by human activities.
- increase in the proportion of greenhouse gases in the atmosphere
- increase in global average temperatures
- melting of glaciers
- environmental pollution
- I have no idea



What are the main reasons of climate change?

- Inefficient consumption of energy
- air, water and soil pollution
- Inefficient consumption of natural resources
- Deforestation
- Population growth and unplanned urbanization

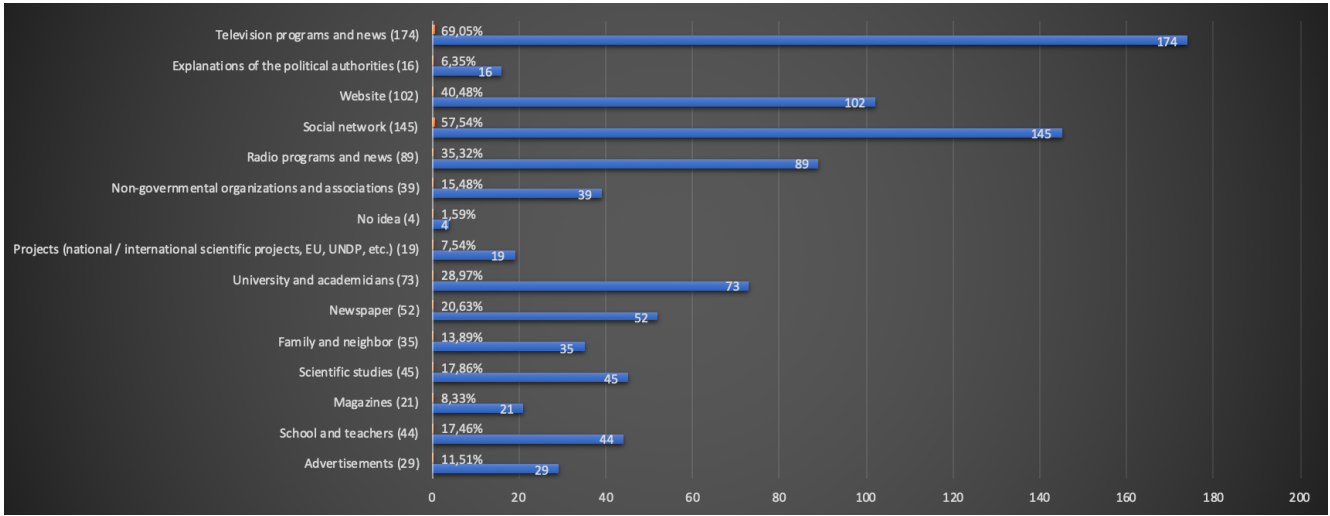
- o Industrial activities / wastes
- o Other
- o I have no idea



From where do you get information on climate change, environment and energy?

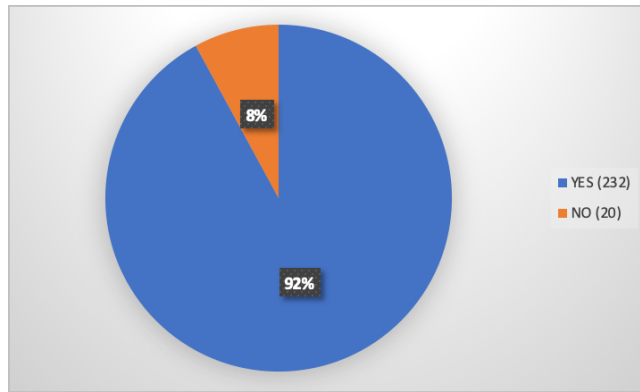
- o Television programs and news
- o Radio programs and news
- o Social media
- o Family, neighbor
- o Universities and academicians
- o Newspapers
- o Websites
- o School and teachers
- o Advertisements
- o Explanations by political authorities
- o Non-governmental organizations and associations
- o journals
- o scientific studies

- Projects (National/international scientific projects, EU, UNDP etc.)
- I have no idea



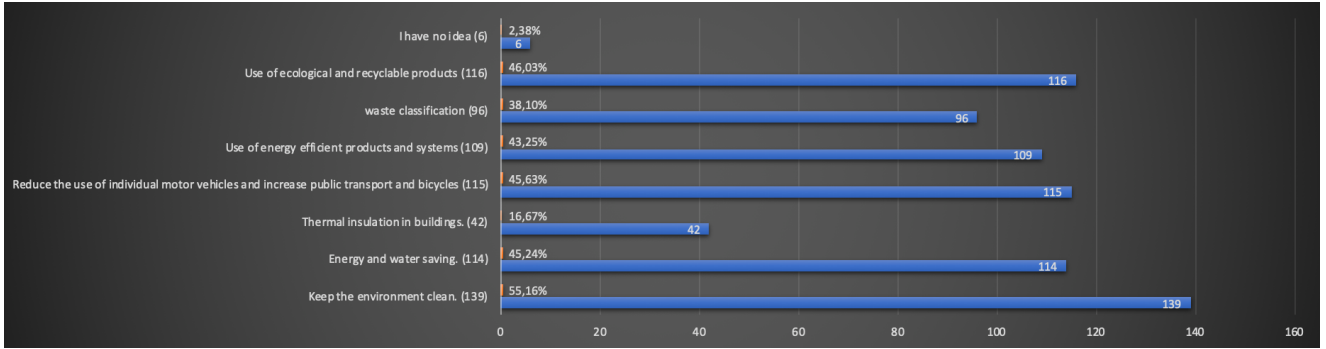
Do you think that climate change and environmental problems affect your quality of life?

- Yes
- No



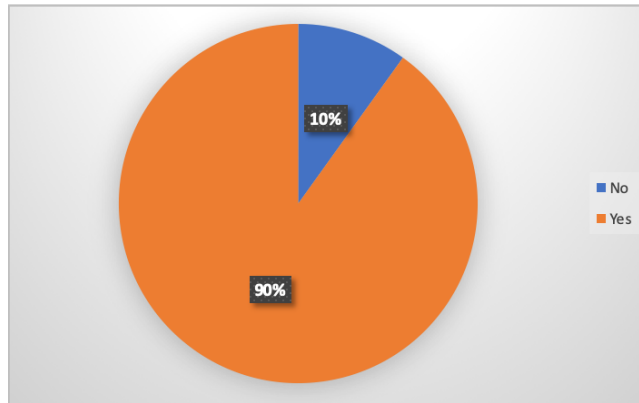
What should be the individual struggle for reducing climate change and environmental problems?

- Saving energy and water
- Keeping the environment clean
- Waste sorting
- Thermal insulation in buildings
- Using energy efficient products and systems
- Using environmentally friendly and recyclable products
- Reducing the use of individual motor vehicles and increasing public transport and bicycle usage
- I have no idea



Would you like to learn more about climate change?

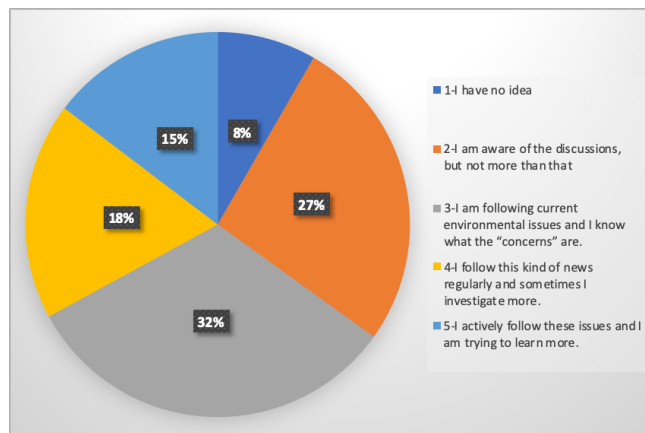
- Yes
- No



ATTITUDES AND BEHAVIORS WITHIN THE CONTEXT OF ENERGY USE

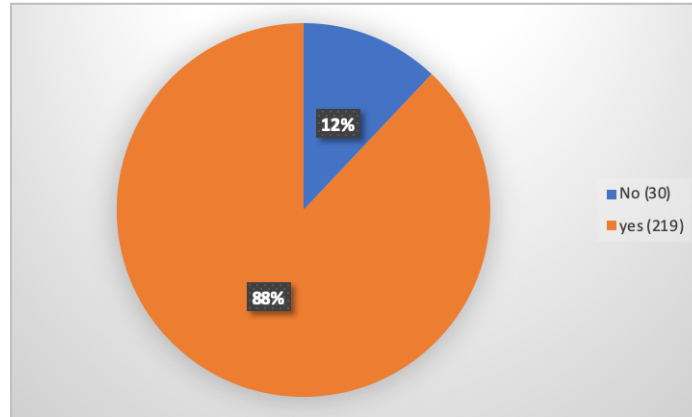
How much are you aware of the environmental impact of energy use?

- 5-I actively follow these issues and I am trying to learn more.
- 4-I follow this kind of news regularly and sometimes I investigate more.
- 3-I am following current environmental issues and I know what the “concerns” are.
- 2-I am aware of the discussions, but not more than that
- 1-I have no idea



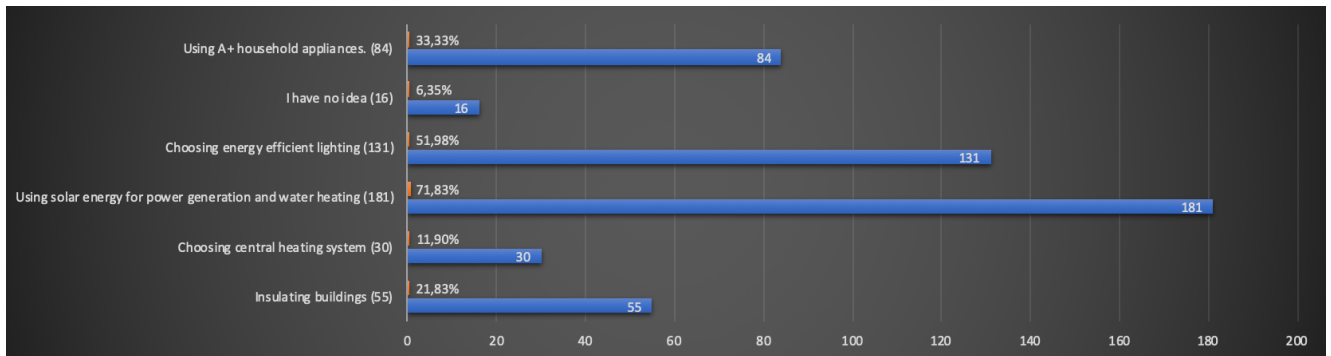
Do you have an attempt to reduce energy use at home?

- Yes
- No



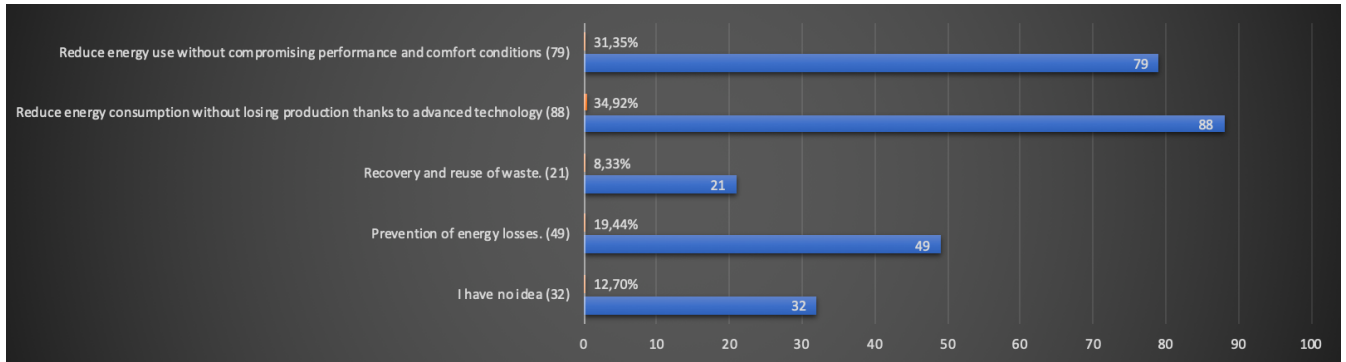
Do you think what kind of precaution can be taken to reduce energy use at home?

- Using A+ household appliances
- Choosing energy efficient lighting
- Insulating the buildings
- Preferring central heating system
- Using solar energy for power generation and water heating
- I have no idea



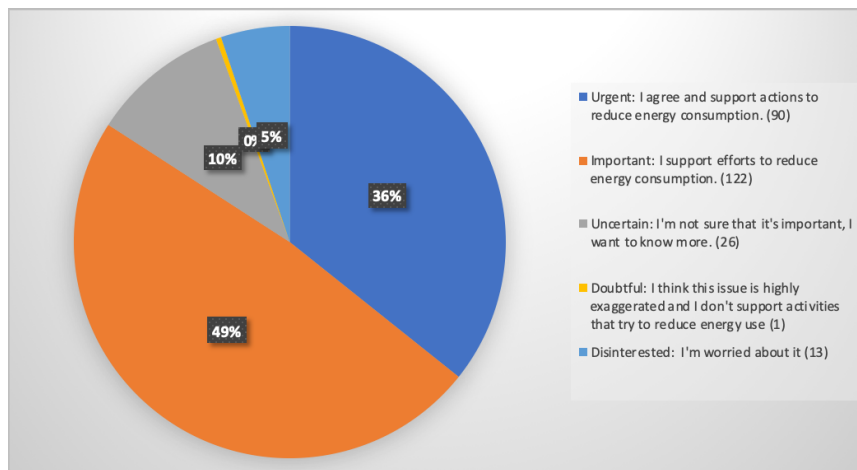
What is energy efficiency?

- Prevention of energy losses
- Recovery and reuse of wastes
- Reducing energy use without compromising on performance and comfort conditions
- Reducing energy consumption without dropping production thanks to advanced technology
- I have no idea



What are you doing in terms of energy related to environmental problems?

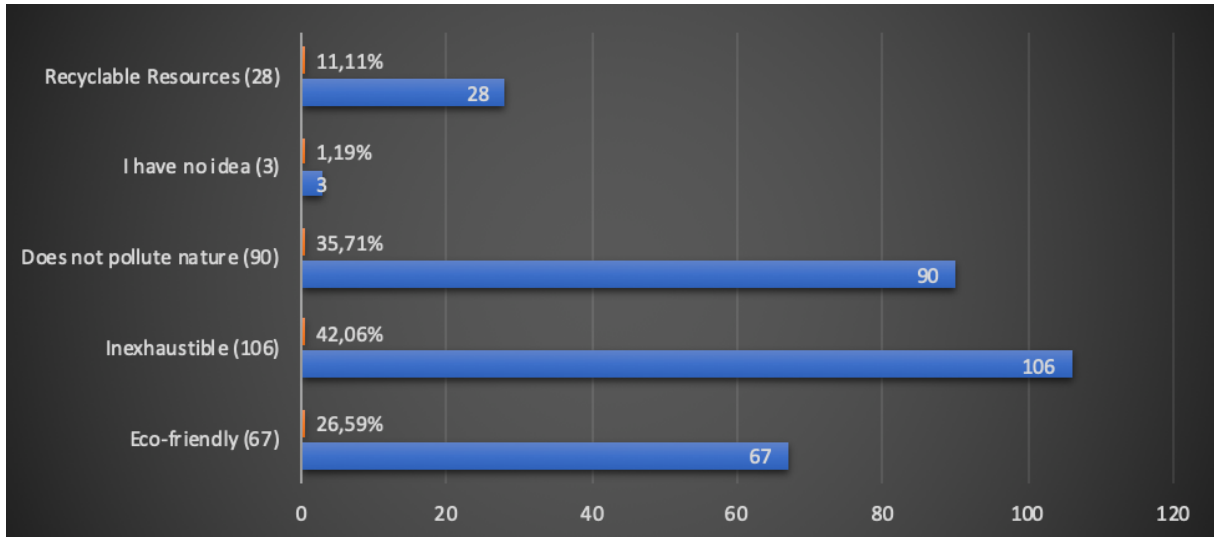
- o Urgent: I agree and support actions to reduce energy consumption.
- o Important: I support efforts to reduce energy consumption.
- o Uncertain: I'm not sure that it's important, I want to know more.
- o Doubtful: I think this issue is highly exaggerated and I don't support activities that try to reduce energy use.
- o Disinterested: I'm worried about it



RENEWABLE ENERGY AND RENEWABLE ENERGY SOURCES

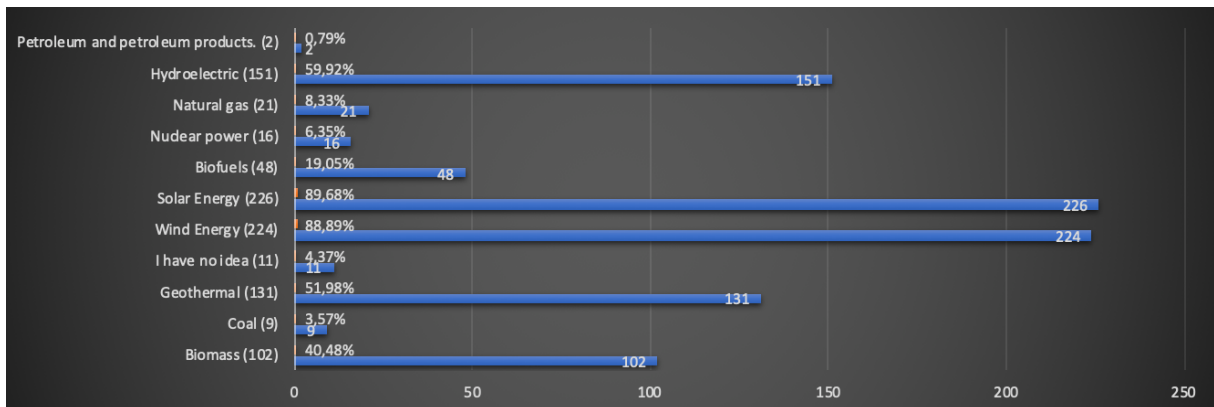
What do you understand from renewable energy?

- o Recyclable resources
- o Does not pollute nature
- o Inexhaustible
- o Eco-friendly
- o I have no idea



Which of the followings are renewable energy sources?

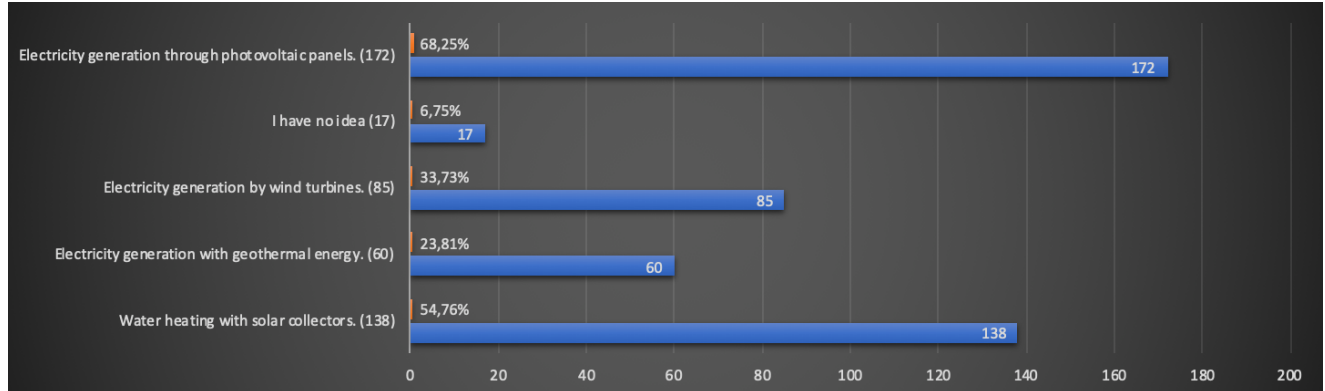
- Wind power
- Solar energy
- Coal
- Geothermal
- Hydroelectric
- Biomass
- Natural gas
- Biofuels
- Nuclear energy
- Petroleum and petroleum derivatives
- I have no idea



How renewable energy sources can be used in buildings?

- Generation of electricity by photovoltaic panels
- Heating water with solar collectors

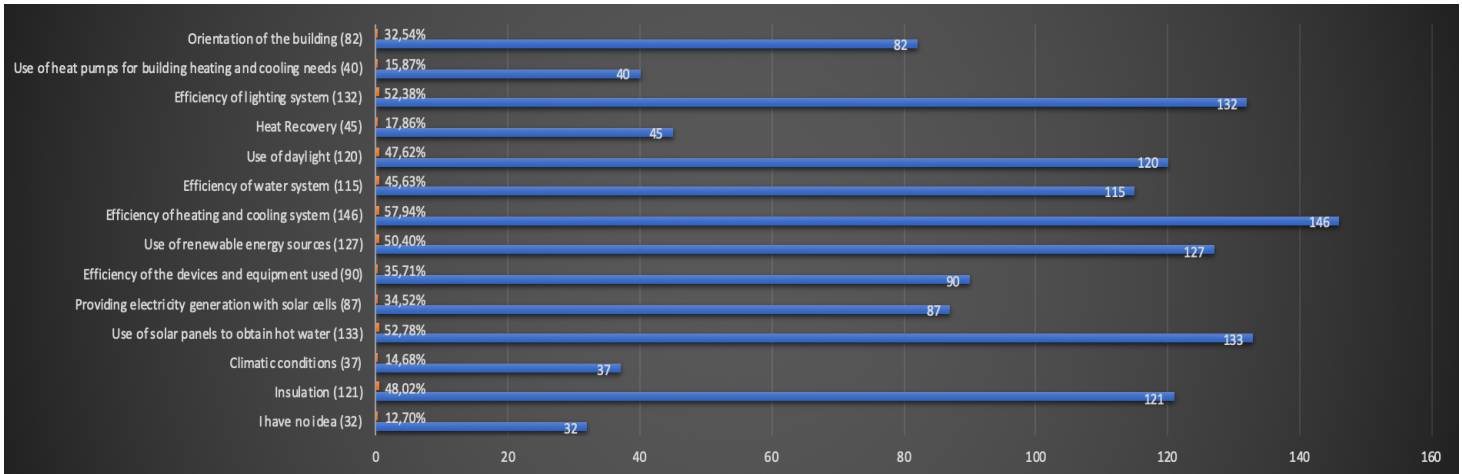
- Generation of electricity by wind turbines
- Generating electricity with geothermal energy
- I have no idea



ZERO ENERGY BUILDINGS

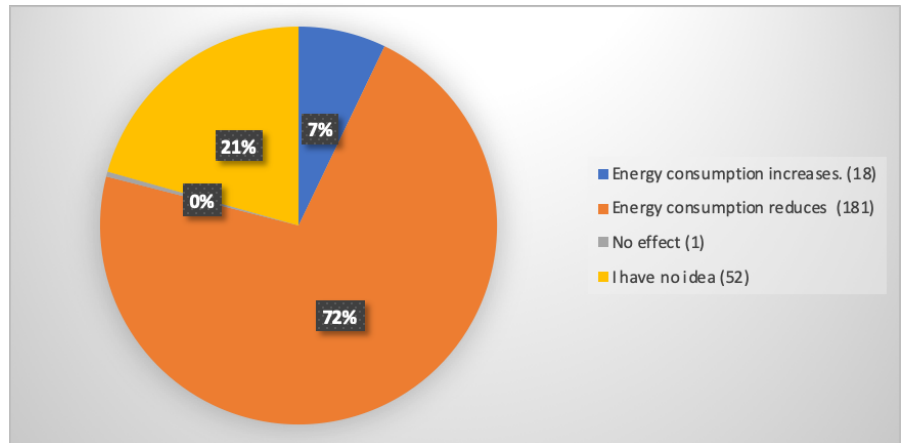
Which of the following(s) are effective in increasing energy efficiency in buildings?

- Insulation
- Efficiency of heating and cooling system
- Efficiency of lighting system
- Efficiency of water system
- Orientation of the building
- Daylight use
- Climatic conditions
- Efficiency of devices and equipment's used
- Use of solar panels to obtain hot water
- Providing electricity generation with solar cells
- Use of renewable energy sources
- Heat recovery
- Heat pump use for building heating and cooling needs
- I have no idea

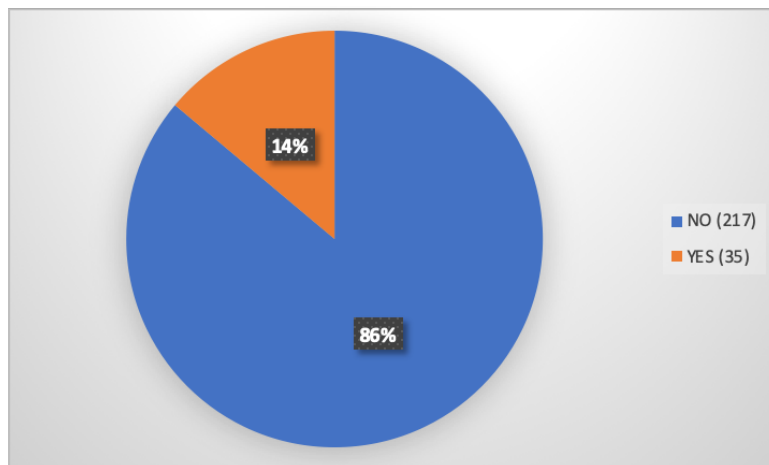


What are the effects of using thermal insulation in buildings?

- Energy consumption increases
- Energy consumption reduces
- No effect
- I have no idea

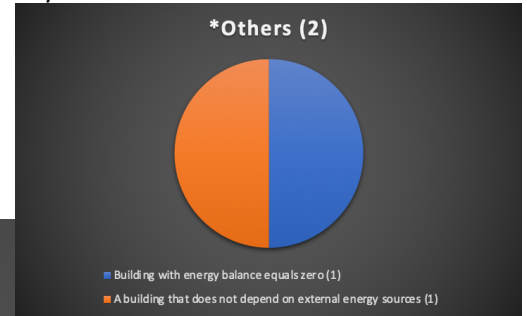
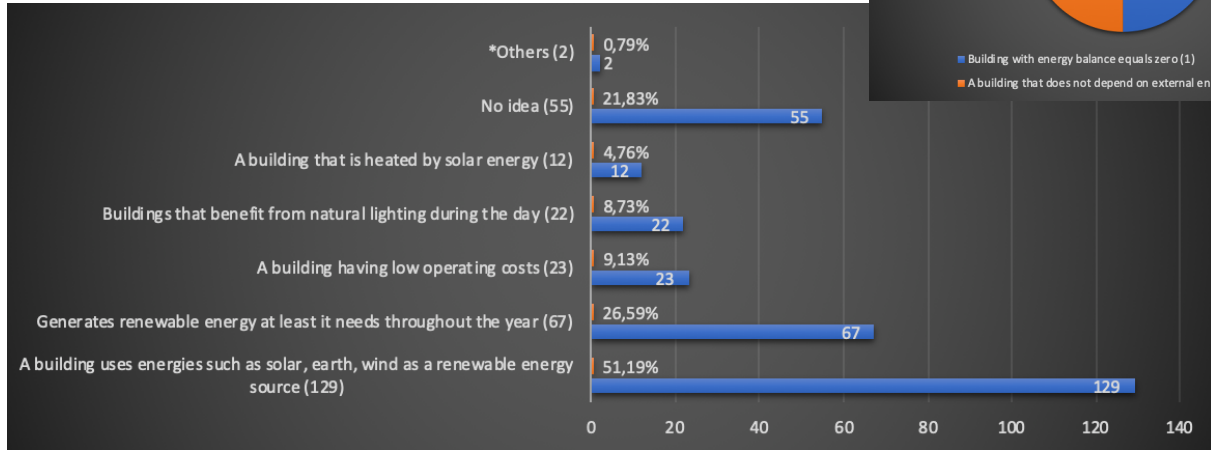


- Do you have any idea about zero energy buildings?
- Yes
- No



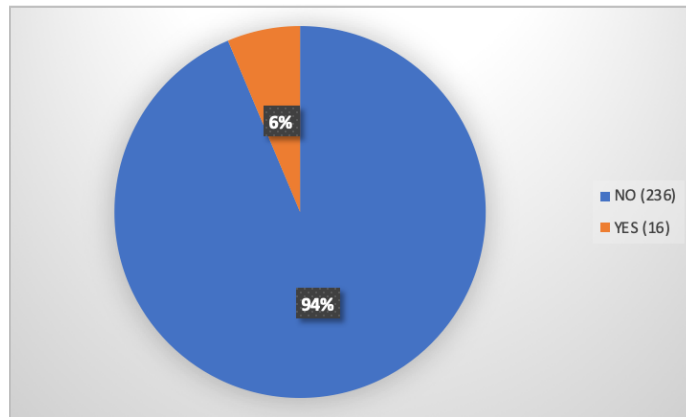
Do you think what is a zero energy building?

- A building uses energies such as solar, earth, wind as a renewable energy source.
- Generates renewable energy at least it needs throughout the year
- A building having low operating costs
- Buildings that benefit from natural lighting during the day
- A building that is heated by solar energy
- I have no idea
- Others



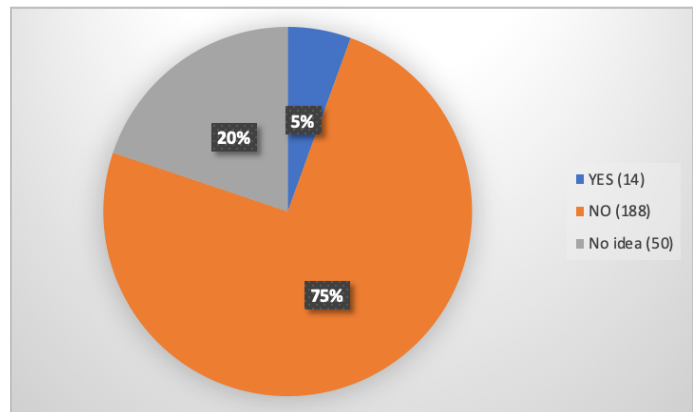
Have you ever participated in any workshop, awareness campaign or seminar about zero energy building?

- Yes
- No



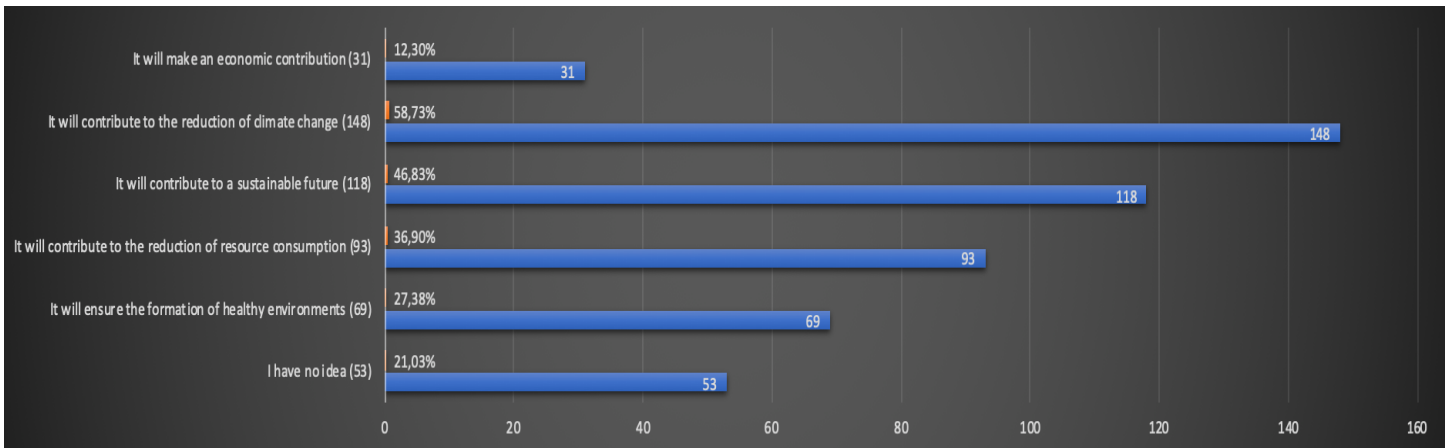
Have you ever seen a zero energy building?

- Yes
- No
- No Idea/No answer



What can be the benefits of increasing the number of zero energy buildings in your country?

- It will contribute to the reduction of climate change
- It will make an economic contribution.
- It will ensure the formation of healthy environments.
- It will contribute to the reduction of resource consumption
- It will contribute to a sustainable future.
- I have no idea

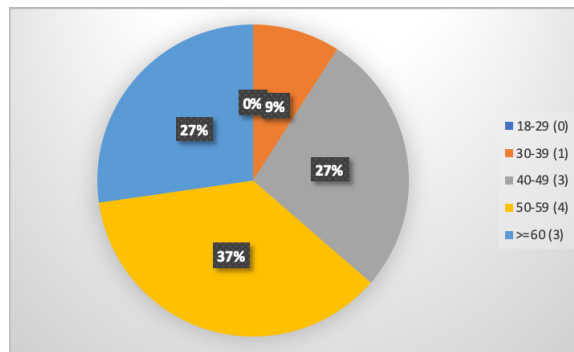


4.3. Survey Results of 10 face to face meetings with sectoral stakeholders, energy institutions, academicians, policy makers, experts etc.

We have done 11 survey between sectoral stakeholder

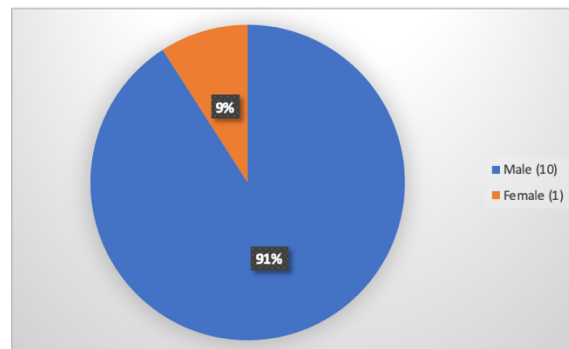
1. Age

- 18-29
- 30-39
- 40-49
- 50-59
- 60 and 60 +



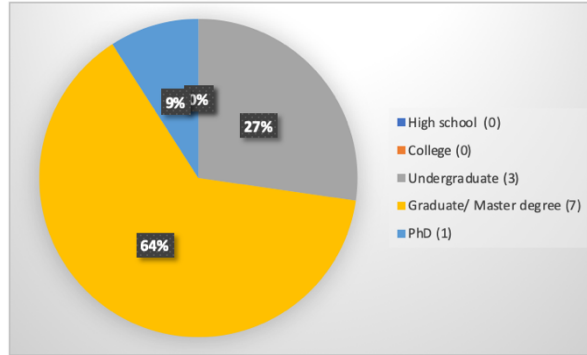
2. Gender

- Female
- Male



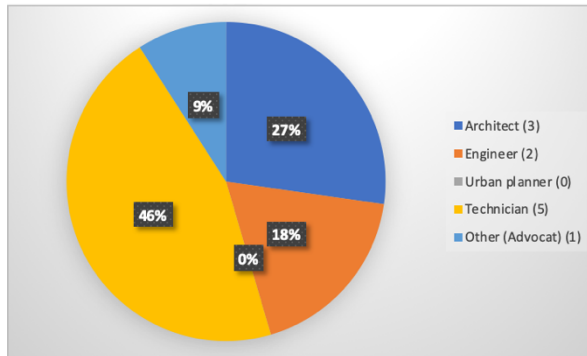
3. Educational level

- High school
- College
- Undergraduate
- Graduate/ Master degree
- PhD



4. Profession

- Architect
- Engineer
- Urban planner
- Technician
- Other (.....)

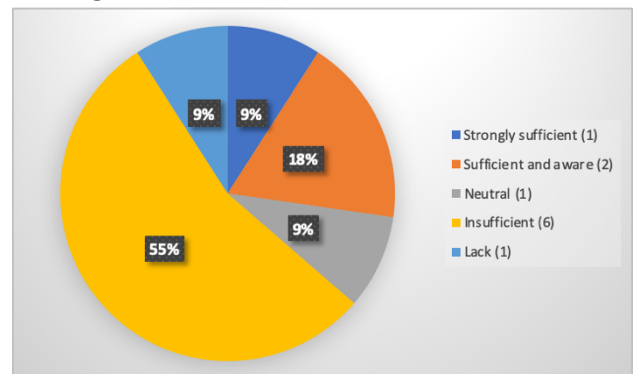


5. What is your institution and the department you work?

1. Project Director at the Instituto de Estudios de la Tierra, SL.
2. General Administration
3. Andalusian Energy Agency - Department of Internationalization and Prospective
4. Provincial Energy Agency of Cádiz, -Financial Department and Project Management
5. Architect with own studio
6. Autonomous
7. Ministry of Agriculture, Livestock, Fisheries and Sustainable Development. Andalusia Board
8. Junta de Andalucía
9. Free professional. projects / construction management / expert reports
10. Scholl
11. TRAGSA, Project Management

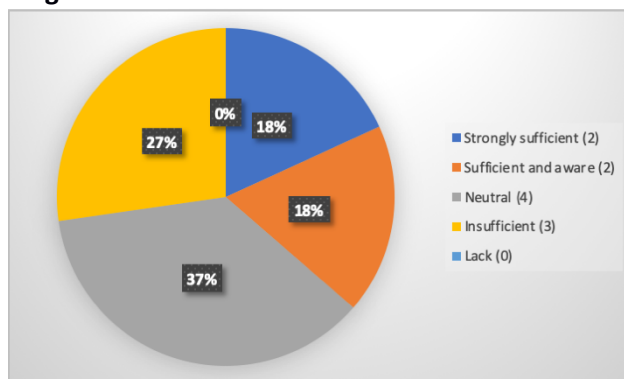
6. Do you think that energy conservation in existing buildings is taken into the consideration in your country?

- Strongly sufficient
- Sufficient and aware
- Neutral
- Insufficient
- Lack



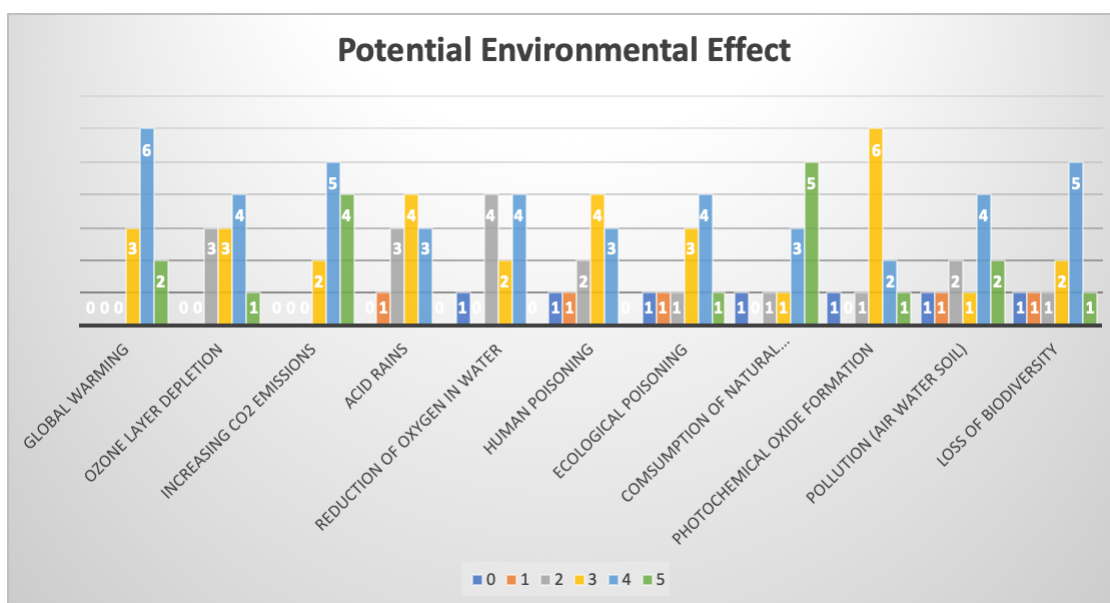
7. Do you think that energy conservation in new buildings is taken into the consideration in your country?

- Strongly sufficient
- Sufficient and aware
- Neutral
- Insufficient
- Lack



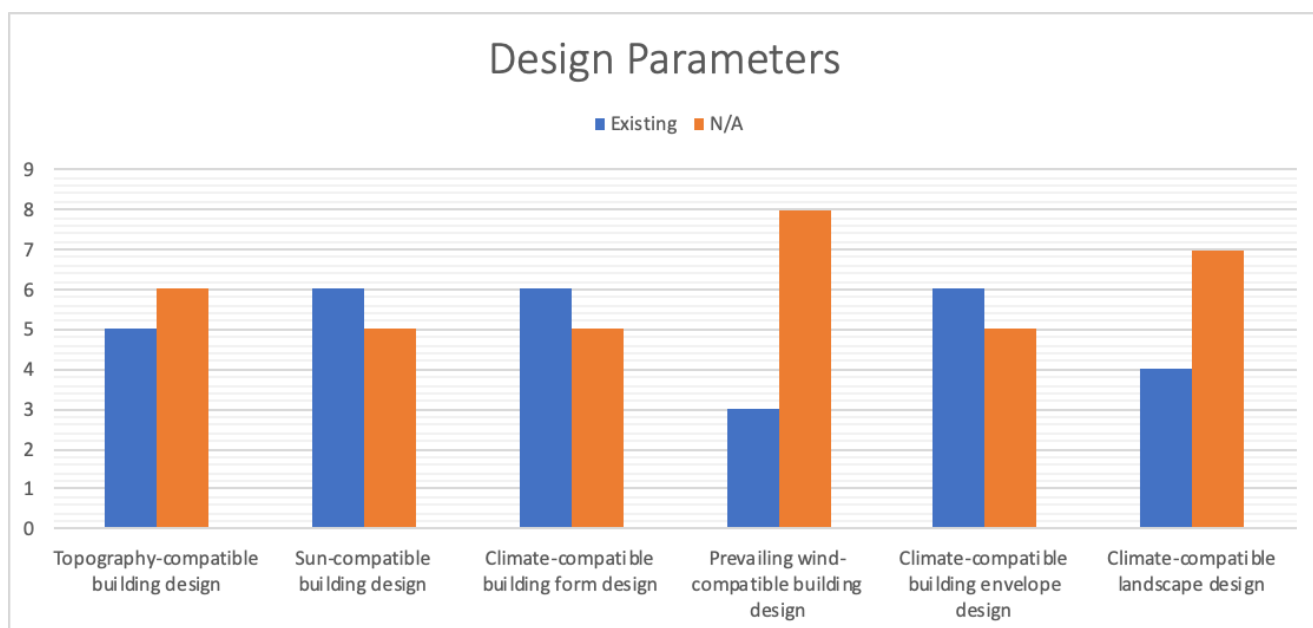
8. Please rate the environmental impacts of disregarding the energy conservation in buildings. (0=none, 1=very little, 2=little, 3=neutral, 4=much, 5=to much)

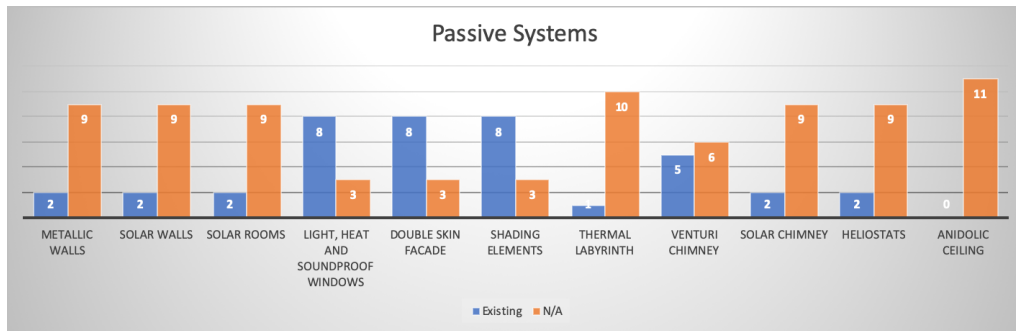
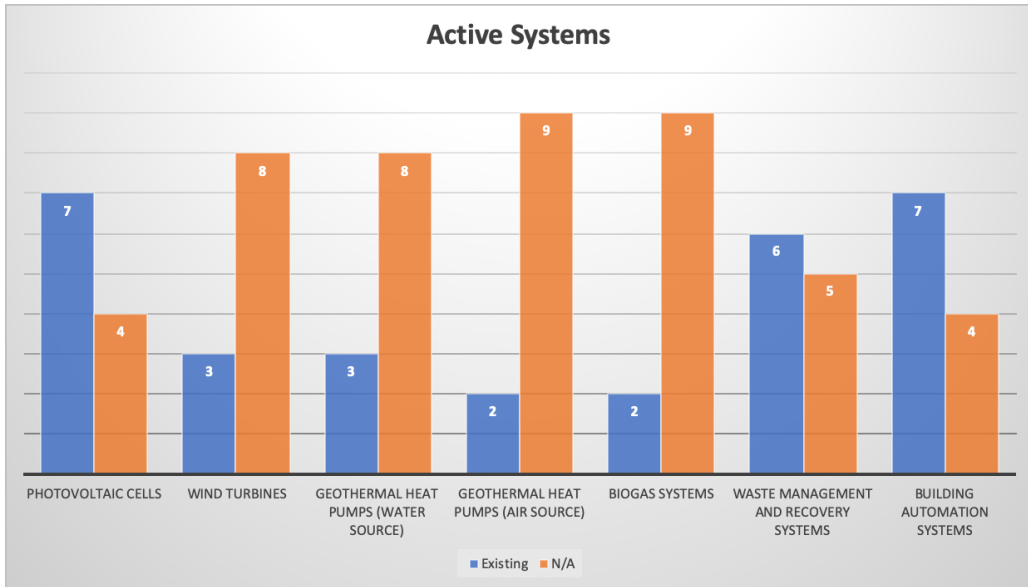
Potential Environmental Effect	0	1	2	3	4	5
Global warming	0	0	0	3	6	2
Ozone layer depletion	0	0	3	3	4	1
Increasing CO ₂ emissions	0	0	0	2	5	4
Acid rains	0	1	3	4	3	0
Reduction of oxygen in water	1	0	4	2	4	0
Human poisoning	1	1	2	4	3	0
Ecological poisoning	1	1	1	3	4	1
Consumption of natural resources	1	0	1	1	3	5
Photochemical oxide formation	1	0	1	6	2	1
Pollution (air, water, soil)	1	1	2	1	4	2
Loss of biodiversity	1	1	1	2	5	1



9. What are the studies on design parameters, active and passive systems regarding energy efficient building design in the sector you are working in?

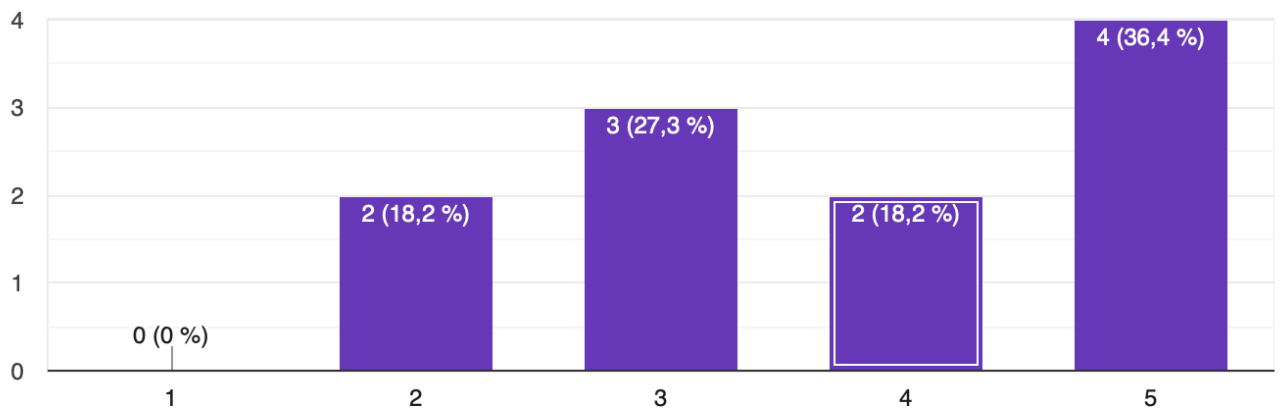
Design Parameters	Existing	Not-existing	Passive Systems	Existing	Not-existing
Topography-compatible building design	5	6	Metallic walls	2	9
Sun-compatible building design	6	5	Solar walls	2	9
Climate-compatible building form design	6	5	Solar rooms	2	9
Prevailing wind-compatible building design	3	8	Light, heat and soundproof windows	8	3
Climate-compatible building envelope design	6	5	Double skin facade	8	3
Climate-compatible landscape design	4	7	Shading elements	8	3
Active Systems	Existing	Not-existing	Thermal labyrinth	1	10
Solar cell	7	4	Venturi chimney	5	6
Wind turbine	3	8	Solar chimney	2	9
Geothermal heat pumps (water source)	3	8	Heliostats	2	9
Geothermal heat pumps (air source)	2	9	Anidolic ceiling	0	11
BIOGAS Systems	2	9			
Waste management and recovery systems	6	5			
Building automation systems	7	4			





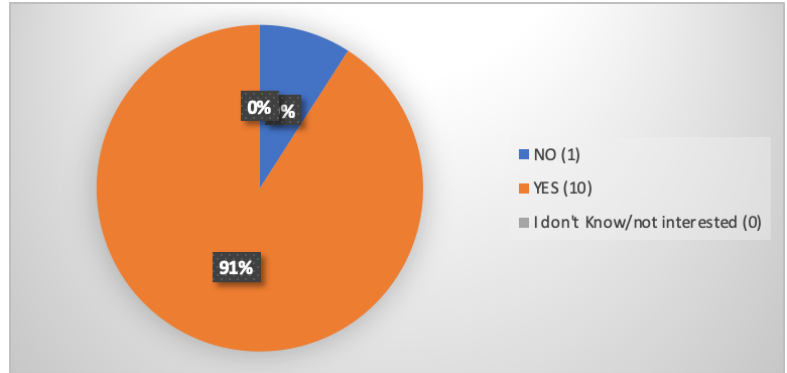
10. Does energy efficient building design ensure efficient use of country resources?

	1	2	3	4	5	
Nothing ensures	0	2	3	2	4	Strongly ensures



11. Do you think energy efficient building design approaches (design parameters / active systems / passive systems) are important when buying a real estate property?

- a-) Yes
- b-) No
- c-) I don't know / I am not interested

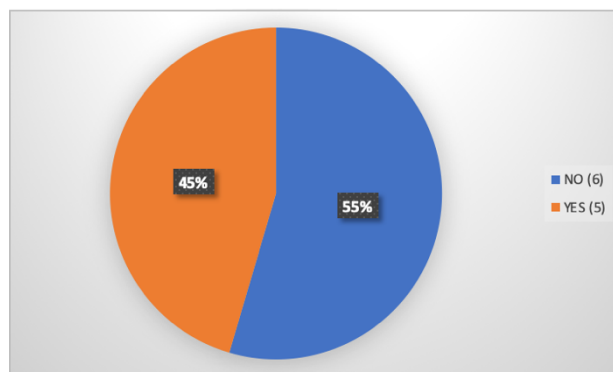


12. If your answer is yes high of the active and paswsive systems in energy efficient design approaches are effective on the economic value of the real estate

They are,..... :
covered, walls, analysis of weather, wind and sun
liabilities: orientation, ventilation, sunlight. Assets: SATE, efficient glazing, heat recuperators
Automation systems, double walls and shading systems
Andalusia
Photovoltaic
Comfort
They are several; especially those related to solar energy
Seville
Systems that improve thermal comfort.
Isolation; thermally efficient windows; sunscreens
Use of Renewable Energy Sources-Non-fossil fuels-Recycling ...

13. Are there appropriate legislation and operation for the promotion of energy efficiency in buying and selling of real estate?

- a-) Yes. They are,.....
- b-) No



14. Do you think that legislations on energy-efficiency in your country are sufficient? Can you explain your opinions about this subject?

We have to improve

Do not

No, a lot of legislation, little practice and difficult to carry out.

Spain

Yes theoretically

Insufficient

No. Lack of awareness at all levels

Spain

Yes. The CTE implied a great change in these requirements.

Is not sufficient. The energy certificate of buildings, for example, is greatly devalued.

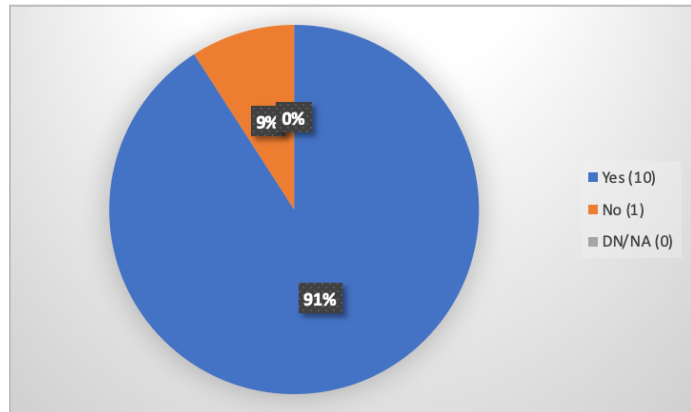
I don't think it's enough, but I think that more than legislating it is important to educate. That always

15. Do you think that the operation costs will be reduced in buildings with implementation of energy-efficiency building design approach (parameter of design/passive systems/active systems)?

a-) Yes

b-) No

c-) I don't know / I am not interested



16. Do you think that design of an energy-efficiency building will increase the investment cost?

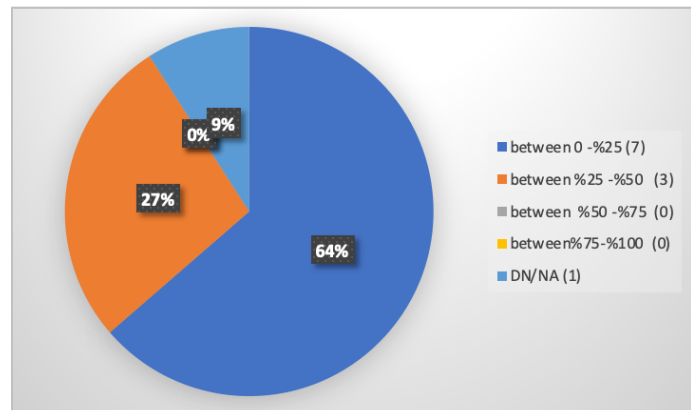
a-) between 0 -%25

b-) between %25 -%50

c-) between %50 -%75

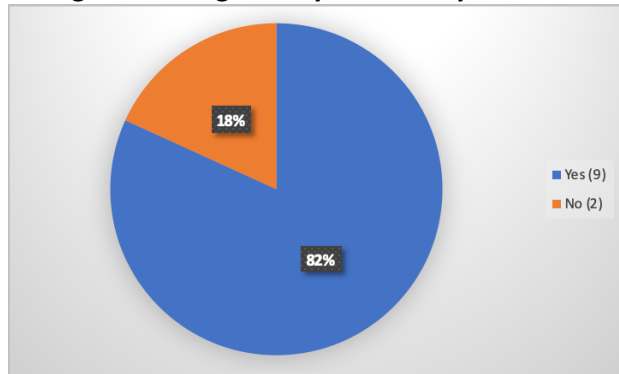
d-) between %75-%100

e-) I don't know / I am not interested



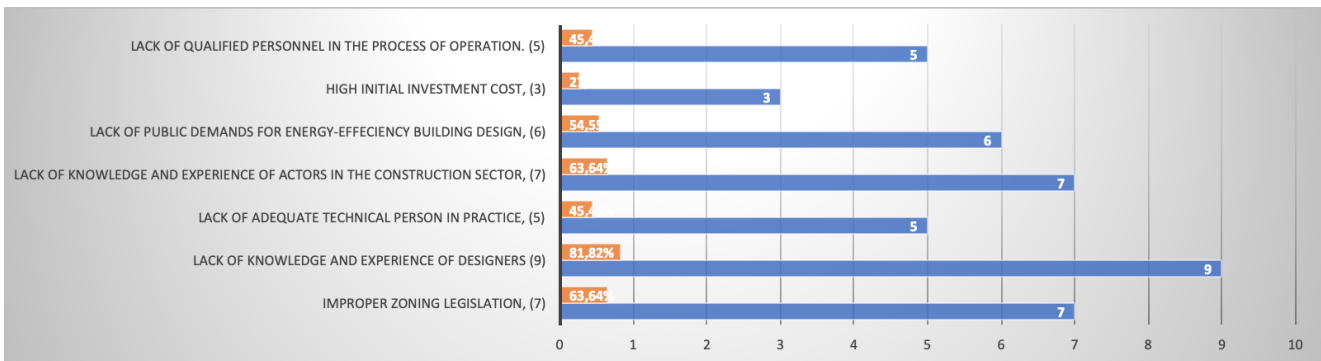
17. Do you think that energy- efficiency buildings are designed in your country?

- a-) Yes
- b-) No
- c-) I don't know / I am not interested



-If your answer is "No"; which of the following issues are not implemented because of the energy efficient building design approach? (You can mark multiple options).

- a) Improper zoning legislation,
- b) Lack of knowledge and experience of designers
- c) Lack of adequate technical person in practice,
- d) Lack of knowledge and experience of actors in the construction sector,
- e) Lack of public demands for energy-efficiency building design,
- f) High initial investment cost,
- g) Lack of qualified personnel in the process of operation.



18. In which field does your organization gives service in terms of energy- efficiency?

- Design
- Projects
- In all fields
- In all
- I dont know
- Solar
- fight against climate change
- Perform environmental impact study
- Detached house mainly.
- Public administration
- Architecture



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19. What are the goals of your organization in terms of energy- efficiency?

Analysis and commissioning of energy efficiency solutions

mandatory implementation at 4 levels, from highest to lowest: passive systems, then assets, compliance with CTE and minimum or almost zero consumption.

Minimize emissions. Impact 0

Promote and promote these actions

Relative

Implement R + D + I technology

fight against climate change

Saving fossil resources and policies against climate change

CTE compliance.

Promote energy efficiency through public instruments (subsidy programs, financing lines, regulation, training, etc.).

Orientation of buildings to harness solar energy

Choice of low energy materials

Build integrated technologies

Minimum environmental impact ...

20. What are your goals for Zero-Energy Buildings?

Self-supply and life cycle analysis of materials used in construction

high efficiency in passive and active systems; short periods of investment recovery through constructive quality

Transform the design, construction and management procedures of buildings towards greater energy efficiency in buildings and convert them into zero emissions

None

The maximum

R&D

Be self-sufficient

Energy efficiency

Application of alternative energy sources.

Publicize almost zero energy consumption buildings, and comply with the European Directive on energy efficiency of buildings in terms of new construction of public buildings.

The same



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4.4. Evaluation of Survey Results

4.4.1 Youth:

An analysis has been carried out on 252 surveys of young people, the majority in the range of 19 to 22 years (115) and being the same number of surveys between boys and girls. The majority of respondents (168) live in Seville, a medium-sized city, capital of the Andalusian autonomous region and with one million inhabitants.

The majority of respondents are studying at university (111).

Everyone has heard about Climate Change and believes that it is a change caused by human activities and an increase in global average temperatures.

And they believe that the main reasons for this climate change are caused by air and water pollution, followed by inefficient consumption of natural resources, deforestation, industrial activities and waste and by inefficient use of energy as well as by the increase Population and an unplanned urbanization.

As for the sources of information they use to know about climate change, more than half (174) of the respondents obtain information from the media such as television, followed by social networks and websites, radio and the press. It is noteworthy that the information that our politicians give on the subject is irrelevant according to the respondents and that, although 80% of the university students surveyed also obtain information from their universities and academics. The information obtained through non-governmental organizations, scientific studies, international projects, family and announcements is below 20%.

92% of respondents believe that climate change and environmental problems affect their quality of life and that the best way to fight individually is to keep the environment clean (55.16% of respondents), reducing vehicle use motorized individual and using public transport, using ecological and recycled products, improve water and energy savings, using energy efficient devices and improving the thermal insulation of buildings.

90% of respondents would like to learn more about climate change.

Regarding attitudes and behaviors in the context of energy consumption. 32% are following current environmental problems and know what the "concerns" are followed by those who are aware of the discussions, but no more than that. Only 15% of respondents actively follow these issues and try to learn more.

88% of respondents try to reduce energy consumption at home and believe that the greatest precaution to reduce consumption at home is the use of solar energy to generate energy and heat water (71.83% of respondents) , followed by choosing low-energy lighting (51.98%) and the use of efficient A + appliances (33.33%). Only 22% think that insulating buildings can reduce energy consumption, and almost 12% think it is best to use central heating.



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As for the question, what is energy efficiency? Almost 35% think it is to reduce energy consumption without losing production thanks to technology, followed by 31% who think it is to reduce energy use without compromising performance and comfort conditions. Less than 20% think it is the prevention of energy loss.

Almost 50% of the respondents think that support for efforts to reduce energy consumption is important, with 36% being those who think that support for actions to reduce energy consumption is urgent. So we see that more than 805 respondents think that measures must be taken to reduce energy consumption.

Regarding the issue of RENEWABLE ENERGIES AND RENEWABLE ENERGY SOURCES, 42% of respondents understand renewable energy as inexhaustible, followed by almost 36% who understand that they are the ones that do not pollute nature and 26% that They think they are the most ecological energies.

Most respondents clearly identify the main renewable energy sources such as solar and wind energy, although slightly more than 505 identify hydroelectric or geothermal energy as renewable. And below 10% are those that confuse renewable energy sources with others that are not renewable such as coal, natural gas, nuclear, etc.

Most respondents identify solar energy as the one that can best be used in buildings, for the generation of electricity and for heating domestic water. To a lesser extent below 33 and 23 they would use wind turbines or geothermal energy to produce electricity.

As for the topic on ZERO ENERGY BUILDINGS. To the question of Which of the following items are effective in increasing energy efficiency in buildings? Above 50% of respondents think that the elements that would increase the efficiency in buildings would be:

Efficiency of the heating and cooling system, followed by the use of solar panels to obtain hot water, to use efficient lighting systems and the use of renewable energy sources. Between 40 and 50% think that insulation, the use of daylight, efficiency in water systems are the measures to be used, and below 35% the use of efficient devices, the orientation of buildings and The rest of the proposals. Only 12.70% have no idea.

72% of respondents believe that energy consumption is reduced when a building is thermally insulated. But it is surprising that 21% of respondents have no idea what is the consequence of using thermal insulation and there is a minimum 7% that believes that energy consumption increases.

86% of the surveys have no idea what a Zero Building is and believe they are the buildings that use renewable energy as energy sources (51%). Only 2 participants believe that they are buildings whose energy balance is zero and that does not depend on external energy sources.



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94% of respondents have not participated in any campaign or seminar on Zero Energy Buildings, and 75 have never seen a ZERO building, with 20% not knowing if they have ever seen it. Only 5% have visited a Zero building. And although not most have not seen it and they are not clear about the concept if you think that these buildings can be beneficial to contribute to the reduction of climate change, to a sustainable future by reducing the consumption of resources.

From what we can say that the theme of this project is very correct, since we have been able to verify that there is a gap in young people regarding this issue, of crucial importance for our sustainable development. And we think that the tools that are created will make the knowledge of young people push the generation of new Zero Buildings, because they demand it for their future and that of others.

4.4.2. Face to face:

11 Face-to-Face interviews have been conducted among professionals working in the renewable energy, construction, engineering and environmental sectors. The conclusions obtained from these interviews are:

The majority of respondents are in the age range of 50-59 and with people over 60 make more than half of the sample, in addition all of them have university studies and more than 64% have postgraduate and Master studies, counting on the opinion of a PhD.

All of them excepting one are active workers with 3 architects, 2 engineers, 1 lawyer and 5 technicians specialized in the Environment and the energy sector.

5 come from the public administration, Ministry of Environment and Energy Agencies of the Junta de Andalucia and the rest of it from private sector, including large companies such as TRAGSA and SCHOLL and independent architecture studies or law firm, specialist in urban issues.

So they are people with a background and large experience.

All respondents have been men except one woman.

When asked if energy conservation in current buildings is taken into account, 55% think that it is done insufficiently, and only one respondent thinks that it is taken into account.

To the question of whether the conservation of energy in new buildings is taken into account, if we add those who think neutrally or insufficiently, we again have more than half of the sample who think that this issue is not being taken into account.

As for the assessment of environmental impacts due to not taking into account the conservation of energy in buildings, everyone believes that it is a lot or too much, except in the formation of photochemical oxide that the impact they think is small.



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As for design parameters, active and passive systems in the design of energy efficient buildings in the sector in which it is working. Regarding design parameters, they are balanced, except in the construction design compatible with the wind that most people see as nonexistent. As for the active systems, it can be seen that those who work in public administrations take into account the use of photovoltaic panels, waste management and automation systems, with most of the other aspects nonexistent. Repeating again in the passive systems, since the public buildings of the environmental administrations and the energy agency in Andalusia use facades with double walls, shading elements and parasols, lighting and soundproof windows, but the rest of aspects they are nonexistent in both public and private buildings of the companies or organizations where respondents work.

As for the question of whether the design of buildings with energy efficiency guarantees the efficient use of the country's resources, more than 54% are convinced or strongly convinced about this, but almost half doubt it.

90% of respondents think that energy-efficient building design approaches (design parameters / active systems / passive systems) are important when buying real estate. And these parameters are effective and influence the economic value of the property such as roofs, walls, climate analysis, orientation, the isolation used and resources related to solar energy.

As for whether there is appropriate legislation and operation for the promotion of energy efficiency in the purchase and sale of real estate ?, there are opinions facing 50% and depending on whether it is from the private company or the public administration in charge of these issues believe or not believe there is appropriate legislation and operations. And everyone except 2 of the respondents believes that the legislation on energy efficiency in their country is insufficient.

But they agree in 91% that the operation costs in buildings will be reduced with the implementation of the energy efficiency building design approach (design parameter / passive systems / active systems), but they also think that the design of a Energy efficiency building will increase the cost of investment between 0% -25% and to a lesser extent between 25% - 50%.

And more than 80% think that energy-efficient buildings are designed in Spain and those who have responded that they don't think it is due to the lack of knowledge and experience of designers and actors in the construction sector.

The rest of the answers are personal visions, but they are aimed at supporting measures to encourage the building ZERO.



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5. Conclusions and future comments.

Nature is a perfect cycle, everything we find has a purpose from a small bee to an elephant or a centennial tree, everything has its ultimate goal which is to continue with the cycle. But nature is wise so it will do everything possible to ensure that, if we try to end it, life goes on.

10,000 years ago, when people created their own shelters were surrounded by life, we needed that life to continue our existence. Currently, we can not say the same because, although we continue to depend on nature, we try to distance ourselves from it.

The number of species that have been extinct since the appearance of man have been enormous. Only the fauna has decreased an average of 60%. For the first time in history, we can not count on the stability of nature. Even so, the natural environment persists and continues to retain great wealth.

It seems that we do not remember, or do not want to remember that our survival is linked to the survival of our planet. It is not possible to imagine a world in which we live without trees, without animals, etc., because they are necessary for the ecosystem, for our life.

Although every time we have a greater ecocentric thinking and we are making great advances when it comes to wanting to leave behind all the problems we have been and continue to cause, we have to continue striving every day.

Nowadays it is more important than ever to understand how the natural environment works and how to help it.

In Spain we can see how, although the first most used energy source is not renewable, the second source of energy if it is being the most used wind energy among renewable energies being aware of the increase in ecocentric thinking .

In a generation in which children increasingly know less than what is an animal or a plant because they have not been able to observe nature beyond the parks of large cities, Environmental Education is necessary because as living beings it is our right of honor to be able to explore part of what we were, are and will be, although we are trying to get rid of it because we think that loving nature makes us more "primitive".

From the beginning, we thought that all our actions had no consequences, but now we know that what we have always been thinking is false. It is true that, at first, we did not generate enough to affect us, but after the Industrial Revolution started by the steam engine, the damage we are doing to the planet has increased.

Among the reasons why people do not contribute to protecting the environment are mainly economic reasons or that it is thought to be a very distant problem that will not affect us.

Regarding economic issues, it does not make much sense that they do not want to invest economically in protecting the environment because climate change will be a great loss in all senses. The longer we take to act, the greater will be the loss produced by the high increase in temperatures.



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In this way, although a considerable investment of money is necessary when constructing activities that do not harm the environment, these are amortized because we would need to invest more money in case of climate change.

We must fix what we are causing ourselves. The melting of the poles, the increase in temperature, acid rain, among others, are the product of man's actions.

We are not aware that it is already affecting us and that if we continue along the same path there will be no turning back.

One way to combat climate change is the construction of buildings "Zero emissions", which we discussed in this paper.

When we started, we did not know much about this type of building. However, as we collect the data on the purpose of these buildings to be sustainable, thus helping the environment, we have acquired a great curiosity on the subject and we have appreciated the need to build buildings of this type and from now on. that those already built are modified.

Although in the beginning if it requires more economic investment this is cushioned in several years so, as we have said before, not only is it sustainable, but it is also economically profitable.

So, if it can become a challenge both in engineering and other aspects, adapting to existing circumstances and improving them, introducing technological advances and materials that improve our quality of life without harming the environment.

It is not the same design a building from the beginning following the principle of energy savings and zero balance or even almost zero, which modify existing ones to fit this principle or objective. Since the first involves a single capital income while the second one would have to invest more money, needing a first investment to be built and then a second investment to be reformed to be sustainable.

These initiatives that lead to the reduction of emissions are what drive to improve the existing situation. Currently it is of world interest to improve our quality of life and for that there is a change in the lifestyle we have maintained for years.

That is the main reason why this type of construction is necessary, we must compensate everything that previous generations did wrong.

With this National Report we want to learn that there are many ways to modify certain aspects of our life that influence our environment in a positive way.

Unfortunately, in Spain there are few constructions "Zero Emissions". It is curious how, although they teach us the importance of protecting the environment through education as in the case of the university, they do not make a priority investment in ecocentric aspects with respect to others.



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While it is true that there are some measures that facilitate their protection, we do not think that these are sufficient considering the knowledge that we should all have for the training given, knowing the consequences of not acting when it comes to protecting the environment. Among all living beings on our planet there are necessary relationships that are beginning to be destroyed along with the stability on which we depend. The decisions we make in the next 20 years will determine the future of all the living beings we inhabit on Earth. That is why it is crucial that we fix what we ourselves have caused.

We have before us the responsibility for people and nature to progress, but we are only managing to end life not only because of the actions that are taking place, in addition, due to the lack of action of the people.



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