PATH TO SUSTAINABILITY

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ABSTRACT:

The work that I am going to analyze refers to the objectives and goals of the 2030 Agenda and Sustainable Development Goals, highlighting the importance in particular, of Development Goal number 7 that highlights the current needs to continue growing and renewing ourselves in addition to continuing to contribute to achieve a cleaner and more sustainable world that is the purpose focusing on renewable energies and energy efficiency at the level of the Union European. The importance of international cooperation on the environment is also essential to get where it is desired. Achieve these Objectives marked by the 2030 Agenda and Development Goals where the specific regulations of the European Union are measured, highlighting the articles of greatest importance and most necessary to address the objectives through the directives of both the renewable energy directive and the energy efficiency directive.

Keywords: Sustainable, Renewable Energy, Efficiency, Objectives.

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1.Introduction.

This work is focused on the topic of sustainability as it is considered a very current and relevant topic for everyone, due to the importance of clean energies and where inexhaustible natural resources are needed in order to respect the environment and pollute as little as possible to achieve a better world. Renewable energies due to the influence they have nowadays for the control of pollution and the need to change habits acquired by all that are good and sustainable for the improvement of the environment.
Awareness is growing due to the increase of information and experiences that are being detected in the environment and situations where we are seeing that we all act in a more necessary way and be more aware of future problems if we do not act in the present in terms of the impact on both welfare and climate.

That is why, in order to be more aware of this issue, we want to give greater visibility to the problem and the solutions to be able to act as soon as possible and be much more involved in making this world as sustainable as possible, both economically and naturally, as it is undoubtedly a challenge that we are currently facing and which must be analysed with time and to comply with the established goals that are dealt with in this work and in some objectives to achieve it as soon as possible.

So in addition to addressing the goals and objectives to be reached and give more information and developments in both the world and in Spain on clean and renewable energy, also talk about a content that today the population has more and more questions about how to proceed to start a change from the home with photovoltaic installations and the benefits that such energy attract.

For all these reasons, it is guided by the goals and objectives reflected in the history from 2000 to 2015, where the Millennium Development Goals (MDGs) of the United Nations are eight development goals for progress and development and are enhanced in the Agenda 2030.

2.Birth of the 2030 Agenda.

The 2030 Agenda was launched in 2015 because the majority of society is more aware of the future problems that may arise if existing natural resources are depleted, which is why it incorporates Goals related to sustainable development and social well-being. However, there is still a long way to go to reach the goals of the 2030 Agenda (United Nations, 2023).

As mentioned above, the objectives are key to achieving these beneficial goals for society and the environment, which is why they are highlighted below.

2.1. The SDGs: Sustainable Development Goals.

The Sustainable Development Goals focus on the countries that need the most help, as they have fewer natural resources than other countries, especially in the area of basic diseases such as food, and are also born out of the current need for environmental and economic challenges. There are 17 goals for sustainable development with more than 100 targets, covering topics such as environmental protection as well as issues related to the prosperity of the global economy and social welfare. In 2017, UNDP's support for these goals was confirmed (United Nations Development Programme, 2023). These 17 Sustainable Development Goals are central to the implementation of the 2030 Agenda. Of the 17 Sustainable Development Goals (SDGs), the following are those that address sustainability, in particular environmental sustainability and its most characteristic targets, as set out in the UN's Agenda 2030 declaration.

- ***Goal 6***

Clean water and sanitation. Ensure availability and sustainable management of water and sanitation for all people. Both to achieve access to sanitation and hygiene services and to improve water quality. Reduce pollution and wastewater.

- ***Goal 7***

Affordable and clean energy. Ensure access to affordable, safe, sustainable and modern energy for all people: Ensure universal access to energy, and increase renewable energy.

- ***Goal 8***

Decent work and economic growth. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. As would be: Sustaining economic growth, improving efficient and respectful production and consumption, and achieving full employment and decent work.

- ***Goal 9***

Industry, innovation and infrastructure. Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation. As is: Developing sustainable infrastructure, promoting inclusive and sustainable industry, and finally, increasing scientific research, technological capacity.

- ***Goal 11***

On Sustainable Cities and Communities. Make cities and human settlements inclusive, safe, resilient and sustainable and ensure access to shelter and sustainable urbanization.

- ***Goal 12***

Responsible consumption and production. Ensure sustainable consumption and production patterns. Such sustainable consumption and production would be carried out with waste prevention, reduction, recycling and reuse.

- ***Goal 13***

On climate action, take urgent action to combat climate change and its effects by strengthening resilience and adaptation, and promoting environmental education and awareness.

- ***Goal 14***

  Aiming at the enhancement of underwater life, conserving and sustainably using the oceans, seas and marine resources for sustainable development with marine and coastal ecosystem management. In addition to support for marine research and technology.

- ***Goal 15***

  Life of terrestrial ecosystems. Sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss.

- ***Goal 17***

  Partnerships to achieve the goals. Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development. In particular, by mobilising domestic resources for tax collection.

Focusing greater importance in the research motive on the SDG, Sustainable Development Goal, which would be the one aimed at the importance of renewable energies and analysing their evolution and impact on sustainability today is Goal 7, which is developed below.

2.1.1. Impact of SDG 7 renewable energy on sustainability.

Due to the needs described above in developing countries with natural resource needs, Goal 7 on the study of renewables would be more focused on the issue of analysis, which is to see the evolution towards a better world, since energy is the main factor influencing climate change, accounting for approximately 60% of all global greenhouse gas emissions (United Nations, 2023).

The Sustainable Development Goal (SDG) is quite relevant in this case as fossil fuels such as coal, oil and gas have been the main source of electricity generation for many years, but the burning of carbon-intensive fuels generates large amounts of greenhouse gases, which contribute to climate change and adverse effects on human health and the environment (United Nations, 2023).

In addition, global electricity consumption is increasing rapidly. Simply put, without a stable electricity supply, countries will not be able to develop their economies. As the world moves towards Goal 7 (SDGs), there are signs that energy is becoming more sustainable and affordable, much of which depends on access to electricity. We are seeing how poorer countries have started to develop, energy efficiency continues to improve and renewable energy sources are making great strides in the electricity sector (United Nations, 2023).

Even so, greater attention must be paid to improving access to clean and safe fuel and energy technologies, as well as expanding the use of renewable energy sources beyond the electricity sector. Energy access plays a key role in preventing disease as well as providing electricity for health care facilities and clean water for essential sanitation operations. Millions of people live without electricity. For example, it is estimated that only 28% of healthcare facilities in sub-Saharan Africa have access to a reliable source of electricity, despite the fact that electricity is essential to keep vital medical and household equipment running. So without electricity for hospitals and communities, human disasters could intensify and the pace of global recovery could slow dramatically (United Nations, 2023).

Prioritise energy solutions to power healthcare facilities and emergency services, as was the vital case in Covid-19, connect sensitive consumers, increase reliable, continuous and adequate energy production to prepare for a more sustainable economic recovery. Above all, to emphasise that energy is the main contributor to climate change and accounts for around 60% of all global greenhouse gas emissions (UN Secretary General, 2023).

In addition to the targets mentioned above, there are changes provided by the Spanish government to reduce greenhouse gases that have been increasing over the years. The evolution of these gases in Spain is detailed below.

2.1.2. Evolution of greenhouse gas emissions in Spain (2005-2020).

Due to renewable energies, we are seeing a change in greenhouse gases and pollution today. The Spanish government aims to meet the 2030 targets mentioned above, which is why greenhouse gases in Spain must be reduced by at least one third in order to meet the target set by the Climate Change and Energy Transition Act for the year 2030. In order to achieve the reduction of greenhouse gases, photovoltaics and wind power have grown by 19.6% in the case of photovoltaics and 8.4% in the case of wind power. What led to these results was the reduction in coal-fired generation due to the price of CO2. The increase in the price of coal has played a significant role in the gradual decrease of coal for electricity generation, which is why sustainable energy in Spain has increased (Observatorio sostenibilidad, 2020).

Alternatively, it is worth mentioning that through the Spanish Inventory System (SEI) of greenhouse gas emissions in Spain, which is carried out every two years, focusing on the evolution from the period 1990 to 2030, which is the target year for the change to a much more sustainable world, it can be observed how the net absorption of carbon dioxide increases from 289.4 in 1990 to 334.3 in 2018, in addition to the 282.5 which would be the target to be reached by the Spanish government, among other targets mentioned (Ministry for Ecological Transition and Renewable Energy), 4 in 1990 to 334.3 in 2018, in addition to the 282.5 which would be the target set by the Spanish government among other goals mentioned (Ministerio para la Transición Ecológica y el Reto Demográfico, s. f).

With regard to the value of greenhouse gases emitted by vehicles, this would be obtained according to market demand in terms of fuel calculated by service stations and the kilometres travelled by users, types of vehicles, among others (Lazo, M, 2021).

Due to the importance of sustainable development and the objectives set for 2030, in order to contribute to achieving these goals, the renewables market was being improved, as detailed in the following section

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3.Electrical energy in Spain.

Therefore, another challenge for Spain, if it wants to reach the mentioned goals, is that it must also pay attention to the supply of electricity, because the lack of power in the amount of water in the dams, examples like Sierra Nevada among others, where there is not enough energy to accumulate nor enough wind turbines to feed some municipalities to be able to be self-sufficient, needs the development of the supply of renewable energies. Because there are a limited number of investors, the state transmits investment bonds for different industries or sectors that use more energy than they can generate, as many nuclear power plants are being shut down, which, although negative for health, are indispensable for generating energy (Llobet, S).

Furthermore, the absence of electricity storage requires supply to be equal to demand at any given time, i.e. for there to be storage of renewable energies to accumulate energy that can be used when there is a greater amount of demand for electricity. In this sense, the regulations related to the electricity industry are being profoundly reformed. Their main objective is the economic and financial stability of the electricity system, while ensuring the supply of electricity with the necessary quality and at the lowest possible cost, an effective level of competition in the industry, all within the framework of the environmental friendliness of modern society. This is done with the aim of improving the supply of electricity while looking after the environment, where renewable energies, in particular photovoltaic energy, would take on greater weight in order to generate this energy through the sun and thus improve the quality of the environment; furthermore, to achieve its storage and be more self-sufficient (Ministry for Ecological Transition and the Demographic Challenge, n. d.).

3.1.Sustainable, renewable energy and its types.

Due to the importance of photovoltaic energy in the generation of electricity for the sustainability and care of the environment in the current evident challenge that is climate change, clean and renewable energies are of special importance and to know more about them and their evolution since nowadays it is important to prioritise actions that benefit the environment, due to the increasing need to implement cleaner energies in order to improve the quality of the environment and especially in terms of current outstanding issues such as drought and environmental pollution in general. This is why

sustainable energy is described as energy that can be used to meet the needs of the present without affecting future generations. It can also be defined as energy whose source is not depleted during use (or is depleted at a minimum rate).

The sources of these clean energies of unlimited use would be wind, channelled water and sunlight. These energies are obtained, whether or not they are used in everyday life, from natural sources such as the sun's rays, water and wind, which are always available on a daily basis. In the market, all renewable energies such as wind, solar, hydro, geothermal and biomass are considered sustainable energies (Fernández, 2020).

Renewable energies accounted for 40% of the electricity generated in Spain during 2019 (Fernández, 2020). This means that electricity demand is decreasing as the years go by and we move towards a more sustainable world. Specifically, total national electricity demand in 2022 was 250,596 gigawatt hours (GWh), which means that demand was 3.2% lower than in 2021. In 2022, renewables accounted for 42.2% of national production, of which wind power accounted for 22.2% of total electricity and the fourth position was held by solar PV (10.1%). The cumulative annual production of wind power (61,255 GWh) exceeded 1.2% over the whole of 2021, setting a new all-time record for this renewable energy source, while the annual production of photovoltaic power exceeded the previous year's number by reaching 27,830 Gwh, or 32.6% compared to the previous year. It was also the highest ever. Electricity demand in Spain fell by 6.8% in November, seasonally adjusted (El periódico de la Energía, 2023).

By contrast, in 2023, the share of energy from non-renewable sources is 57.9%, of which 23.9% is combined cycle and 21.9% is nuclear energy. From January to September 2023, electricity demand on the Spanish mainland was estimated at 19,670 GWh, 3.1% less than in September 2022. In September 2023, renewable energies generated 43.8% of the total, of which wind power accounted for 21.8% and solar photovoltaic for 15.2% (Red Eléctrica, 2023).

The difference between renewable energies and non-renewable energies is that the latter are limited, so the production of these limited resources implies consumption of the same means that reserves are depleted more quickly because they are not renewed naturally. In the following, the main renewable energies used, such as wind, hydro and photovoltaic energy, will be detailed.

Wind energy, which converts energy from the inexhaustible wind resource into electricity, is a sustainable and valuable option for the future. Wind energy brings numerous benefits to both the companies that invest in it and to society, helping to reduce the impact of

climate change, as it is clean, inexhaustible and cheap energy as well as generating green jobs (Endesa, 2022). Harnessing the wind requires the installation of wind farms on land or at sea, equipped with dozens of wind turbines. As mentioned above, in 2023, wind energy will account for more than 20 % of the electricity generated in Spain (Red Eléctrica, 2023).

Wind power plants, which combine a large number of wind turbines and make it possible to produce this energy in large quantities, must be installed in places where wind prevails. Each wind turbine that makes up the wind farm is connected to each other by underground cables that transmit the energy to the substation. From there, it is transported to homes, factories and schools, among other places, through the distribution networks of various energy companies (Iberdrola, 2023).

Wind turbines for this type of energy are located from Galicia to Andalusia, via the Meseta, Aragon and Castile-La Mancha. Around 1,203 wind farms have been installed in more than 800 Spanish municipalities. The largest installation of such wind turbines in Spain and the second largest in Western Europe is in El Andévalo (Huelva) with a total capacity of 244 megawatts. However, this number may increase in the not too distant future. On the other hand, 2019 saw the inauguration of the first offshore wind farm in Spain to use wind energy from the sea. It is the first offshore wind turbine and is located in Gran Canaria (Endesa, 2022).

Another type of renewable energy is hydropower, which uses the kinetic and potential energy of freshwater in falling currents. This type of energy is sought in natural watercourses or in reservoir constructions, where water is stored to be made to fall by water-driven turbines. In 2023, hydropower covers 8.2% of the national electricity demand (Red Eléctrica, 2023).

There are currently 800 hydroelectric power plants in Spain, one of the most important of which is Muela II in Valencia. This plant produces enough electricity per year to supply 200,000 Spanish households. Another important hydroelectric power station is the Aldeadávila hydroelectric power station in Salamanca. To produce energy, and subsequently electricity, part of the water is released, which descends at high speed through turbines that use the force of the water to do so. Generally speaking, the most commonly used are pumped-storage turbines because they provide more stable electricity. These plants have two reservoirs on either side of the dam at different heights,

which are activated at night, taking the electricity surplus from the day and pumping it from the lower reservoir to the upper reservoir to generate electricity (Endesa, 2022).

And finally, solar or photovoltaic energy provided by the sun's rays when the sun's electromagnetic rays are harnessed and which can be produced in photovoltaic solar power plants, the now much talked about solar farms where the light provided by the sun is transformed through solar panels with built-in cells (Endesa, 2022).

We are going to focus in more detail on photovoltaic energy as it is the energy that is currently gaining the most importance and of which I have previous experience due to my work in an office in the sector.

3.2. First steps of photovoltaics in Spain.

As in many places, the start of the PV market in Spain is fully tested. The photovoltaic market in Spain is currently one of the most dynamic in Europe and the world. Moreover, Spain is one of the countries on the continent with the highest number of sunshine hours per day.

Nowadays we can see many houses with roofs full of photovoltaic installations, this is a fact, which to a greater or lesser extent makes us more aware and see that we can go a step further and raise awareness a little more to contribute to a sustainable world, but the use of photovoltaic or solar energy began years ago. Specifically, in 1984, the first photoelectric centre in the country began operating, in San Agustin de Guadalix (Community of Madrid) with a power of 100 kW, and it was also the first power plant of this type to be connected to the national grid. For ten years, this will be the only photovoltaic or solar installation in Spain. In fact, around 1993, interest in photovoltaic energy increased again thanks to modest and still experimental projects. Specifically, the installation was carried out in four private homes in Pozuelo de Alcorcón with a power of 2.7 kW each. From there, others of higher capacity were added, such as a school in Menorca with a capacity of 42 kW and the Solar Energy Institute of the Polytechnic University of Madrid (13.5 kW), the library of Mataró (53 kW) (Grupo Espacio Industrial, 2021).

In 2021, PV was one of the world's largest renewable technologies with an installed capacity of 940 GW. Its annual growth rate positions it as the leading renewable energy technology, mainly due to lower installation and process complexity. It has grown from 70.47 GW installed worldwide in 2011 to 940 GW in 2021. In the last five years, global installed PV capacity has tripled from 306.5 GW installed in 2016 to the aforementioned levels (Blanco, 2023).

At the European level (EU-27), installed capacity will increase from 106.7 GW in 2017 to 159.9 GW in 2021, increasing this indicator by 48.9%. Going one step further and translating these numbers to our country, we see limited growth until 2018, with a cumulative capacity of 4.77 GW, which has accelerated in recent years to 19.11 GW in 2022. Summarising the above, the capacity installed in the last 4 years (2019-2022) in Spain (14.3 GW) was three times the total PV capacity installed at that time. This is why Spain ranks eighth in the world in terms of installed PV capacity and second in Europe. China is in first place with 377.1 GW, followed by the United States with 122.1 GW (Blanco, 2023).

The growth in the use of this energy observed in Spain in recent years is related to the promotion of self-consumption and aid or subsidies from the main state and European institutions for this sector, based on the need to decarbonise Europe, the decrease in production costs and the rapid recovery of investments. Furthermore, the decrease in the average price per kWH, the reduction in costs, the increase in the efficiency of photovoltaic cells has encouraged installation, which has risen from 6% at the beginning to 20% today (Blanco, 2023). The direct contribution of the PV sector to the Spanish GDP was 7,014 million euros in 2022, 51% more than in 2021, and the number of direct, indirect and induced jobs was 197,383, of which 40,683 were direct (Red Eléctrica, 2023).

Today, this technology is being more actively developed in our country due to its low environmental impact compared to other types of vehicles, lower technology cost and high availability of resources (around 2500 hours of sunshine per year). Spain is well positioned to develop this technology, which will help us achieve our European targets and accelerate the energy transition worldwide. The sun's heat can also be used in addition to light to heat water in our homes or even to generate electricity, such as solar thermal power plants. In one way or another, these energies provided by the sun, both light and heat, make up 5.5% of the energy consumed in Spain, according to the report by Red Eléctrica de España, but it has also grown at a faster rate in 2019 due to the elimination of the tax on solar energy that year, so it has grown from 2018 to 2019 by

88.3%, although there is still a lot to do in addition to Spain being abundant in terms of hours of sunshine.

The increase in the use of renewable energies has been based on the need to implement agreements or policies that promote their use and allow the protection of the environment, this is how some international treaties have set objectives or goals to improve the environment, the most important of which is the 2030 Agenda created by the UN in 2015.

After having a more global idea of what they are and the types of energy there are also follow some laws and regulations to which are hosted such sector where Government of Spain count with the protection of the environment, and have methods to analyze if the areas are allowed for installations and licenses, The Spanish government is also interested in promoting the development of renewable energies through the presence of subsidies and aids, which will later be granted in addition to investment facilities for financed projects, joint contracts with existing electricity companies and to be able to reduce consumption, as well as the sun tax, which is still a frequent question in the offices of this sector, from their own experience, and the regulation of the renewable energy sector (Grupo Espacio Industrial, 2021).

3.3.The "Sun Tax" is a major obstacle for photovoltaics.

Due to wanting to bring a change in terms of a better world by doing their bit, society had and has many doubts about what matters: which is how much this change costs and the installation of equipment and use of this type of energy for the pocket of each taxpayer and therefore the most frequent doubt that occurs is due to lack of information on the sun tax is why it is about clarifying this issue. To carry out the solar or photovoltaic installation you have to take into account that since 2018 there is no longer this tax, this toll was approved in the Royal Decree 900/2015 which regulated the self-consumption facilities, however the famous "sun tax" was eliminated in 2018, hence there is a boom of photovoltaic installations from 2018 to the present, since the elimination of the tax greatly boosted the use of this energy in Spain, being the only country where it was imposed and contribute to energy savings (Selectra, 2023).

Focusing more on Spain and the challenges towards sustainability in the country by 2030 would be the following.

3.4.Photovoltaic regulation and processing of photovoltaic installations.

As for the new regulation in force, it encompasses all the aspects to be taken into account, such as the need for a more democratic model and to continue to evolve in a regulation on photovoltaic energies, thus embarking on a legal path towards sustainability (Presicce,L, 2019).

For the sake of clarity, it should be noted that the legislation in these aspects is governed by RD 244/2019 which regulates the administrative, technical and economic conditions established in Royal Decree 15/2018 on urgent measures for energy transition and protection of citizens who have invested in photovoltaic energy for their own needs. The most important changes stipulated in the new regulations on the installation of photovoltaic panels are:
All procedures must be notified to the supplier, but depending on the type of installation, certain permits and licences are required. Depending on the type of installation, licences are required or not. For example, in the case of installations without discharge, it is only necessary to have the installation certificate, a report and the engineer's project of the supplier, if applicable. However, in the case of installations with surpluses, it is necessary to be connected to the grid and process the documentation within a maximum period of 10 days and the supply company, such as Iberdrola, Endesa or Gas Natural (which are the best known), are obliged to respond within a maximum period of 5 days, in addition to complying with the requirements of Law 24/2023, of 26 December on the Electricity Sector (Selectra, 2023).

4. Sustainable development challenges for 2030 in Spain.

Due to the increase in CO2 emissions from the combustion of vehicles, factories and others, it is necessary to look for alternatives for combustion with a lower level of emissions, and even to avoid polluting products, as well as to avoid disposing of plastic waste in marine waters or rivers. The second problem that stands out is efficiency. Spain shows serious deficiencies in key indicators of human capital development and

cumulative productivity growth, such as in the case of wetlands where there would be insufficient capacity for the performance of other activities to improve climate and environmental conditions (United Nations, 2023).

In order to improve these problems, Spain establishes governmental measures such as aid and information among other important measures such as, for example, reaching pacts like the European Green Pact for the achievement of these objectives, since without them it would not be possible to reach the goals set for the year 2030, which is to achieve sustainability by applying radical changes. The challenge in terms of productivity improvement must focus on significantly increasing investment in R&D and improving quality along the human resource development chain and technology transfer to the business structure, as Spain needs to reach a broad consensus in society, both within political parties and in the business, social and cultural sectors, to move forward with confidence in its development tasks. Due to the current inequality in developed and well-resourced countries and in developing countries, there is a need for a significant increase in capital mobilisation, as well as technical discussions on the best public policy options to address these challenges (United Nations, n.d.).

5. Impact of green energies.

5.1. Economic impact of renewable energies.

Both the increase in the price of fossil fuels and the drop in renewable energy has caused the green (clean) economy to overtake the fuel sector, due to the importance of renewable energy in the green economy, being an important pillar in the green economy, since increasing production in renewable energy has led to the need for more materials manufactured with a view to caring for the environment by using clean and recyclable energy, such as the green economy, which also contributes in particular to lower vehicle emissions and low carbon emissions, among others. Consequently, as renewable energy production increases, green energy increases and investment opportunities become more significant and secure, according to the FTSE Russell report (United Nations Climate Change, 2018).

The green economy has reached the fuel sector, which accounted for approximately USD 4 trillion from pollution abatement services such as recycling, water sanitation and others. If the sustainable economy keeps up this pace in terms of lower emissions and especially the abundance of clean energy, it could reach the targets by 2030 and account for 10% of the value of the global market (United Nations Climate Change, 2018).

As the report says, it encourages investment in the green economy as it highlights how essential the green (clean) economy is for the production of materials that are less polluting for the climate, among other things, and therefore the importance of playing a role in achieving the objectives set, we should be even more confident and committed to the challenge of climate change in 2030, as it has international support. According to the FTSE Russell report, which I say Espinosa, P.", "Climate change is the death of progress. Climate change is the death of progress and prosperity. Doing nothing about it is simply a bad investment for the future. "It is clear that the new economy is clean, green and prosperous, and I encourage everyone to be part of it" (United Nations Climate Change, 2018).

6. Advantages and disadvantages of photovoltaic energy in Spain.

The responsible use of the planet's resources is increasingly becoming one of the most popular and necessary topics of debate in energy policy. The inevitable need for our economy to rely on clean and sustainable energy sources is becoming increasingly clear.

Solar energy as mentioned above comes from the sun and is delivered to us in the form of light, heat and sunlight. This energy can be obtained by two different methods: thermal convection and photovoltaics. In order to understand the benefits and disadvantages of these energies more clearly, the following aspects are mentioned below.

Among the main advantages of the use of photovoltaic energy are the availability of cleaner energy of unlimited use, improved environmental health, no noise and helps to reduce emissions, as well as compensation for solar surpluses (energy produced but not consumed) in self-consumption solar installations, while solar installations also allow savings of up to 70% on electricity bills, as well as being beneficial for agriculture and beekeeping. Moreover, subsidies and grants provided by the government are available, which can increase savings to up to 40% of Spanish households (Selectra, 2023).

Box 1. Example of the benefit of renewables in beekeeping:

It has been observed that photovoltaic areas can favour beekeeping thus benefiting the world of the countryside. The use of solar power plants in beekeeping is also widespread: Spain has extensive experience in the production of "solar honey". An example of this trend is the honey produced in hives located in photovoltaic plants in Carmona (Seville) or Andévalo (Huelva) (Grupo Espacio Industrial, 2021).

However, its main disadvantages are that it is difficult to store, as it is necessary to have a large area of land and it depends on the intensity of sunlight each day, so it would be necessary to have another additional device for consecutive days of low sunlight. In addition to having to have sufficient space for the photovoltaic installation, an initial amount of money must be available as an investment for the installation, which would not be amortised until after 5 to 10 years depending on the solar installation available in the house (Ibérica, 2021).

7. Characteristics of photovoltaic energy consumption.

7.1. Photovoltaic self-consumption.

More than 298,000 homes and more than 54,000 installations in rooftop generation companies represent 1.8% of the national electricity demand: this is one of the main conclusions of the I Annual Report on photovoltaic self-consumption,.The report, based on information obtained from real data from the main companies in the sector, covering almost all the finished equipment and installations sold in Spain, shows unprecedented growth: in 4 years, the annual installed capacity has multiplied by 26 (Cambio Energético Especialistas en Ahorro Energético y Renovables, 2019).

"We are living an unprecedented energy revolution. "It is good that 2,649 MW of clean and distributed generation have been installed, but it is important that by 2022 more than 217,000 new households will be apostles of a generation method", Autoconsumo in its launch report (Cambio Energético Especialistas en Ahorro Energético y Renovables, 2019).

Solar self-consumption installations can be shared, for example if you are an industrial estate or in the case of neighbourhood communities, where in the latter case the express consent of all the neighbours would first be required, if only one of the neighbours is excluded, under no circumstances would the installation be feasible, if everyone agrees, whether it is the case of an industrial estate or a community, then the profits obtained

will be shared equally (Cambio energético specialists in energy saving and renewables, 2019). Figure 1 shows the figures for self-consumption of photovoltaic energy in Spain in schematic form.

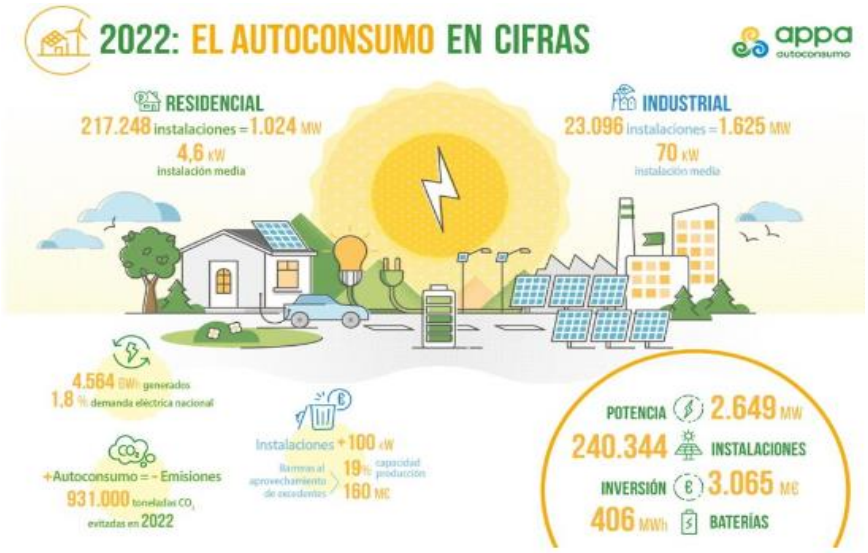

Figure 1. PV self-consumption figures. taken from: APPA (2022). I annual report on photovoltaic self-consumption**..** https://www.appa.es/i-informe-anual-del-autoconsumo-fotovoltaico/

The aim of self-consumption is not to completely isolate oneself from the grid, but to save as much as possible on the electricity bill. During the day the energy generated by the photovoltaic installation will be used and at night the energy from the grid will be used, which together with a certain coefficient of hourly discrimination will allow paying less for the energy captured from the grid. The advantage is saving the day, as energy bills are significantly reduced and you can also avoid battery costs because you can always stay connected and never run out of power. Since April 2019, self-consumption of solar energy has been regulated by Royal Decree 244/2019 of 5 April, which regulates various types of self-consumption. The types of self-consumption photovoltaic installations are described below.

7.1.1. Self-consumption photovoltaic installation eligible for compensation.

This type of installation is characterised by the economic use of its surplus energy, which is generated, for example, when we are not present at the installation site and therefore do not use it. This energy is fed into the grid and compensated. In this case of an installation that is subject to surplus compensation, it is necessary to have a specific meter called a bidirectional meter that counts the energy demand from the grid as well as the surplus, which can be rented by the same distributor and/or installation company (Selectra, 2023).

The price per kWh is the average and/or balance of the other bidders, followed by a leader usually between 4 cents/kWh and 5.5 cents/kWh. In Figure 2, the characteristics of this type of installation are detailed (Selectra, 2023).

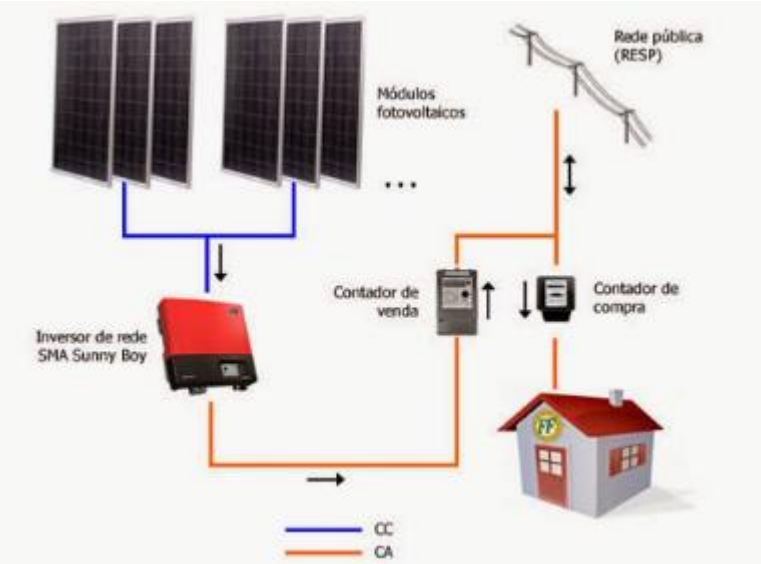

Figure 2. Self-consumption photovoltaic installation under compensation. Taken from Google images. Note: direct current (DC) alternating current (AC).

7.1.2. Self-consumption photovoltaic installation with battery storage.

In this self-consumption option a surplus battery is introduced, accompanied by the installation, which allows you to consume hours when there is no solar radiation. However, you are connected to the grid, so that after the energy accumulated in the

battery is finished, you can continue consuming what we remove from the web. All these installations have certain advantages, such as guaranteeing full use of the energy produced, avoiding losses of both own energy and energy extracted from the grid during transport. If this type of installation is chosen, the initial investment must be taken into account. Adding batteries to the kit means that material costs and battery life increase significantly; therefore, the depreciation allowance should be checked to ensure that it is cost-effective. In Figure 3, the characteristics of the self-consumption photovoltaic installation with battery storage are detailed (Saclima solar photovoltaic, 2016).

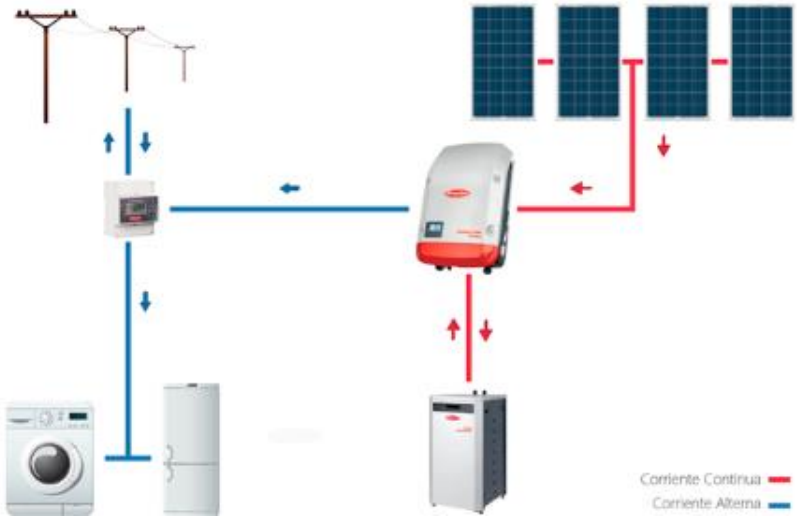

Figure 3. Characteristics of the self-consumption photovoltaic installation with battery storage. Taken from Google images.

7.1.3. Self-consumption photovoltaic installation without surplus.

The main characteristic of this installation model is that it does not pump to the grid, but consumes energy when necessary. These settings are very similar to the previous ones, with the difference that an anti-dumping mechanism is added to the settings, which will communicate directly with the inverter, thanks to which no more energy will be generated than is consumed and will not enter. the grid. By dumping the surplus, the opportunity to use it is lost without others benefiting from it and without receiving any compensation or benefit for the energy produced. In this case, it is not necessary to change the meter, as this is a very common question, unlike in the case of surplus mentioned above.

7.2. Types of photovoltaic installations.

7.2.1. Isolated installations.

Self-consumption photovoltaic solar energies allow us to take advantage of the energy produced by solar radiation to convert it into electrical energy (DC) and alternating current (single-phase or three-phase) for use. Their advantages depend on many different factors, such as the place of installation, the electricity consumption needs and the current regulations of the area where the photovoltaic system is installed. There are two types of PV installations for self-consumption of electricity: grid-connected and off-grid. The main difference between the two is that the former can consume electricity when necessary, while off-grid installations do not have this option. Generally, off-grid installations have no choice but to switch on the batteries. Another difference is the inverter. In a grid-connected photovoltaic installation, for the inverter to work, it must be connected and synchronised with the grid; in off-grid installations this is not necessary.

First of all, the off-grid system: off-grid systems are not connected to the electricity grid. The electricity produced is consumed on site, independent of the grid. At the heart of this type of photovoltaic installation are the batteries or accumulators that are used to store the energy, so that surpluses generated during periods of high productivity can be stored and used during periods of low sunlight, as well as inverter chargers and generators. The latter is optional for small installations, but recommended for larger installations. The design of the installation will be such that the energy generated and the storage capacity will allow several days to pass without receiving specific radiation. The isolation installation is ideal for homes or businesses (farms, etc.) isolated from the electricity grid and is the most economical and sustainable option in this case. This type of installation complies with the low voltage regulations and specifications for off-grid installations (The Energy Blog, 2023).

7.2.2. Installations connected to the electricity grid.

Here we can see the sunlight collected by the photovoltaic panels connected to an accumulator/battery controller which would be useful for storing the light on a sunny day and making it available on consecutive cloudy days, which would provide greater peace of mind in terms of supply. Then connected to an inverter that transforms the direct current from the batteries into alternating current to be consumed in our homes in terms of electronic devices. And as for solar photovoltaic installations connected to the electricity grid, it would be as follows: This type of installation is characterised by the fact that it remains connected to the grid, this is a distributed generation model. They prioritise their own consumption, self-consumption, using energy from photovoltaic systems if they can rely on them, and when they cannot, they draw energy from the grid. What distinguishes this or that type of installation is the management of the residual, i.e. what we do with the energy generated and not consumed by our installation (The Energy Blog, 2023).

Industries can also benefit from the compensation of surpluses as long as they are greater than 15 kW and a grid connection is contracted, otherwise it is not profitable to benefit from this compensation (Cambio energético, specialists in energy saving and renewables, 2019). The compensation will depend on the distributor and the solar or photovoltaic producer. Another use that can be given to photovoltaic energy other than household consumption is the use of this energy for the operation of electric cars, which run on batteries that can be recharged through this energy. The increase in the use of this type of car is due to policies and legislation that increasingly promote the use of this type of vehicle with the aim of reducing the emission of polluting gases and environmental protection. The relationship between electric cars and photovoltaics is described below.

Photovoltaic energy as we have talked about previously has quite a few benefits and one of them would also be to take advantage of it to charge electric cars so that it takes intensity the end we want to reach which is to reduce the levels of CO2 and pollution. For this reason:

Nowadays, one of the most frequent uses is to use photovoltaic panels to charge electric cars, and more and more people are switching to electric mobility, making a significant contribution to environmental protection, and therefore charging the car with green electricity, because it is not the same if I charge the car with polluting energy, as it is with clean photovoltaic energy that I am helping not to pollute, which is the goal after all if you buy a car with low emissions. So the best way to do this is to use solar energy from your own PV system, because the energy you can collect from your own roof is clean and very cost-effective. Currently, solar energy is the most cost-effective form of electricity. Therefore, using it to charge electric vehicles makes economic sense. It is best to use your own PV system so that the energy your car uses is not only environmentally friendly but also extremely cost-effective (Fronius, 2018).

In addition, the economic benefits of charging allow you to amortise the cost of your electric vehicle purchase even faster. Also, such vehicles offer longer-term economic benefits than internal combustion engine vehicles because they require less maintenance. Everyone can use such photovoltaic systems. In fact, the investment can pay for itself more quickly if you use as much electricity as possible. If you charge an electric vehicle with photovoltaics, you can achieve exceptionally high self-consumption. With charging solutions such as Fronius among other providers, as they are the best-selling and most efficient, your electric vehicle will automatically charge itself when there is excess PV power in your home. This way you can simply charge it with energy that is no longer in use and put it on the public grid (Fronius, 2018).

9.Conclusions.

In 2015, the 2030 Agenda was born with the 17 Sustainable Development Goals (SDGs) where agreements are created to help the neediest countries, hunger and above all the environment, which is the focus of the analysis. And the objectives are to reach this goal where it is committed to lowering greenhouse gas emissions among other climate goals as well as focusing special attention on SDG 7 as it is based mainly on sustainable development due to the importance of making the energy used for electricity more sustainable as well as being the concept of analysis of this work. It is also worth mentioning that sustainable development means that poorer countries are developing faster and energy efficiency is improving thanks to renewable energy sources.

Nowadays, renewable energies are gaining more weight, especially in photovoltaic energy, as we are seeing an increasing number of solar panels being installed in isolated houses as well as in new constructions and houses in general, reaching last year to represent almost half of the national production with 42.2%. In addition to photovoltaic energy, wind and hydroelectric energy should be mentioned, highlighting that this year 2023, wind energy obtained more than 20% of the electricity generated in Spain, together with hydroelectric energy, covering 8.2% of the national electricity demand.

emissions in Spain must be reduced by at least one third in order to meet the target set by the Climate Change and Energy Transition Act for the year 2030. To this end, Spain has established governmental measures to achieve the 2030 target.
The famous "sun tax" was abolished in 2018, which is why there has been a boom in photovoltaic installations from 2018 to the present day.

Green energy is beating the fossil fuel economy due to the increase in the price of fossil fuels as well as the decrease in renewable energies, which has caused the green economy to overtake the fuel sector with the help of renewable energies, which are a fundamental pillar for the development of the green economy. The regulations related to the electricity industry are being profoundly reformed.

Spain is one of the countries with the highest number of solar or photovoltaic installations. Nowadays you can see many houses with roofs full of photovoltaic installations, this is a fact, which to a greater or lesser extent makes us more aware and see that we can go a step further and raise awareness a little more to contribute to a sustainable world, but the use of photovoltaic or solar energy began years ago.

There are two types of photovoltaic installations, isolated and grid-connected. The main difference between isolated photovoltaic installations is that the former can consume electricity when necessary, with the inverter connected to the grid, while the isolated installation must have batteries to be able to consume the electricity generated, but in this case it is not necessary to connect the inverter.

The main advantages of the use of photovoltaic energy are to have a cleaner energy and unlimited use, improve environmental health, does not make noise and helps to reduce emissions, also of solar surplus compensation, also allow savings in the electricity bill up to 70%, however, its most prominent drawbacks would be that it is a difficult storage,

since it must have a lot of land and depends on the intensity of sunlight each day, in winter you depend much more because there are not so many hours of sunlight.

The types of self-consumption are a) Self-consumption photovoltaic installation with compensation, characterised by the economic use of its energy surplus,

b) Self-consumption photovoltaic installation with accumulation in batteries, a surplus is introduced from the battery, accompanied by the installation, which allows it to consume hours in which there is no solar radiation.

c) Self-consumption photovoltaic installation without surplus, are very similar to the previous ones, with the difference that an anti-dumping mechanism is added to the settings, which will communicate directly with the inverter, thanks to which no more energy will be generated than is consumed and will not enter. the grid.

In addition to the modality of being isolated or grid-connected installations: Isolated: Installations of this type are not connected to the electricity grid. The electricity produced is consumed on site, independent of the grid. The heart of this type of photovoltaic installations are the batteries or accumulators that are used to store the energy, so that the surpluses generated in periods of high productivity can be stored and used in periods of low sunlight, as well as the inverter chargers and generators. And 27 as for the solar photovoltaic installations connected to the grid would be the following, This type of installation is characterised by remaining connected to the grid, this is a model of distributed generation. They prioritise their own consumption, self-consumption, using energy from photovoltaic systems if they can rely on them, and when they cannot, they draw energy from the grid.

Everyone can use such photovoltaic systems to charge their car, in fact, the investment can pay for itself more quickly if you use as much electricity as possible. If you charge an electric vehicle with photovoltaics, you can achieve exceptionally high self-consumption, which is the goal after all.

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