Overview

Climate change poses considerable risks to the human species and to natural ecosystems, and consequently to our economic, social and cultural systems. But it also hides some excellent opportunities.

The consequences of inaction could be underestimated at this time, and a failure to come up with systems that facilitate the transition to renewable sources could be fatal, and it is of utmost importance that there are not only immediate reactions, but also actions that anticipate future developments.

The Earth's ecosystem is constantly changing; it is never the same.

Typically, climate change occurs slowly over time on a scale of thousands or millions of years. This allows living species to adapt. In some rare cases, however, shocks can occur that abruptly alter the ecosystem and climate in a very short period of time, such as an asteroid impact or the eruption of a supervolcano, although thankfully natural shocks are very rare. Unfortunately, however, human activity, so technological, economic and demographic development now has a significant impact on our climate, bringing this activity almost on par with an external shock, as the consequences are being felt quickly and are quite severe.

Human productive activities release large quantities of greenhouse gases through the combustion of fossil fuels, thus increasing the *Greenhouse Effect*, i.e. the phenomenon of global warming due to the presence mainly of carbon dioxide, methane and water vapor in the Earth's atmosphere. It is important to understand that the greenhouse effect is what makes the earth hospitable, with average temperatures of 15°C, on the contrary without the greenhouse effect temperatures would be around -15°C, with practically impossible living conditions for most species. On the other end, when the greenhouse effect is not natural, but *Anthropogenic*, it creates the effect of *Global Warming*, which is one of the major environmental problems and challenges of our time.

The problem of the greenhouse effect has been known since the 1970s, and since the 1990s the international community has attempted to reduce gas emissions through a binding agreement called the *Kyoto Protocol*, committing to a 5.2% reduction in emissions by 2012. However, many large countries did not ratify the protocol, while developing or emerging countries were not included so as not to hinder their economic growth trajectory. In December 2015, the *Paris Agreement* was signed, also an agreement between states regarding the reduction of emissions from 2020, with the aim of containing the increase in average global temperature below 2°C, which is the only way to reduce the risks and effects of global warming, with a target of a maximum increase of 1.5°C by 2030. Beyond this threshold, the impacts of the climate crisis could be catastrophic and irreversible.

However, as we have learned from the last global crisis, Covid-19, every crisis also provides an opportunity, and our job is to understand where and how humans should focus their efforts, especially from an economic point of view.

The objective of this research is to illustrate an overview of the legacy energy market, and then analyze the future evolution of the renewables market.

Cause & Effects:

As mentioned above, productive activities release a large quantity of greenhouse gases into the atmosphere, increasing the so-called greenhouse effect to an unsustainable level. When the heath becomes excessive, the balance of the ecosystems and of the biosphere is put at risk. In fact, it is important to understand that there are two types of greenhouse effect:

- **Natural Greenhouse Effect:** a natural system of temperature regulation, which is the natural phenomenon that warms the Earth and makes life sustainable. The environment releases CO2 through the plabts, organic decomposition or volcanic activity.

- **Anthropogenic Greenhouse Effect:** caused by the excessive presence of greenhouse gases in the atmosphere due to the release of CO2 and methane from the atmosphere to the release of CO2 and methane from human activities.

The increase in emissions begins in the 19th century, after the first industrial revolution and then due to the massive use of coal as fuel in heavy industry, transport and domestic heating. In the 20th century, emissions increase exponentially with the invention and diffusion of the automobile, the production of electricity and the use of oil derivatives. In the last 50 years, methane emissions have also increased, mainly due to intensive livestock production. According to estimates, between the 19th and 21st centuries, CO2 emissions increased by 30% and methane emissions by 200%.

The energy sources that have fueled this destructive process are therefore the so-called non-renewable energies, among which we find:

- **Oil:** dear old oil continues to move the economy, cars and industries, even if recently something is changing and dependence on this source is decreasing, but at a rate still too slow compared to the real goals set by countries.

- **Coal:** coal was the main source of energy in the first industrial revolution, in the eighteenth and nineteenth centuries, and it is still today one of the main resources. Currently, coal is mainly used to produce electricity in thermal power plants.

- **Natural Gas:** natural gas is made up of gaseous hydrocarbons found in the subsoil from where they escape spontaneously or are extracted through drilling. It is the last source of fossil energy to be exploited and can be used for the production of heat and energy.

Although it may seem too catastrophic a vision, many scientists believe that there is little time left to save the earth, and that we must reverse course before the consequences are irreversible. According to the report of the *IPCC,* the most important scientific body dedicated to climate research, by 2030 the increase in average temperature will be more than 1.5° C, probably reaching 2° C.

The most important effort in recent years is represented by the *Paris Agreement*, which commits governments to act on greenhouse gas emissions to keep the increase in temperature below 2 degrees by 2050, also focusing on economic opportunities offered by the development of renewable energy, particularly solar and wind power. Climate change obviously affects all regions of the world, but with different modalities and intensity: some areas are affected by heat waves, fires and droughts, while other areas are becoming much more prone to very dangerous floods and inundations.

In fact, among the main consequences, direct and indirect, of climate change are:

- **Melting ice and rising seas:** Sea level has been rising since the 1950s and its rate of increase is accelerating, considering that in the last fifteen years it has been about twice as high as in the previous 2 decades. The melting of glaciers and the loss of mass from the continental ice caps have contributed about 60% to the rising seas. Increased freshwater flow from Arctic rivers to the oceans alters sea level as it reduces salinity and thus seawater density, causing sea level to vary from region to region.

- **Flooding:** Committee Chair Ursula von der Leyen. after the severe floods in Germany and Belgium in 2021 in which nearly 200 people died, with damage to homes, roads and infrastructure, called the floods 'a clear sign of climate change', a sign that by now even the world's most important institutions are focused on solving this problem.

- **Prolonged periods of drought:** According to the *World Food Program*, at the time of writing, more than one million people in southern Madagascar are struggling to get enough to eat due to what could be the first famine caused by climate change. In fact, in Madagascar the dry season usually lasts from May to October, and the rainy season starts in November. However, in recent times, climate change seems to have interrupted the cycle, primarily affecting small farmers, as the main use of water resources around the world is agricultural in nature. Madagascar could be just the first example of what is going to happen in many countries vulnerable to climate crisis, and many experts predict more and more frequent water crises around the world in the coming decades.

According to the IPCC report, to stay below the 1.5°C threshold, carbon dioxide emissions must decrease by 45% by 2030, and by 100% (so called carbon free) by 2050. To achieve these goals, four main paths are laid out:

1. **Substitution** of energy from fossil fuels with energy from renewable sources.

2. **Electrification** of transport and heating.

3. **Reforestation** of the planet, through which billions of tons of CO2 will be removed from the atmosphere.

4. **Change in the agricultural sector**, with innovative applications to reduce water use.

At this point, we have certainly realized that the main problem of climate change is energy production. In fact, although many are moving towards electrification, especially of transport, this will prove totally useless if the source of electricity is 70% dirty energy. For electrification of transport to make sense, it is of absolute importance that the energy that powers it is produced from renewable sources.

But what are renewable sources and which are the most efficient?

Renewable energies are energy sources whose use does not affect the natural resources available to man. These energy sources regenerate after each cycle of use and, therefore, are inexhaustible. Some renewable sources are present in large quantities and are not affected by intensive human exploitation, such as the sun and wind. These two sources are continuously available on planet earth, even if intermittently.

Renewable energy sources are therefore those whose use does not affect the availability in the future. The main sources, as well as the most efficient, are:

- **Solar Energy:**

  Solar energy is the best known and most widely used renewable source. It is the flow of energy radiated by the sun towards our planet, and only part of the sun's rays reaches the ground. The other part is instead absorbed by the atmosphere (if this were not so, there would be no life on our planet). The flow of solar energy that invests the Earth plays an essential role in the balance of the biosphere and ecosystems. In particular, it fuels the process of chlorophyll photosynthesis that allows green plants to transform energy from the sun into organic matter, and the birth of vegetation is obviously the basis of the food chain. This energy can be transformed, after decades of study and technological advances, into energy useful for human activities. The main technique to transform solar energy into useful energy is that of solar panels, which can be:

  Photovoltaic, that is, they produce electricity with solar energy. When irradiated by sunlight, the panels generate an electric current for an effect called 'photovoltaic effect'. The system therefore transforms solar energy into electricity and feeds it into the national grid, or makes its own consumption.

  Thermal, that is, they allow you to heat domestic water for daily use without using gas or electricity. They use heat from the sun to use it for heating or hot water production.

  Solar energy is therefore a clean, ecological and renewable resource that can and must allow to improve the quality of life and reduce dependence on the use of fossil fuels for the production of electricity. The solar energy market is expected to grow with a CAGR of 20% in the next 5 years.

- **Wind Energy:**

  It is the source of energy generated by wind, from the continuous movement of air masses. Wind power is one of the oldest sources of renewable energy, as for millennia it was the only source of energy for maritime navigation over great distances. Windmills also used wind

energy which, by moving the blades of the mill, the mechanical energy generated was used to grind grain, olives and agricultural products. Wind power is the evolution of windmills.

A wind turbine consists of a support pole, a rotor, and wind blades. The pole has the function of placing the wind blades as high as possible, depending on the size, and have the task of capturing the energy of the wind which then through the mechanical rotor transforms mechanical energy into electricity. They are usually located in hilly and coastal areas, with constant winds. Lately, off-shore wind power has emerged, with wind turbines located in the high seas, where the wind blows more constantly, and is the ideal place to capture it.

- **Hydraulic Energy:**

Hydraulic energy is the force of water movement. As much as a mass of water moves, it produces an enormous amount of energy. The movement of water has been studied by man since ancient times, especially for agricultural production. Initially, man undertook to convey the water in basins or wells, with the passage of time it was realized that it could also be used to produce mechanical energy, and then were born water mills. Since 100 years ago, water is also used for the production of electricity through the so-called hydroelectric power, which even today, especially in Italy, is a very important source of renewable energy, and the most used in Italy.

- **Geothermal Energy:**

Geothermal energy is a natural energy source that uses the heat of the subsoil to produce electricity, or heat water or indoor environments. Geothermal energy is widely used in countries with a lot of volcanic activity and tectonic movements, such as Iceland, which uses geothermal technology on a large scale to produce electricity.

- **Biomasses:**

Biomasses are organic materials from agriculture, forestry, livestock waste, which are used to produce electricity. They are also considered renewable energy, having a much lower environmental impact than fossil energy sources. The main materials used are wood, processing waste in the agro-food industry, organic waste, plants and vegetables, waste and effluents from livestock farming, agricultural residues. In this sense, these materials can form a fuel of organic origin. Not to be confused with the incineration of municipal solid waste which, despite having the same purpose, i.e. to use the heat produced by incineration for heating or electricity production, the process and environmental impact are very different.

- **Nuclear Energy:**

Despite not being officially recognized as a renewable source due to the difficulty in disposing of waste, nuclear energy is actually the technology with the most energy efficiency but at the same time with the least emissions available to man. However, after the Chernobyl accident in the 80's, the development of nuclear power had a long period of stop, although in recent times it is coming back in vogue. Certainly, the use of this technology would be very useful to ensure continuity of energy with low gas emissions. On the other hand, building a nuclear power plant requires a lot of time and capital, and also the disposal of radioactive waste could be a very significant problem. Not to mention of course the tail risk of accidents similar to Chernobyl. We must absolutely avoid solving a problem while creating others potentially more serious for humanity, but this does not take away from the fact that in the future this

type of energy could flank renewable sources, to give more continuity and reliability to the energy system.

Fossil fuels used for electricity production in Italy, such as natural gas, coal and oil, are largely imported from abroad, due to the scarce presence in the territory. We firmly believe that this ecological transition could represent a great opportunity for the boot. Contrary to fossil fuels, Italy has an incredibly high potential for *RES* (*Renewable Energy Sources*), as our country has a high concentration of sun, wind, geothermal and hydraulic energy. It has been estimated that with the potential of a region like Sicily alone, half of Europe could be illuminated. If well exploited, these sources of energy could represent what in recent centuries oil, gas and coal have represented for countries such as Saudi Arabia, the United States, Russia and China.

But then why not exploit these energy sources immediately?

We have identified three major obstacles that limit the production of energy from renewable sources not only in Italy, but in many parts of the world:

1. **Battery Storage**

   Energy from renewable sources such as solar and wind, i.e. the cheapest and most scalable ones, have a major flaw: they are intermittent, and suffer from what is known in the energy industry as the *'duck curve'*. The sun shines during the day but not at night. The wind is unpredictable, but tends to blow harder at night. So energy supply is either abundant or non-existent, as energy tends to peak during certain times of the day or night, or not produce at all. Demand, however, peaks around late afternoon and early evening, and this is a time when neither sun nor wind could be abundantly available. The result, then, is more power than society needs at certain times of the day, and not enough power when energy demand would be highest. In addition to being a daily problem, it is also a seasonal problem, as the sun shines more during the summer and the wind blows more during the winter.

   In order for these technologies to advance and penetrate the market, it is of paramount importance to develop batteries that can store excess energy produced both during the day, but also during the seasons. The battery storage market is very interesting, although it is not yet a scalable business on a large scale. More investment is needed to make the technology more efficient, but also more economical.

2. **Infrastructure**

   The challenge of storing excess energy is further compounded by grid congestion, similar to highway traffic. In fact, because most of the grid's transmission system was built in the previous century, many areas still have little transmission capacity relative to today's energy supply and demand. In addition, solar and wind projects are often built-in rural areas with lots of sunlight and wind, but little nearby load (i.e., end users with energy demand).

   Consider that in the U.S. alone there are more than 200 GW of malfunctioning solar and wind capacity, and that curtailment often occurs globally, which is the process of shutting down renewable energy production systems at times when supply far exceeds demand, risking congestion on the power grid and in some cases overloading it, with risks to the entire infrastructure. To make things simpler, imagine that oil started spurting out of your backyard, but you didn't know how to manage it and how to accumulate it, so you decided to plug the

hole and pretend nothing happened, even though you knew about the potential wealth under your feet. Doesn't that sound a bit stupid?

Decentralizing production systems also presents many challenges, as more and more people use self-generation and self-consumption systems, such as photovoltaic or micro-wind panels mountable on the roof of their homes. However, this increases the complexity of the electricity grid, which will have to respond to a continuous need for balance between supply and demand, which can only be achieved with smart grid systems, as well as greater flexibility and programmability of energy demand.

An interesting way could be to use excess energy to produce hydrogen, which would then be green hydrogen, i.e. obtained from renewable sources. But this would require adequate infrastructure for both the power grid and the transportation and storage of hydrogen. In addition, the continued growth of electrically powered vehicles will represent a major challenge for infrastructure, which will therefore need to be increasingly intelligent to meet the balance between energy supply and demand.

3. **Excessive Bureaucratization:**

Another obstacle of no small importance is the excessive bureaucracy present in the development of solar, but especially wind farms. This is a problem that plagues many parts of the world, but particularly Italy. Many regions have dozens of requests to start up solar and wind power plants, but due to many landscape constraints, and delays in administration, many projects end up stagnating for years.

After the Covid-19 pandemic, the European Union has allocated a lot of funds and incentives, also in support of renewable energy development. As excessive bureaucratization is a serious problem, the European Union decided to grant these funds only if the applicant country would be able to carry out a bureaucratic reform. In this sense, Italy will be obliged to review its position in order to access these funds.

Selected Opportunities

Despite these limitations, we believe that the need to avoid disaster will outweigh any obstacle that comes our way. That's why we've identified companies, and a metal, that could play a very important role in this ecological transition.

Nextera Energy (NEE)

Company Profile:

- *HQ:* Florida (USA)
- *Market cap:* $165 Bn
- *Stock price:* $84

Founded in 1925, NextEra Energy, generates, transmits, distributes and sells electricity to retail and wholesale customers in North America. The company generates electricity through wind, solar, nuclear and fossil fuels, such as coal and natural gas plants. It also develops, constructs, and operates long-term contract assets with a focus on renewable generation facilities, electric transmission facilities, and battery storage projects; It also owns, develops, constructs, and operates electric generation facilities in wholesale energy markets.

As of December 31, 2020, the company operated approximately 28,400 megawatts of net generating capacity. It serves approximately 11 million people through approximately 5.6 million customer accounts on Florida's east and west coasts with approximately 76,200 circuit miles of transmission and distribution lines and 673 substations. In its most recent earnings release on October 22, 2021, the company reported negative results, with weaker earnings, revenues and profit margins. Revenue was down 8.7% from Q3 2020, and profit margin was also down 26% over the past year.

Despite this, it has tended to grow its earnings at a rate above its target market averages, and the company's goal is to have the largest, as well as the best, decarbonization platform in the world, and we have reasons to believe that it could really compete, especially in the United States. In fact, it remains well-positioned to be the leader in the clean energy transition, fueling the company's future profitability, with earnings forecast to grow 13.5% year-over-year over the next 5 years.

The company's share price has been largely unchanged in recent months, due primarily to concerns about monetary policies, inflation and uncertainties over Covid-19.

Plug Power (PLUG)

Company Profile:

- *HQ:* New York (USA)
- *Market cap.: $*19 Bn
- *Stock price:* $32

Plug Power Inc. provides turnkey hydrogen fuel cell solutions for the electric mobility and stationary power markets in North America and Europe. It focuses on proton exchange membrane (PEM) fuel cells and fuel processing and hybrid fuel cell/battery technologies, as well as related infrastructure for the generation, storage and delivery of hydrogen and green hydrogen. In addition, the company offers dispensing, generation, storage and delivery systems for clean hydrogen supply. It has a strategic partnership with Airbus to decarbonize air travel and airport operations with green hydrogen.

The company will invest billions of dollars to increase green hydrogen production to 500 tons per day by 2025. The company's sales of green hydrogen to customers will replace current gray hydrogen purchased by Plug Power from incumbent gas suppliers, delivering it to customers at huge losses. The company believes that profit margins with the production of green hydrogen, i.e., produced from renewable energy sources, could provide a better profit margin, although this will depend on the production capacity of renewable sources. Very important will be the monetization of future tax credits proposed by the Biden administration, which could improve the picture in important ways.

The company certainly operates in a very promising sector, supported by governments and global corporations at a time of frenzy over the ongoing green transition. Despite huge losses in recent quarters, the company has a fairly strong balance sheet. Europe's push towards a green hydrogen future, China's push towards 1 million hydrogen fuel cell powered vehicles, will certainly be important catalysts to push the market. Europe has already launched ambitious goals for the hydrogen economy, and Plug power wants to become one of Europe's leaders.

The stock is down 55% from its February highs due to portfolio rotation from Growth to Value at the beginning of the year on concerns about inflation, monetary policies and covid-19. Valuations and future forecasts are very positive, even overly so at times. The company in question needs to prove it can deliver on its promises, and execution is never more important than now to the company's future. Even before considering financial data and results, the development and cost-effectiveness of their technologies will need to be closely watched.

Nio (NIO)

Company Profile:

- *HQ:* Shanghai
- *Market cap.:* $64 Bn
- *Stock price:* $39

NIO Inc. designs, develops, manufactures and sells smart electric vehicles in China. The company offers five-, six- and seven-seat electric SUVs, as well as smart electric sedans. In October 2021, the company reported monthly and quarterly deliveries for the third quarter and the numbers beat expectations. Nio delivered 10,628 vehicles worldwide as of September 2021, an annual increase of 125%, and 24,439 vehicles in the three months ended September, son an annual increase of 100%.

The company is making excellent progress on production and deliveries, also pushing for a foothold in Europe, with the first batch of vehicle deliveries in Norway. Nio is therefore on track for profitability, after recent losses in the previous year. Overall market confidence in Nio is very high, however, with the company expected to reach profitability in the next 2 years. Despite the slightly high debt, the company is well funded and has enough cash to cover the debt.

China is very well positioned in the electric vehicle sector and has all the makings of a dominant market. Nio could be a major player in the Chinese EV market and beyond.

Silver ($SILVER)

This time it's not a company, but a metal. An excellent opportunity to take advantage of the green transition could also be in silver. Silver is scarce by nature, so especially with potential inflation persisting in the coming years, it could increase in value.

But the reason we include it in this report is another. The production of photovoltaic panels and electric vehicle batteries will drive the demand for silver, since each photovoltaic module contains an average of 20 grams of silver, corresponding to 6.1% of the total cost of each construction. The choice of material is obviously not aesthetic, but purely technical: silver in fact is the metal with the highest electrical and thermal conductivity, making it perfect for producing the conductive paste for the front and back of most photovoltaic cells. Silver contacts are also used for most of the electrical connections in cars and serve a variety of functions. Increasingly electrified cars will require an increasing amount of silver, reaching 2,350 tons by 2040.

Conclusions:

Every crisis also presents an opportunity, if we can act in time and with the right plan. The climate crisis could bring the whole of humanity to its knees, and we have every reason to get seriously involved to prevent this emergency from becoming irreversible. Man has demonstrated an ability to adapt since ancient times, and we see no reason not to be optimistic and not to think that this time too man will adapt. We can and must succeed. But to do this, we need a true synergy between investors, policymakers and citizens.

From a financial and economic point of view, we believe that the renewable energy sector represents a great opportunity right now, especially in the field of solar energy and development of innovative batteries. Considering that the cost of energy for solar and wind in the last decade has decreased by 90% and 71% respectively, the costs of solar and wind energy are around 2-5 cents/kWh, as opposed to fossil fuels, which are around 5-7 cents/kWh. This means that these technologies are already priced lower than coal or natural gas, making these businesses already competitive and scalable.

Certainly, there are many challenges to be addressed, such as excessive bureaucratization, storage of excess energy, infrastructure upgrades, and disposal of waste produced by these sources. Increasing transmission capacity and energy storage will be key to solving some of these issues, especially as lithium-ion batteries continue to steepen their cost curve. For now, however, large-scale batteries are still too expensive to be universally deployed. After costs drop another 80%, they will still face physical limitations regarding their useful life and how long they can store energy without dissipation. They will, however, be the most important technology for storing cheap mid-day solar energy for evening peak demand. There will probably not be a dominant renewable resource technology, but it will all depend on the climatic and geological conditions of the location. We will likely utilize a mix of multiple energy sources to ensure sustainability but also energy efficiency and continuity. But, if up until now fossil fuels have powered the whole world, we strongly believe that the trend can and should reverse, with the next two decades probably characterized by a strong penetration of technologies based on the exploitation of renewable energy sources, especially solar and wind, being these two businesses already competitive and scalable on a large scale.

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