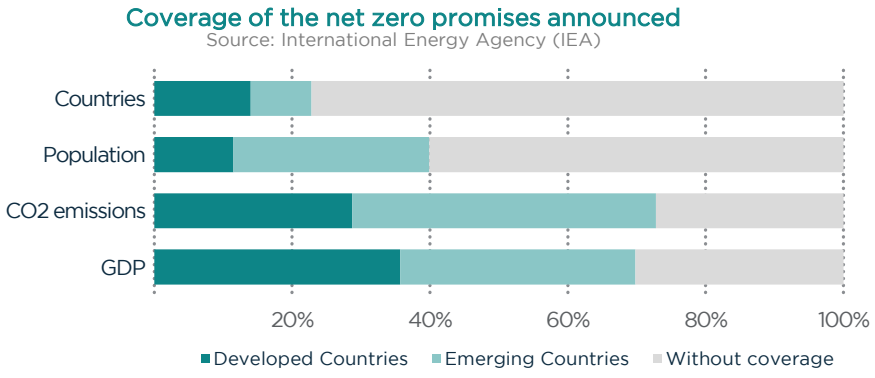
The challenges of the Energy Transition

The global concern over the effects of climate change has been discussed at international events since the 1990s with the aim of combining efforts to reduce emissions of the so-called Greenhouse Gases Effect (GHG). Signed by 195 governments, the emblematic Paris Agreement (2015) marked these nations' commitments to limit the increase in the planet's average temperature to below 2°C by the end of the century, with efforts to ensure that this rise would not exceed the 1.5°C mark. Since then, countries and institutions have assumed targets to eradicate net greenhouse gas emissions completely by 2050, also known as net zero, in a bid to prevent irreversible consequences for future generations.



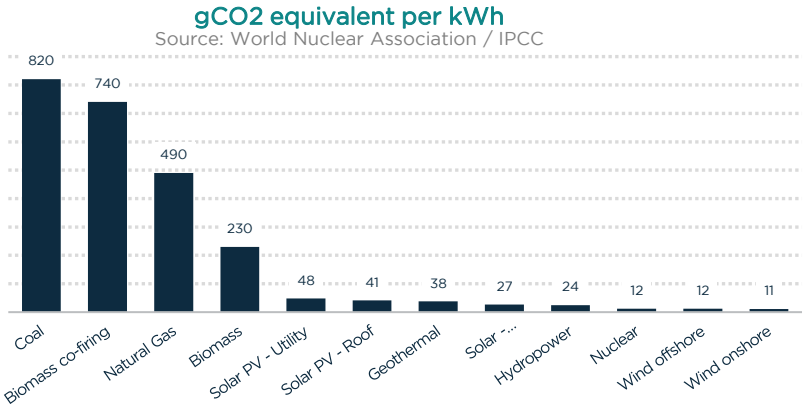
The countries which represent around 70% of the global CO_2 emissions and global GDP established targets to achieve zero net emissions in their laws, legislative proposals or in political documents.

These commitments were reviewed at the latest United Nations conference on climate change in 2021 (COP26) and, as a sign of their concern and of how important they judge the subject, countries representing about 70% of global GDP and CO2 emissions are making efforts and/or have made legal commitments to achieve net zero[1].

In this context, the Energy Transition discussion has become primordial as energy consumption is responsible for 73% of the greenhouse gases[2].

Among energy sources with lower carbon intensity, the following stand out: wind, hydroelectric, nuclear and solar power. These sources allow a reduction of at least 90% of carbon dioxide compared with traditional fossil sources during their life cycle[3], as can be seen in the following graph.

Moreover, although we agree about the remarkable efficiency of nuclear energy as a form of decarbonization, we believe discussions are still complex due to its inherent tail risk. One example of this is the accident at the Fukushima nuclear power plant that occurred in 2011. Faced with the uncertainty over how important nuclear energy will be in the global matrix, the focus of this Letter will be restricted to wind and solar power and their complementary solutions like batteries and green hydrogen. Hydroelectric power, in turn, has limitations due to its low availability of energy potential on a global scale.



However, decarbonization is only one of the guidelines that should lead policymakers in drawing up an energy agenda. Economic viability will also have to be considered to ensure a supply that is as affordable as possible and guarantee energy security, as the effects of any rationing could result in extreme economic and social consequences. While the competitiveness of renewable sources shows signs of being an issue from the past, we will see below that aspects such as intermittency and the amount and speed of investments required remain as the next challenges to be faced.

Renewables show greater competitiveness

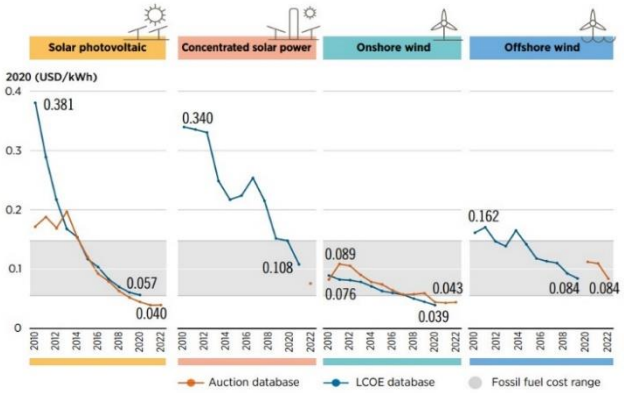
When talking about green energy, it's worth noting how the combination of technological advances and government incentives significantly increased its efficiency over the last decade. A study by MIT showed that public policies were responsible for approximately 60% of the cost reduction[4]. The technological advance in wind energy can be exemplified in the larger diameter of the blades[5] and in solar energy, the energy efficiency of the panels has developed mainly due to

1 IEA – Net Zero by 2050: A Roadmap for the Global Energy Sector. Read more here
2 Our World in Data – Sector by sector: where do global greenhouse gas emissions come from? Read more here.
3 World Nuclear Association – How can nuclear combat climate change? Read more here.
4 MIT – Explaining the plummeting cost of solar power. Read more here
5 DOE – Wind Turbines: the Bigger, the Better. Read more here

new materials and panel sizes[6]. Last but not least, the learning curve itself reduces the cost, as shown in Wright's Law where the unit cost decreases after accumulated production doubles[7].

A common measurement used in the industry to compare different energy sources is the LCOE (levelized cost of energy), i.e. the break-even selling price of energy for a typical generator to pay for itself at the end of its working life. The following chart shows how solar and wind energy are now already more competitive than fossil fuel sources, with the first one showing a slump of approximately 85% in US$/kWh and the last one, just 50% in US$/kWh between 2010 and 2022.

Global weighted-average of LCOE and PPA/auction prices
Source: IRENA – World Energy Transition Outlook 2022



Other important evidence highlighting the increasing competitiveness of renewables is the continued gain these sources are making in production share. They amounted to approximately 80% of added new capacity in 2021 compared with less than 20% in the early 2000s[8].

Despite their many benefits, the expansion of clean sources also has its challenges. Like any natural phenomenon, there is a normal statistical variation in wind and solar incidence, causing them to be inherently intermittent (e.g. winter in higher latitude regions or erratic wind systems). Therefore, a secure energy system requires reliable stabilizing sources in order to balance supply and demand.

Batteries and Hydrogen

Ideas gaining greater importance in the system's planning to solve the intermittency of renewable sources and maintain a low-carbon economy are mainly linked to batteries and green hydrogen. Each with its specific use. Batteries will be focused more on durations of between 4 and 10 hours of storage. On the other hand, hydrogen will have a similar use to that of natural gas today as it can be stored to deal with longer periods of low energy production from renewables. This is what happens in the German winter, for example.

When talking about batteries and green hydrogen, because their costs are still prohibitive for adoption on a large scale, we are in the technological development phase. As a result, these solutions should gain greater traction at the end of this decade if we assume a similar pattern to what we experienced in the fall of the cost of solar and wind energy.

The lithium battery has been produced on a commercial scale for at least 3 years, and government incentives were essential in making the electric car viable at the beginning. We are currently seeing a similar occurrence to what we saw with wind and solar power where the cost of the battery dropped by 89% between 2010 and 2022 from $1,220/kWh to US$135/kWh[9].

However, this cost is still high since the LCOE of the combined system (solar with batteries) will remain above US$0.20/kWh[10], i.e. higher than the cost of fossil fuels. A further reduction of around 50% will still be needed to achieve sufficient competitiveness and this progress will have to come almost entirely from lower battery costs. New chemistries are being refined such as the LFP (Lithium Iron Phosphate battery) and show great promise for further cost reductions.

In the case of low carbon intensity hydrogen, we can say it is still at a very early technological phase when compared to the battery. The hydrogen supply comes from three main categories: (i) grey hydrogen which comes from burning fossil fuels, particularly natural gas and coal; (ii) blue hydrogen which undergoes a process similar to grey hydrogen but is associated with carbon capture, utilization and storage techniques; and finally (iii) green hydrogen that is generated through the electrolysis of water from renewable energy which makes it the only one that can be considered a low carbon energy .

The technological development of the electrolyzer will be largely responsible for the viability of green hydrogen in the coming years, according to the IRENA[11] (International Renewable Energy Agency). It will cut the cost from the current US$5/kgH2 to around US$1/kgH2. The level needed for it to become competitive with fossil sources is below US$2.5/kgH2.

Heavy Investments Needed

6 Clean Energy Reviews – Most Efficient Solar Panels 2022. Read more here
7 DOE – Do electricity prices follow learning curves? Read more here
8 IRENA – World Energy Transition Outlook 2022. Read more here
9 BNEF – Race to Net Zero: The Pressures of the Battery Boom in Five Charts. Read more here
10 Lazard – Levelized Cost of Storage – Wholesale (PV + Storage). Read more here
11 IRENA – Making the Breakthrough: Green Hydrogen Policies and Technologies Costs. Read more here

As if the early days of the technological stage of finding solutions that can solve the intermittency of wind and solar incidence systems were not enough, add to this the heavy capital investment needed of US$4.4 trillion/year[12], i.e. 2.1x the amount society invested in 2019 to achieve its net zero goal.

Most of this investment should go to wind and solar sources in a bid to bring the share of power generation from around 20% to over 60%[13].

Moreover, as we have previously seen, public and private players perform a fundamental role in making these investments, whether through tax incentives or research and development.

Unfortunately, the short-term outlook presents an obstacle, particularly in terms of the speed at which such investments need to be made.

Governments came out of the Covid-19 crisis highly indebted while the risk of a recession is increasing as a result of monetary tightening that has been introduced to control inflation. This raises many questions about the feasibility of implementing the projects in the time required to achieve net zero.

Other Challenges

The complex aspects of this subject extend to other areas such as supply and demand, supply chain and geopolitics.

The higher demand will eventually rein in the very viability if it is not matched by higher supply. The clearest example of this mismatch we are seeing in lithium where the price has increased by more than 5x compared with the average price from 2018 to 2021.

The concentration of solar module and battery production in China, 80%[14] and 70%[15] respectively, combined with the escalating geopolitical risk we have seen in recent years, such as the trade war between the United States and China that has been ongoing since 2018 and the conflict between Russia and Ukraine in 2022, pose a significant threat on the path to a greener world.

Final Considerations

The signs to date point to the world continuing to move towards a cleaner energy matrix.

Even with the headwinds from the current energy crisis, we have seen the resilience of investments in renewables, as well as incentive mechanisms. Examples of these are the carbon credit markets and the additional effort of the United States legislation through the Inflation Reduction Act.

At the end of the day, we are on a path of no return as there is no alternative when the price to be paid may be the very sustainability of our planet.

12 IRENA – World Energy Transitions Outlook: 1.5°C Pathway. Read more here
13 BP – bp Energy Outlook 2022. Read more here
14 Benchmark Minerals – Infographic: China's Lithium-Ion Battery Supply Chain Dominance. Read more here
15 IEA – Solar PV Global Supply Chains. Read more here

Turim's first and next 21 years

This year we completed 21 years[16] of existence but it seems like only yesterday we started as a small office in Rio de Janeiro. In this Letter, we'll reflect on what we've been through, how we are now, and where we want to go.

Turim was founded in 2001 at a time when the Family Offices market in Brazil was still taking its baby steps – we were the pioneers of the model in the country. Then, we'd already pursued the "aim of integrating the services needed to protect, preserve and increase the wealth of a restricted and select number of families", as we well expressed in our first Turim Letter[17]. In this same Letter we pointed out that a client's legacy goes beyond their liquidity, assets and businesses but also their reputation, beliefs, values, virtues, history and "prepared opportunities". One generation creates an opportunity which the next generation will be able to take advantage of and optimize.

Now, to make this dream become true, we had to create pillars that would be non-negotiable values ensuring our alignment with our clients. Our independence, impartiality, transparency and confidentiality will always guide us. These values are our guidelines that allows us to provide our clients with the best service, allocating their portfolios in the best possible way, without using proprietary products, preserving their identities, and always being crystal clear about our fees and investment views.

It was based on these pillars that, since Turim's foundation, we were able to build a very rich culture within our company, attracting talents who have been with us for so many years that they're now already a part of our history. Turim was transformed into a partnership in 2007 in the belief that if we were to provide top-quality service, we needed talents who had an ownership attitude and would make a permanent commitment to accompanying the lives of our clients. We've been partners of Fundação Estudar for four years organizing a case study competition on asset and wealth management which is open to undergraduate students[18]. The competition is a great opportunity for us to discover new exceptional professionals whom we consider to be our raw material – we are made up of people and it's with them that we shape our future. We are here to provide the best service and, as we wrote in our 22nd Letter[19] in November 2014: "we can say with certainty that we love what we do, and we've been doing it for a long time".

This brings us to all the experience we have with planning and consultancy services in the areas of finance, accounting, tax, law, social security, real estate, insurance and family governance – services we've defined as essential for a Family Office since our first Letter. It's thanks to this that our clients became one of the best means of highlighting our brand through word-of-mouth recommendation. This has helped us build and shape Turim since its foundation and makes us grow every day.

We have always taken a global approach with our clients' portfolios, looking at investments in Brazil and abroad. In 2012, we became part of the Wigmore Association[20], a global non-competing group of family offices spread across Europe, Oceania, North America and South America, centered on investment discussion and best market practices. We are the only representative from our continent. Also in 2012, we opened an office in São Paulo and in 2016 also expanded to an office in London, moving even closer to European and Asian markets. That same year, we also established an investment point in Palo Alto, boosting even further our structured investment program in illiquid assets. Our program allows for greater diversification of our Private Equity and Venture Capital portfolios across sectors, vintages, geographies and investment stages. Our capability to offer our clients today the possibility of "investing in the future" with expertise arose originally from our presence in Silicon Valley, the world's leading center for innovation and technology, and is the result of relationships we've created over the years.

As we've been working abroad since our very start, we've formed several partnerships. This includes an outstanding one with the MIT Sloan School of Management in 2017 for the development of a new investor profile mapping process. Through cognitive psychology and risk metrics, we were able to develop a process that maps the investor's profile during their onboarding. This allows us to build an investment portfolio that reflects our clients' real objectives and restrictions, as well as paying attention to other non-financial aspects of our clients' lives.

One of the services we envisioned for a full Family Office in our first Turim Letter was to help families with philanthropic planning. At the time, when ESG (Environmental, Social and Governance) issues were not very widespread, we felt philanthropy was the solution for this, offering philanthropic advisory for clients. Today, we see that the issue goes much deeper and is not restricted to philanthropy[21]. For this reason, we use ESG criteria throughout our entire analysis process and pursue new impact investment opportunities, offering our clients global access to companies that align their financial objectives with a positive impact on education, health, climate change and various other topics. We are proud to be a signatory to the Principles for Responsible Investment (PRI), a global standard for responsible investment.

16 For curiosity's sake, the number 21 is very symbolic for our Founder and Board Chairman, Gustavo Marini, and for this reason it is an important date for us. Turim was founded as Turim 21 Investimentos in 2001.
17 Read more in Turim Letter Nº 1 here.
18 For further information access premioturim.com
19 Read more in Turim Letter Nº 22 here.
20 For further information access wigmoreassociation.com
21 Read more in the Letter "Why are we talking about impact?" which we published in May 2019 on this topic here.

We are regulated by the CVM and ANBIMA in Brazil, the Securities Exchange Commission (SEC) in the US and the Financial Conduct Authority (FCA) in the UK. These connections have always been very important in helping us develop the Family Offices market as a whole, aiding us in constructing a framework that is favorable to all clients in the sector and which reflects our core values. As a result, we helped fulfill one of the goals stated in our first letter: "to encourage a dialogue on the Multi-Family Office role regarding families that are or intend to be dynastic".

Over these last 21 years, our teams grew, we expanded to new offices, and became even more global. We face and aspire to new challenges and we are proud to look after families with two or even three generations with us, serving clients spread over seven different countries. All this solidity has prepared us to cater to clients who are subject to even stricter regulations. As a result, we also started serving institutional clients, such as Pension Funds, endowments, associations and foundations. Our highly structured compliance and risk areas allow us to adapt to the specific requirements from these clients. We realized that some of their demands are different from those of families and that we were able to provide support to their entire structure, following their investment guidelines and maintaining strict regulatory controls. We have always valued personalized and exclusive service since our foundation, operating in the Brazilian and global markets, whether for a family or an institution.

Since the very first Turim Letter, we have outlined and highlighted several subjects so that the market could better understand how we can help our clients with an all-encompassing wealth management approach. We've tried to familiarize our readers with financial concepts such as hedges, booms, bubbles and crashes, diversification vs concentration[22], various geopolitical and macroeconomic issues such as the succession process at the Fed, China and its enormity, emerging markets, past economic plans and inflation[23]. We have also raised topics related to family businesses, family governance, immigration and family succession[24]. In terms of technology and innovation, we have written about the Private Equity industry, the importance of Silicon Valley, the Venture Capital ecosystem in Brazil and SPACs as alternatives to IPOs[25]. Our first Letter commented on "the importance of the dollar as a store of value". Today, we see an increasingly strong dollar in relation to other currencies and it is still a highly relevant topic.

As far as the world and investment options are concerned, our opening Letter is still highly relevant to the present time:

"The number of investment alternatives has multiplied, markets are more volatile, the correlation between countries has increased, new currencies have emerged, and others have disappeared from circulation, traditional institutions lose their status quickly, new legal and fiscal rules and structures are implemented and improved, and the global socioeconomic and geopolitical environment is more dynamic every day. In this context, it is becoming increasingly important to actively manage, on a full-time basis, the various situations that involve a client's long-term strategy, with a broad and holistic understanding of their objectives to better justify the decisions to be made".

We know the world is no longer the same as the one 21 years ago and we soon realized that the reason for doing what we do would also have to keep up with this development. Focusing on our **purpose** of preserving our clients' wealth so that they can achieve their goals and dreams safely and with peace of mind, allowing their legacy to pass through generations. Based on a relationship of trust and professionalism, we are a motivated team that is determined to cultivate long-lasting connections that impact families and institutions in a sustainable way.

We believe planning is key in order to perpetuate and that an asset manager needs to offer services and bring new solutions that go beyond financial management. We are proud to have a genuine partnership and a team of experienced and complementary professionals who help our clients with the coordination of structures abroad, tax, estate and succession planning (locally and abroad), review of accounting services, changes in tax residency and citizenship, consolidation of information and documentation, financial education for families and philanthropic planning, amongst others. Our **mission** is to provide an excellent wealth management service to families and institutions in an independent, impartial and transparent manner. We have a global vision that allows us to create innovative solutions that go beyond asset management.

We began as pioneers of the Multi-Family Office model in Brazil in 2001 and today we are one of the largest independent asset managers in the country.

Looking ahead, we want to continue being pioneers while always maintaining our independence, essence and culture. At the end of the day, Turim has a soul. Our **dream** is to go beyond borders and help design the future of Wealth Management in a constantly changing world. We operate globally and want to continue being the first choice of families and institutions that are with us today, the next ones to come and their future generations, creating bridges and guiding our clients in an innovative way to leave a positive mark on the world.

22 Turim Letters Nº 4, 8 and 18 – all our Letters are published on the Turim site and can be consulted here.
23 Turim Letter Nº 3, 8, 14, 20, 25 and 28 all our Letters are published on the Turim site and can be consulted here.
24 Turim Letter Nº 2, 3, 4, 12, 24, 30 and 37 all our Letters are published on the Turim site and can be consulted here.
25 Turim Letter Nº 22, 31, 33 and 35 all our Letters are published on the Turim site and can be consulted here.