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Equity Research - EDP Renováveis S.A : A global energy company

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Abstract

This is the first half of a joint equity research on EDPR. In this half, we discussed the global energy industry, EDPR competitors, relevant costs and technology trends of wind and solar power.
An overview was given on the government efforts pushing for energy transition. The market expansion and diversification strategy of EDPR was reviewed.

Keywords
EDPR, Energy Markets, Renewables

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This report is part of the 2021-22_Fall_32265_Jose_Costa_41470_Bernardo_Martins_Part2.pdf (annexed) and should be read has an integral part of it.

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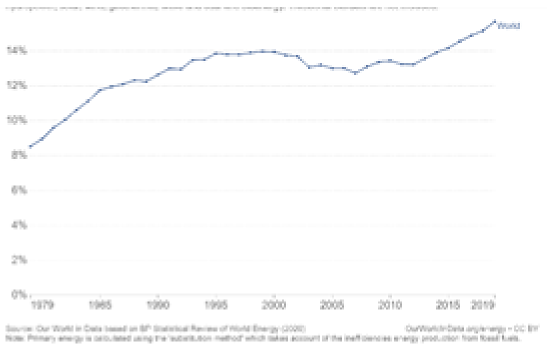


Source: OurWorldData

Fig 2 -Evolution of energy sources

Year	Fossil Fuels	Renewables	Nuclear
1970	94%	5.6%	0.40%
1980	91.60%	6.0%	2.40%
1990	88%	6.4%	5.60%
2000	87%	7.0%	6%
2010	87%	7.8%	5.20%
2020	84.30%	11.40%	4.30%

Source: OurWorldData

Industry Overview

The rapid growth of solar and wind power production in the last years has been mostly due to a shift towards greener alternatives, as governments and corporations look to reduce their impact on greenhouse gas emissions. This mindset change can be seen as unanimous between different industries as we observe, from small merchants to big corporations, a greater concern for our future and its sustainability. Renewables are not only attractive because they are green, but also because they are getting cheaper.

Global Energy Industry

Governments around the world have set targets to be met, in a joint effort to speed up our change to different, carbon-free, energy sources. In 2015 the United Nations hosted an important summit in Paris in which 75 countries announced new commitments, with 24 pledging to reach carbon neutrality. Renewables are the backbone of decarbonization. In 2015, World's wind power generation was around 305.77 TWh and in 2020 a growth of 25% led it to 383.21 TWh . The same trend can be observed for solar, which more than doubled its generation in the same period, growing 136%, from 146 TWh to 344 TWh. Although this growth is significant it still is not enough to meet the aforementioned targets established in 2015 and most recently in 2021 (further in Government Regulations/Policies section).

With the development of new technologies, renewables have in recent years gained a good positioning, being a lower cost and carbon free alternative. With overall energy demand forecasted to keep rising in upcoming years, increasing 47% in the next 30 years , driven by population and economic growth. Tax-based CO2 is also expected to increase, making other alternatives seem less attractive over time.

Competitors

EDPR is present in most continents, diversifying their presence around the world from 15 countries in 2020 to 25 in 2021. In order to provide a meaningful analysis, we alienated them into different regions, North America, South America, Europe, and Asia. It is also important to denote how the demand in this sector is fulfilled, it works by a bidding system, where power-generation is stacked from lowest bid to highest bid, based on costs. Renewable resources like wind and solar are more cost-effective than other sources like gas and coal, who are only used to meet demand when all other cheaper alternatives fail to do so. Competing with EDPR for the whole demand is also other non-renewable alternatives, and the competitors described below include utilities as well, and different energy mixes in their operations.

- North America

The first region includes USA, Canada and Mexico and accounts for around 60% of all EDPR's power generation. The reason it holds so much weight in total production is mostly related to the regulatory framework in place in these countries (further in detail in Regulatory Framework section). Our main competitors in this region are big utilities like Siemens Gamesa, Vestas, and General Electric Energy. More focused competitors would be NextEra Energy Resources, Invenergy LLC, and Avangrid Renewables.

- South America

In the past year EDPR's presence in Latin America has been growing, with an emphasis to the current year with a strategic plan to increase operating capacities in the Brazilian and Colombian markets. In Brazil it currently has 0.4 GW of operating capacity, and it is developing 1.6 GW. It has also, in October 2021, secured a 15-year PPA to increase the current solar capacity, 2.7GW to 7.4GW overall (wind and solar) capacity for 2021-2025. EDPR's portfolio in this region is split between Brazil, Colombia and soon to be Chile (projects in development).

It's worth mentioning that in this region, in particular Brazil, in 2019 75% of the new 7GW additions to the National grid came from renewable sources.

When analyzing competitors, we took into consideration future and secured capacity as well, as EDPR expects the biggest variation in this region, having already secured a capacity almost 3x the current. Enel Group's Brazilian renewable energy subsidiary, Santa Luzia Complex, Vestas Wind Systems A/S and Siemens Gamesa Renewable are the biggest operators in South America.

- Europe

Iberdrola[1], with 20.269GW, Ørsted[2], which has secured wind capacity of 15 GW by 2025 and Enel[3] green group with 5.642GW in Wind & Solar, plus another 17GW in other renewables, are the main competitors for EDPR in Europe. EDPR's second biggest capacity region, with 4.816GW, has their main projects in Spain and Portugal, having a new secured presence in Scotland (UK) with the OceanWinds 50/50 Joint Venture, and projects that will bring their future capacity to 11.5GW by 2025 according to their strategic update.

- Asia

As the most recent market, Asia-Pacific already represents a big role in EDPRs growth strategy for upcoming years. Entering the market with acquisitions such as Sunseap, which has already established secured capacity for upcoming years in different stages of development. We will go further into detail about Sunseap's activities later.

Vena Energy is the most comparable company to Sunseap in the Asia Pacific solar market, with around 2.5GW capacity of solar, mostly in Thailand and Singapore, just like EDPR currently.

Costs

To understand the operations of the renewable power industry, it is important to first discuss a few key concepts. A load factor (also known as capacity factor) is a utilization rate used to measure the efficiency a power plant, and it is equal to the ratio between the output of a plant over a given period and its maximum potential output[4]. Load factors depend on the country, technology, plant and energy resource. It is important to remark that both wind and solar are variable renewable energy sources, that is, due to the fluctuating availability of their resource they are non-dispatchable on demand. Consequently, these technologies tend to have lower

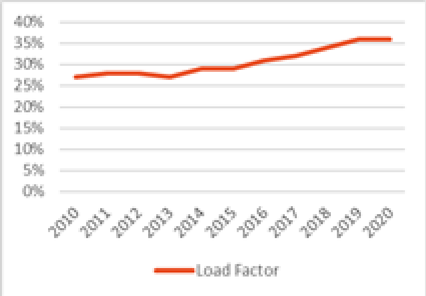
[1] https://www.statista.com/statistics/814615/iberdrola-installed-capacity-europe/
[2] https://orsted.com/en/sustainability/climate-action-plan/our-green-build-out
[3] https://www.enelgreenpower.com/our-projects
[4] https://www.energy.gov/ne/articles/what-generation-capacity

load factors when compared to conventional sources of energy.

The levelized cost of electricity (LCOE) is used to compute the average net present cost of electricity for a power plant. It is a commonly used metric to compare different projects varying in costs, useful life, capacity, size and energy resource, as it encapsulates all costs over the project lifetime.

- Wind

Fig 3 - Evolution of load factor for onshore wind



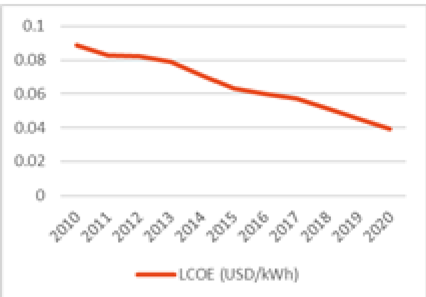
Source: IRENA

Concerning onshore wind, between 2010 and 2020 the global weighted-average load factor grew from 27% to 36%, mainly due to technology improvements. Nonetheless, the main reason for the variation of load factors between countries relies on the quality of wind resources, as wind speed and load factor are positively correlated. Additionally, as wind arises from differences in pressure, the areas with stronger winds are the ones where hot and cold wind masses meet. Such differences in temperature cause differences in pressure (temperature and pressure being positively related) which result in air movements. Another factor influencing pressure include air density, which decreases with height and temperature, being at its maximum at sea-level[5]. This has two implications: it is profitable to install wind turbines near the sea where height is lower but imposes limits on the incremental efficiencies of growing hub-heights.

On the technology side, the trend has been for capacity to grow with time. The weighted-average turbine capacity of onshore wind farms grew from 1.9MW to 2.6MW between 2010 and 2019[6]. Still, the offshore technology has experienced far superior developments. Between 20210 and 2020, the weighted-average turbine capacity increased at a CAGR of 8.84%, growing from 3MW to 7.5MW. In the past year, the average capacity of the turbines in commissioned projects had a 15.38% growth year-on-year.

The same trend has been applied to hub-height, which, according to the Office of Energy Efficiency & Renewable Energy of the US, in the case of onshore wind it has moved from around 58m in 2000 to 80m in 2010 and to around 90m in 2020. In comparison, offshore wind turbines stood at an average height of around 100m in 2016. Higher hub-heights allow turbines to be exposed to stronger winds that are associated with higher heights and to better avoid windbreaking obstacles decreasing wind speed. As higher wind speeds improve energy generation, the efficiency of the turbines is increased.

Fig 4 - Evolution of LCOE for onshore wind



Source: IRENA

Hand in hand with growing hub-heights turbine, rotor diameters have also been increasing. In the case of onshore, turbine rotor diameter evolved from an average of 81m in 2010 to 110m in 2018. For offshore, the weighted-average rotor diameter of offshore wind farms grew from 112m to 161m between 2010 and 2019. On the one side, larger rotor diameters result in reduced specific power. Specific power being the ratio between turbine capacity and rotor diameter. All else equal, a reduction in specific power results in a higher load factor[7]. Additionally, by having larger blades, the turbines attain larger surface areas which allows them to capture more wind and ultimately increase output.

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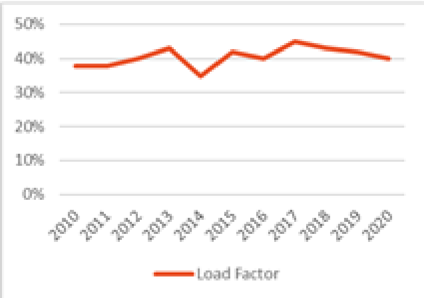
[5] https://www.upsbatterycenter.com/blog/factors-affecting-wind-power-output/
[6] https://www.upsbatterycenter.com/blog/factors-affecting-wind-power-output/
IIRENA, 2019. Future of wind. <https://www.irena.org/-/media/files/irena/agency/publication/2019/oct/irena_future_of_wind_2019.pdf>.
[7] U.S. Department of Energy, 2021. Specific Power | Electricity Markets and Policy Group. https://emp.lbl.gov/specific-power

Furthermore, the greater focus given to the developing stage of wind farms also contributed to these evolutions[8]. Indeed, by adapting the specifications of the wind turbines to the characteristics of the farm sites, the turbines can have improved outputs and lower effects of atmospheric turbulence, which engender reduced maintenance and operating costs (O&M) and so a lower LCOE. These improvements stem from advances in project design software and wind resource assessment and characterization.

Fig 5 - Evolution of LCOE for offshore wind

Source: IRENA

Fig 6 - Evolution of load factor for offshore wind



Source: IRENA

Thus, the average LCOE of onshore wind has been consistently decreasing in the past decade, having a CAGR of 7.92%, going from 0.089 USD/kWh in 2010 to 0.162 USD/kWh in 2020. Meanwhile, offshore wind turbines saw their LCOE decrease from 0.089 USD/kWh to 0.084 USD/kWh. Such reductions can be explained by several factors. The aforementioned trends in developing activities and wind turbine specifications contributed to more efficient turbines and so more profitable projects. Plus, as turbines grow in capacity, the number of deployed turbines decrease for a given project capacity, entailing lower installation and O&M costs. Moreover, O&M manufacturing improvements increased turbine lifetime and advances in data analytics contributed to a better maintenance and use of turbines. The growing number of companies providing O&M services was accompanied by better O&M and higher competition, and so decreasing prices. Finally, the phasing out of feed-in-tariffs agreements towards auctions led to increased competition amongst industry players further motivating cost reduction. However, due to the reduced number of existing offshore wind projects, the evolution of global weighted-average capacity factors of the technology has fluctuated considerably and offer difficult inference.

- Solar PV

Fig 7 - Evolution of load factor for solar PV

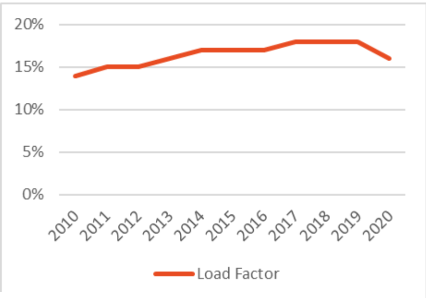
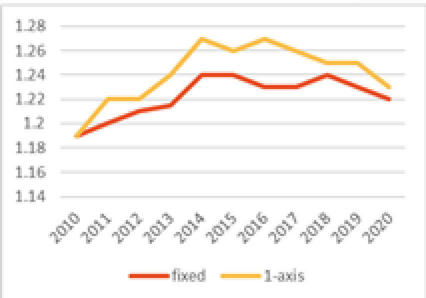


Fig 8 - Global-average ILR



Source: IRENA

The global weighted-average capacity factor for new utility-scale solar photovoltaic systems (solar PV) has slightly improved from 14% in 2010 to 16% in 2020. An increase that is mostly explained by changes in average market irradiance and growing use of trackers and larger inverter load ratios.

To assess the potential of solar resources in the developing stage of a project, researchers tend to look at solar radiation, i.e. energy over surface area. The most used metric is Global Horizontal Irradiance (GHI) measuring all solar radiation incident on a horizontal surface. It is equivalent to the radiation coming directly from the sun (Direct Normal Irradiance, DNI) plus radiation deflected by the atmosphere and reflected radiations (Diffuse Horizontal Irradiance, DHI). Irradiation explains 71.6% of changes in solar PV output, a factor dependant on the geographical characteristics of the site[9]. Consequently, solar tracking solutions have been developed so that modules inclination adapts to the position of the sun to increase irradiance. As a result, the use of solar trackers has increased, improving the efficiency of solar PV.

Another important factor is the inverter load ratio (ILR), the ratio between DC capacity and AC rated-capacity. A higher ILR contributes to increase work time at maximum generation and reduce fluctuations in output. In the past decade, the global ILR followed a slight positive trend, going from 1.9% in both 1-axis and fixed solar PV to 1.23 for 1-axis and to 1.22 for fixed panels.

[8] IRENA, 2021. Renewable Power Generation Costs in 2020. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Jun/IRENA_Power_Generation_Costs_2020.pdf
[9] https://www.utilitydive.com/news/the-3-factors-that-determine-solar-plant-performance/417134/

Also contributing to increased load factor of the technology.

With the sustained technology advancements, the global weighted-average LCOE of solar PV plants decreased at a CAGR of 17.30% between 2010 and 2020, going from 0.381 USD/kWh to 0.057 USD/kWh. The main drivers for such an accentuated reduction were decreases in the equipment price (64%) deriving from production optimization and economies of scale. Solar modules (panels) have grown more efficient whilst experiencing a 93% price decrease between 2010 and 2020, and so are attributed 46% of the LCOE reduction[10]. While cost reductions of balance of system (BOS) hardware, that is, all components other than modules, explained 18% the LCOE decrease. 26% of the reduction resulted from development, EPC (Engineering, Procurement and Construction), installation and other non-hardware costs. The remaining 10% reduction arose from higher load factors, reduced O&M and financing costs.

Fig 9 – Evolution of LCOE for solar PV

Source: IRENA

Covid-19 Impact

Besides closing down borders, Covid-19 also temporarily closed industries, and with that, their respective energy consumption.

In 2020, we first came across it, and analysing the impact it had on EDPR, we saw a decline in regional sales, although it was partly influenced by a sell down in mid/year 2020[11]. Overall industry demand diminished to “Sunday levels” according to IEA[12], due to a big decrease in industrial needs, which was just barely offset by a higher residential use. Lockdown measures started at different times in different regions therefore it is hard to attribute an overall decline, but we can check that when lockdown measures were softened, demand started increasing, with some months in 2020 seeing levels very close to 2019. According to the same study by IEA, the latter months of the year saw an increase of 10% vs 2019, which went in line with pre-covid growth trends. Even during lockdowns where demand was lower, in 2020 renewables share increased, due to lower operating costs and priority access through regulations.

We believe nowadays Covid-19 does not pose a risk for EDPR, mostly due to new vaccines and solutions appearing but also due to local governments knowing how to properly handle similar situations, knowing the impact it has on all industries.

Regulatory Framework

Government Regulations/Policies

The exceptional level of renewable energy capacity additions is expected to be maintained, according to a study, increases in power capacity in the upcoming two years will be 90% generated by renewables. This continuous effort has only been possible due to several

[10] Iea.com. 2021. Projected Costs of Generating Electricity - https://iea.blob.core.windows.net/assets/ae17da3d-e8a5-4163-a3ec-2e6fb0b5677d/Projected-Costs-of-Generating-Electricity-2020.pdf.
[11] https://www.edp.com/en/news/2020/12/28/edp-concludes-07-billion-sell-down-deal-a-wind-and-solar-portfolio-north-america
[12] IEA. 2021. Covid-19 impact on electricity –IEA: https://www.iea.org/reports/covid-19-impact-on-electricity

undergoing agreements and regulations that promote such shift in the energy industry[13].

Most relevant effort in recent years was the Paris Agreement. It is a legally binding international treaty on climate change, adopted by 196 Parties at COP 21 in Paris 2015. The treaty's main purpose is to limit global warming to below 2ºC. The energy sector is responsible for more than 75% of the EU's greenhouse gas emissions. This has driven regions, cities, companies, and countries to establish carbon neutrality targets. The United States, currently EDPRs biggest market, also shares from the same problem, needing to cut down on emissions, in fact, the global greenhouse gas emissions continue to rise, and 73% come from the energy sector[14].

Fig 10 -Established targets per country

	Capacity (GW)	Targets (GW)	
	2020	2025	2030
Spain			
Wind	27.26	40.63	50.33
Solar	11.50	21.71	39.18
Portugal			
Wind	5.24	6.80	9.30
Solar	1.03	6.60	9.00
France			
Wind	17.95	26.50	39.65
Belgium			
Wind	4.72	5.90	10.00
Poland			
Wind	6.61	12.31	13.40
Romania			
Wind	2.95	4.33	5.26
Solar	1.36	3.39	5.05
Italy			
Wind	10.85	15.69	18.40
Greece			
Wind	4.11	5.20	7.00
Hungary			
Solar	1.92	3.77	6.45
United Kingdom			
Wind	24.17	32.00	40.00
Solar	13.46	N/A	40.00
US			
Wind	122.50		300.00
Solar	95.00	173.70	400.00
Canada			
Wind	13.41	17.00	23.00
Mexico			
Wind	8.10	9.00	15.10
Solar	5.60	10.65	
Chile			
Wind	2.15	6.30	
Solar	3.21	7.78	
Brazil			
Wind	17.20	23.15	32.00
Solar	7.88	19.43	26.00
Colombia			
Wind	0.51		3.40
APAC			
Solar	22.53	75.60	

Sources: IRENA, Gov. publications, Analysts

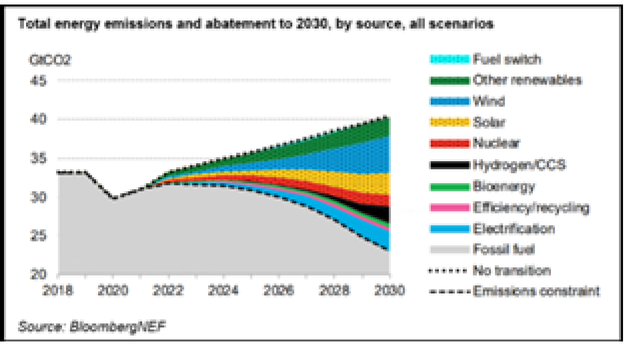
The U.K. has also set in place new limitations on the production of diesel cars, stopping it by 2030, and aiming to have every car on the road be zero emission by 2050.

According to the International Energy Agency, if countries want to meet their 2050 goals, it will require a massive investment into renewables in the upcoming decade, specifically from 2025 onwards where it is expected that the annual clean energy investment will triple[15].

Most recently, the COP26, climate summit of 2021, took place in Glasgow, Scotland in November 2021 and new goals and targets have been set. Notoriously China and the U.S[16] (the two world's biggest CO2 emitters) agreed to join the joint venture to fight the decarbonatization of our energy sources, most of which, as mentioned previously, come from the energy sector production and consumption. In this same conference, the developing countries reassured their commitment to change by pledging up to a trillion dollar a year fund to help under-developed countries cope with the effects of climate change and reduce their CO2 emissions by investing in Renewable sources for a cleaner energy. Another interesting pledge came from several big car manufacturers[17] (i.e Volvo, Mercedes-Benz etc), who pledged to work towards selling only fully zero-emission new cars by 2035.

Even though a lot has been done recently, popular opinion stands that these targets will not all be met, or even, if all measures being taken are the correct ones. Recently, a study[18] conducted by Volvo showed that it would emit more greenhouse gas producing an electric motor compared to the same model but hybrid, by a whopping 70%.

Fig 11 - CO2 Emissions by energy source

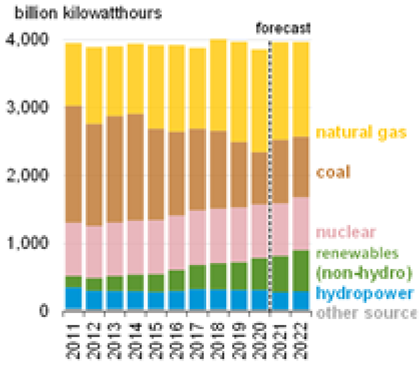


A study by Bloomberg NEF, New energy Outlook[19], which was drafted in July 2021, before the COP26 efforts were put into place, had already estimated a growth of 505Gw and 455Gw per year, for wind and solar, respectfully. This provides us confidence that in the near future undoubtedly there has to be a global investment into renewable/clean sources of energy and a lot of it will be promoted as policies by local governments and global authorities (such as UN).

[13] IEA. 2021. Renewable Energy Market Update 2021 –IEA. https://www.iea.org/reports/renewable-energy-market-update-2021
[14] https://ourworldindata.org/emissions-by-sector
[15] IEA. 2021. Net Zero by 2050 – Analysis - IEA. https://www.iea.org/reports/net-zero-by-2050
[16] https://www.bbc.com/news/science-environment-59238869
[17] https://www.autocar.co.uk/car-news/industry-news-environment-and-energy/major-car-firms-fail-back-cop26-ev-pledge
[18] https://insideevs.com/news/549267/manufacturing-evs-70percent-more-emissions/
[19] https://about.bnef.com/new-energy-outlook

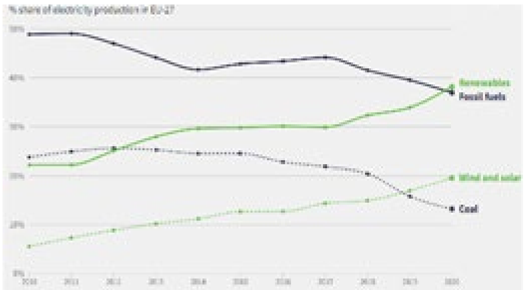
As seen in fig 12 and 13, for both Europe and US respectively, demand is very far away from being met by the renewable lower cost options, therefore it is a fair assumption that all power capacity generated will be met with demand as there is still a big gap to fill for these alternatives.

Fig 12 – Electricity by source in the US



Source: U.S Energy Info. Administration

Fig 13 – Electricity by source in the EU



Source: Ember

Remuneration Schemes

To boost investment in renewables, different policies have been deployed to increase supply[20]. To do so, governments tend to sign power purchase agreements (PPA) with energy companies. These are contracts in which buyers agree to buy electricity generated by producers over a specific term.

In earlier stages, feed-in-tariffs (FIT) were seen as necessary to spread and help the development of renewable technologies. FIT allow producers to be paid a pre-defined compensation per generation during an agreed period, ensuring revenues and decreasing the risk of projects. However, FIT can result in moral hazard, as producers may profit from better information concerning costs and so earn above what they would require. FIT were the highly common in Europe and contributed to a more widespread use deployment of renewables. Together with obligations and quotas, it used to be the most employed incentive for onshore wind and solar projects.

To avoid splurging and secure electricity at inferior prices, there has been an accentuated shift towards competitive auctions in detriment of FIT. Moving to auctions contributed competitive procurement, resulting in innovation and so lower costs across the value chain. As such, auctions and subsequent PPAs contributed to foster more efficient and cheaper technologies. Plus, auctions can be used to fulfil requirements such as commercial operational date (COD), i.e. the day a project becomes operational.

Other alternatives to FIT include contracts for difference (CFD). Through a CFD producers will earn the market price, but if the price falls below an agreed strike price, they have the right to a compensation to reach the strike price. In a two-way CFD in addition to receiving remuneration if market price is inferior to strike price, if it is superior the producer must pay the difference.

Additionally, in the US market EDPR is subject to special incentive programs which include the wind energy production tax credit (PTC) and the solar energy investment tax credit (ITC). Where in efforts to attain 100% carbon-free electricity by 2035 and to fightback delays in

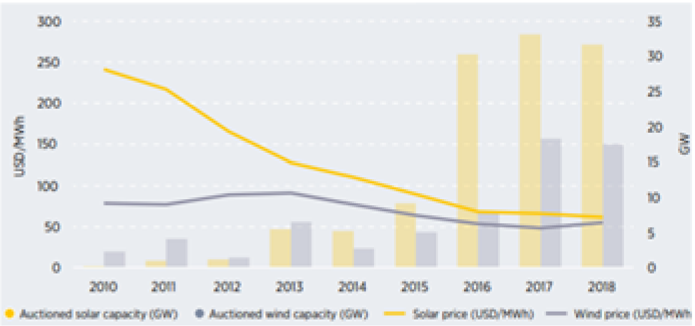
[20] IRENA, 2019. Renewable energy auctions: Status and trends beyond price. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Dec/IRENA_RE-Auctions_Status-and-trends_2019.pdf

additions induced by the Covid-19 recession, eligibility for ITC & PTC programs and respective phasedowns were extended by 2 years.

Being subject to ITCs, energy companies receive a tax credit amounting to 26% of capital expenditures incurred in solar projects which begin construction until 2022[21]. With the incentive phasedown, projects beginning construction in 2023 receive a tax credit corresponding to 22% of capital expenditure (if COD is not prior to 01-01-2026) and from 2024 onwards the rate falls to 10%.

Wind farms benefiting from PTC earn a tax credit depending on their production over a 10-year period after COD. Farms starting construction until 2017 received 100% of a credit equal to 25$/MWh. From 2017 onwards, PTC started phasing out. Then, the credit received by projects starting construction fell to 80% in 2017, 60% in 2018, 40% in 2019 and 60% in 2020. In the past year the complete phase-out of the incentive was postponed to 2022 with new projects in 2021 earning a 60% tax credit[22].

Fig 14 – Auction info global average



Source: IRENA

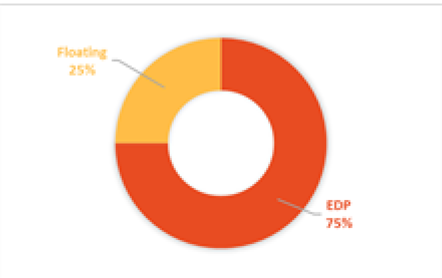
As a result of government aids, technology improvements, decreasing LCOEs and a shift towards more competitive auctions, auction prices have been falling for both wind and solar projects. The auctioned price for wind additions fell around 25% between 2010 and 2018, while for solar the decrease was close to 75%.

Company Overview

Corporate governance

Following investigations of corruption, which in the past year led to the suspension of former CEO Manso Neto, earlier in April EDPR approved a restructuring of its governance bodies in a general shareholder's meeting. Thereafter: the board is organized in a two-tier model with the management team as an executive board and the BoD serving as supervisory board; the board of directors (BoD) counts twelve members: six of them being independent directors, including its chairman, and only two executive members; the former Executive Committee was discontinued, with its members being assimilated in the newly created Management Team (MT); EDPR possesses two committees: Appointments, Remunerations and Corporate Governance, and Audit, Control and Related Party Transactions.

Fig 15 – EDPR's share distribution



Source: Company data

Presently, the EDP group is the company largest shareholder with 74.98% of the shares with the remaining 25.02% being floating stock. Moreover, since January 2021, Miguel Stilwell d'Andrade has been the CEO of both EDP and EPDR. Hence, the most significant risk shareholders may face arises from concentrated ownership. As EDP can approve proposals without further approval, minority shareholders may be exposed to conflicts of interest.

However, having 10 out of 12 non-executive directors in the BoD may ensure the interests of

[21] Solar Energy Industries Association, 2021. Solar Investment Tax Credit (ITC) |https://www.seia.org/initiatives/solar-investment-tax-credit-itc

[22] Rodgers, M. and Dubov, B., 2021. Stimulus Bill Brings Welcomed Changes to the Renewable Energy Industry | White & Case LLP https://www.whitecase.com/publications/alert/stimulus-bill-brings-welcomed-changes-renewable-energy-industry

minority shareholders. As non-executive members are expected to be unbiased, pursuing what is best for the company instead of what better suits the majority shareholder. It is also noteworthy that all EDPR committees are solely composed by independent directors.

Moreover, the two-tier model may ensure better monitoring of the MT decisions, being under BoD supervision. Nonetheless, albeit independent majority is presumed to pursue the company’s best interests, the majority threshold of the BoD is not exceeded. Failing to lessen the potential risks of conflicts of interest in decision-making.

Members of the BoD earn fixed earnings while members of the management team also receive variable and multi-annual remuneration. Since the Management Team is responsible for controlling the activity and performance of the company, by instating variable remuneration linked with performance, its members have incentives to act in shareholders’ best interests. To boot, the multi-annual variable remuneration being deferred for a span of three years, only to be paid whether there are no proofs of misconduct, further weakens motivations for misconduct. Still, the BoD and MT incentive schemes could be improved if payments were made in shares or linked with share price to further align incentives. As of now, its members may be considered to lack assets at stake, and instating variable remuneration so closely pegged with shareholder value could be a solution.

Strategy

- ### Strategy Update 2021-2025

Integrated in the market changes and the collective global efforts pushing for energy transition and carbon-neutrality in the electricity generation market, EDPR has delineated an ambitious strategic plan. In the past decade, EDPR experienced considerable growth, with installed capacity growing 78.64% from around 6.4GW in 2010 to 11.5GW in 2020. Nevertheless, EDPR desires to expand even faster, reaching an installed capacity of 18GW by 2023 and equal to 25GW by 2025. That is a combined growth of 117% in terms of capacity, translating into an average growth of 2.7GW per year.

Using these additions, EDPR plans to cement its presence in its most prominent markets, the US and Europe, reinforce its presence in Brazil and diversify into new markets in Latin America and in Asia Pacific (APAC), a region where EDPR started operating in June after the acquisition of a 28MW solar PV project in Vietnam. Moreover, EDPR seeks to increase the importance of solar power with additions similar to those of onshore wind, as well as exploring the emerging offshore wind technology through Ocean Winds.

- ### Ocean Winds

Ocean Winds (OW) is a 50-50 joint venture between EDPR and the French electric utility company ENGIE, established in 2019 when the offshore wind assets and project pipeline of both companies merged. OW was created with the purpose of tapping into the fastest growing renewable technology market as one of its leading global players. OW will focus on the regions which are expected to grow the most, that is Europe, US and certain countries in Asia. As of now OW possesses projects in different stages of development amounting to a total of 6.6GW of installed capacity.

OW				
Project	Country	COD	Capacity (MW)	Share
Moray East	UK	2022	950	57%
EFGL	France	2023	30	80%
Le Tréport & Noirmoutie	France	2025	992	61%
Mouray West	UK	2025-26	871	62% (plus 33%)
Mayflower	US	2025-26	1336	50%
B&C-Wind	Poland	>2025	400	100%

- Sunseap

On November 3rd, EDPR announced the acquisition of 87.4% of the Singaporean solar power producer Sunseap, for €600m. Sunseap's portfolio include 540MW of installed capacity, 127MW of secured capacity and 4.8G in pipeline spanning over 9 Southeast Asian countries. At the moment, distributed solar panels (DG) account for 72% of installed capacity, being the largest player of the Southeast Asian market (DG only), however the share decreases to 46% when considering the entire portfolio. As such, Sunseap provides an opportunity for EDPR to enter markets responsible for around 55% of expected global additions between 2020-30, with an already significant portfolio (equal to 42% of the previous year capacity).

Annex: Full Report

MASTER IN FINANCE

EDP RENEWABLES S.A.

COMPANY REPORT

POWER GENERATION

17TH DECEMBER 2021

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Equity Research – EDP Renovaveis S.A

A Global Energy Company

- A shift in the energy industry is expected, as power consumption rises, with the renewables sector in particular gaining a higher share of the overall demand, promoted by regulations and government policies, who seek to lower CO2 emissions.

- The recent acquisition of Sunseap with a portfolio of 5.5GW (in different stages of development) reinforces EDPR's market expansion and diversification growth strategy, as they are set to meet their target of 20Gw gross additional capacity by 2025.

- In Europe and the US, EDPR's largest and most mature markets, growth is expected to be pushed by UN targets from COP26. Whilst younger markets such as Latin America and APAC represent an opportunity for a more aggressive expansion.

- EDPR's business life cycle stage was reaffirmed last year, when the company's EV nearly doubled from 2020 to 2021, entering the growth period. It is expected to continue riding the growth wave of the renewables sector.

Company description

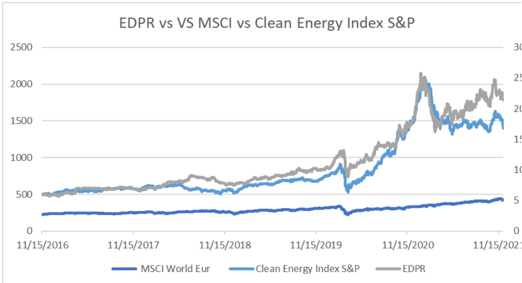
EDP Renovavéis (EDPR) is a renewable energy company subsidiary of the EDP group who owns 75% of its shares. The company is based in Madrid and its activities comprise of developing, constructing, operating, and managing wind and solar power plants. EDPR possesses a portfolio or power generating assets spread across 25 markets, allowing the company to be fourth-largest wind energy producer in the world.

Recommendation:	HOLD
Price Target FY22:	22.34 €
Price (as of 28-Feb-22)	21.58 €

Reuters: EDPR.LS , Bloomberg: EDPR PL

52-week range (€)	16.02-26.40
Market Cap (€m)	20,785.85
Outstanding Shares (m)	960,558,162

Source: Bloomberg



Source: Bloomberg

(Values in € millions)	2020	2021E	2022F
Revenues	1,529	1,771	1,847
EBITDA	1,008	1,626	1,181
Net Profit	463	494	176
EPS	0.26	0.53	0.18
EV/Sales	14.63	14.54	14.91
Installed Capacity (MW)	11,500	13,406	15,865
Generation (GWh)	28,535	29,670	35,264

Source: Bloomberg, Analyst Estimates

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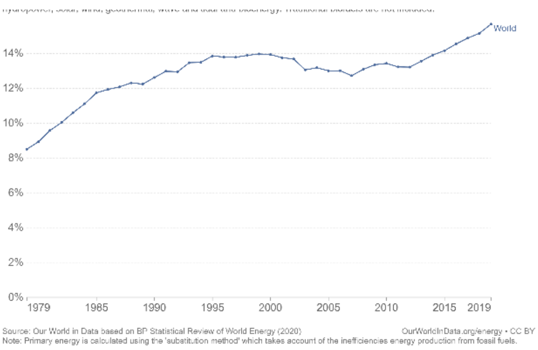
Industry Overview

Fig 1 – Share of energy from low carbon sources



Source: OurWorldData

The rapid growth of solar and wind power production in the last years has been mostly due to a shift towards greener alternatives, as governments and corporations look to reduce their impact on greenhouse gas emissions. This mindset change can be seen as unanimous between different industries as we observe, from small merchants to big corporations, a greater concern for our future and its sustainability. Renewables are not only attractive because they are green, but also because they are getting cheaper.

Global Energy Industry

Fig 2 -Evolution of energy sources

Year	Fossil Fuels	Renewables	Nuclear
1970	94%	5.6%	0.40%
1980	91.60%	6.0%	2.40%
1990	88%	6.4%	5.60%
2000	87%	7.0%	6%
2010	87%	7.8%	5.20%
2020	84.30%	11.40%	4.30%

Source: OurWorldData

Governments around the world have set targets to be met, in a joint effort to speed up our change to different, carbon-free, energy sources. In 2015 the United Nations hosted an important summit in Paris in which 75 countries announced new commitments, with 24 pledging to reach carbon neutrality. Renewables are the backbone of decarbonization. In 2015, World's wind power generation was around 305.77 TWh and in 2020 a growth of 25% led it to 383.21 TWh[1]. The same trend can be observed for solar, which more than doubled its generation in the same period, growing 136%, from 146 TWh to 344 TWh. Although this growth is significant it still is not enough to meet the aforementioned targets established in 2015 and most recently in 2021 (further in *Government Regulations/Policies* section).

With the development of new technologies, renewables have in recent years gained a good positioning, being a lower cost and carbon free alternative. With overall energy demand forecasted to keep rising in upcoming years, increasing 47% in the next 30 years[2], driven by population and economic growth. Tax-based CO2 is also expected to increase, making other alternatives seem less attractive over time.

[1] https://ourworldindata.org/grapher/annual-change-wind?tab=table&time=2015..latest
[2] https://www.spglobal.com/platts/en/market-insights/latest-news/oil/100621-global-energy-demand-to-grow-47-by-2050-with-oil-still-top-source-us-eia

Competitors

EDPR is present in most continents, diversifying their presence around the world from 15 countries in 2020 to 25 in 2021. In order to provide a meaningful analysis, we alienated them into different regions, North America, South America, Europe, and Asia. It is also important to denote how the demand in this sector is fulfilled, it works by a bidding system, where power-generation is stacked from lowest bid to highest bid, based on costs. Renewable resources like wind and solar are more cost-effective than other sources like gas and coal, who are only used to meet demand when all other cheaper alternatives fail to do so. Competing with EDPR for the whole demand is also other non-renewable alternatives, and the competitors described below include utilities as well, and different energy mixes in their operations.

North America

The first region includes USA, Canada and Mexico and accounts for around 60% of all EDPR's power generation. The reason it holds so much weight in total production is mostly related to the regulatory framework in place in these countries (further in detail in *Regulatory Framework* section). Our main competitors in this region are big utilities like Siemens Gamesa, Vestas, and General Electric Energy. More focused competitors would be NextEra Energy Resources, Invenergy LLC, and Avangrid Renewables.

South America

In the past year EDPR's presence in Latin America has been growing, with an emphasis to the current year with a strategic plan to increase operating capacities in the Brazilian and Colombian markets. In Brazil it currently has 0.4 GW of operating capacity, and it is developing 1.6 GW. It has also, in October 2021, secured a 15-year PPA[3] to increase the current solar capacity, 2.7GW to 7.4GW overall (wind and solar) capacity for 2021-2025. EDPR's portfolio in this region is split between Brazil, Colombia and soon to be Chile (projects in development).

It's worth mentioning that in this region, in particular Brazil, in 2019 75%[4] of the new 7GW additions to the National grid came from renewable sources.

When analyzing competitors, we took into consideration future and secured capacity as well, as EDPR expects the biggest variation in this region, having already secured a capacity almost 3x the current. Enel Group's Brazilian

[3] https://www.edpr.com/en/news/2021/10/25/edpr-secures-a-15-year-ppa-a-209-mwac-solar-project-brazil
[4] https://www.irena.org/wind

renewable energy subsidiary, Santa Luzia Complex, Vestas Wind Systems A/S and Siemens Gamesa Renewable are the biggest operators in South America.

Europe

Iberdrola[5], with 20.269GW, Ørsted[6], which has secured wind capacity of 15 GW by 2025 and Enel [7]green group with 5.642GW in Wind & Solar, plus another 17GW in other renewables, are the main competitors for EDPR in Europe. EDPR's second biggest capacity region, with 4.816GW, has their main projects in Spain and Portugal, having a new secured presence in Scotland (UK) with the OceanWinds 50/50 Joint Venture, and projects that will bring their future capacity to 11.5GW by 2025 according to their strategic update.

Asia

As the most recent market, Asia-Pacific already represents a big role in EDPRs growth strategy for upcoming years. Entering the market with acquisitions such as Sunseap, which has already established secured capacity for upcoming years in different stages of development. We will go further into detail about Sunseap's activities later.

Vena Energy is the most comparable company to Sunseap in the Asia Pacific solar market, with around 2.5GW capacity of solar, mostly in Thailand and Singapore, just like EDPR currently.

Costs

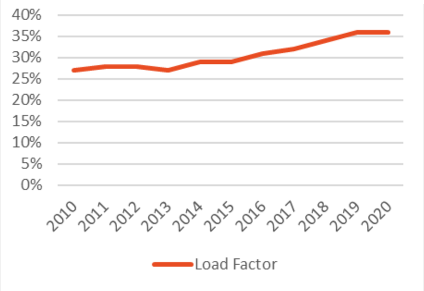
To understand the operations of the renewable power industry, it is important to first discuss a few key concepts. A load factor (also known as capacity factor) is a utilization rate used to measure the efficiency a power plant, and it is equal to the ratio between the output of a plant over a given period and its maximum potential output[8]. Load factors depend on the country, technology, plant and energy resource. It is important to remark that both wind and solar are variable renewable energy sources, that is, due to the fluctuating availability of their resource they are non-dispatchable on demand. Consequently, these technologies tend to have lower load factors when compared to conventional sources of energy.

The levelized cost of electricity (LCOE) is used to compute the average net present cost of electricity for a power plant. It is a commonly used metric to

[5] https://www.statista.com/statistics/814615/iberdrola-installed-capacity-europe/
[6] https://orsted.com/en/sustainability/climate-action-plan/our-green-build-out
[7] https://www.enelgreenpower.com/our-projects
[8] https://www.energy.gov/ne/articles/what-generation-capacity

compare different projects varying in costs, useful life, capacity, size and energy resource, as it encapsulates all costs over the project lifetime.

Fig 3 - Evolution of load factor for onshore wind



Source: IRENA

- Wind

Concerning onshore wind, between 2010 and 2020 the global weighted-average load factor grew from 27% to 36%, mainly due to technology improvements. Nonetheless, the main reason for the variation of load factors between countries relies on the quality of wind resources, as wind speed and load factor are positively correlated. Additionally, as wind arises from differences in pressure, the areas with stronger winds are the ones where hot and cold wind masses meet. Such differences in temperature cause differences in pressure (temperature and pressure being positively related) which result in air movements. Another factor influencing pressure include air density, which decreases with height and temperature, being at its maximum at sea-level[9]. This has two implications: it is profitable to install wind turbines near the sea where height is lower but imposes limits on the incremental efficiencies of growing hub-heights.

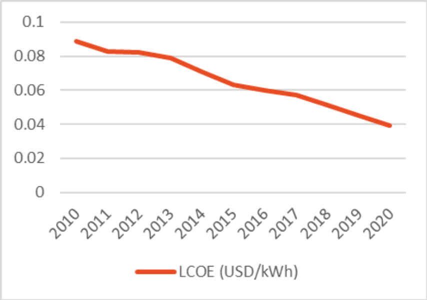
On the technology side, the trend has been for capacity to grow with time. The weighted-average turbine capacity of onshore wind farms grew from 1.9MW to 2.6MW between 2010 and 2019[10]. Still, the offshore technology has experienced far superior developments. Between 20210 and 2020, the weighted-average turbine capacity increased at a CAGR of 8.84%, growing from 3MW to 7.5MW. In the past year, the average capacity of the turbines in commissioned projects had a 15.38% growth year-on-year.

The same trend has been applied to hub-height, which, according to the Office of Energy Efficiency & Renewable Energy of the US, in the case of onshore wind it has moved from around 58m in 2000 to 80m in 2010 and to around 90m in 2020. In comparison, offshore wind turbines stood at an average height of around 100m in 2016. Higher hub-heights allow turbines to be exposed to stronger winds that are associated with higher heights and to better avoid windbreaking obstacles decreasing wind speed. As higher wind speeds improve energy generation, the efficiency of the turbines is increased.

Hand in hand with growing hub-heights turbine, rotor diameters have also been increasing. In the case of onshore, turbine rotor diameter evolved from an average of 81m in 2010 to 110m in 2018. For offshore, the weighted-average rotor diameter of offshore wind farms grew from 112m to 161m between 2010

[9] https://www.upsbatterycenter.com/blog/factors-affecting-wind-power-output/
[10] IIRENA, 2019. Future of wind. <https://www.irena.org/-/media/files/irena/agency/publication/2019/oct/irena_future_of_wind_2019.pdf>.

Fig 4 - Evolution of LCOE for onshore wind

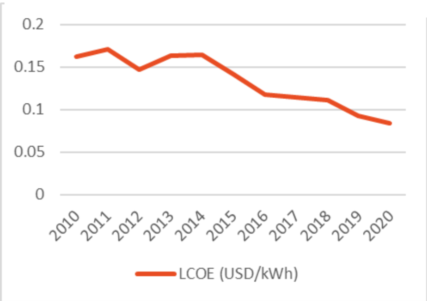


Source: IRENA

and 2019. On the one side, larger rotor diameters result in reduced specific power. Specific power being the ratio between turbine capacity and rotor diameter. All else equal, a reduction in specific power results in a higher load factor[11]. Additionally, by having larger blades, the turbines attain larger surface areas which allows them to capture more wind and ultimately increase output.

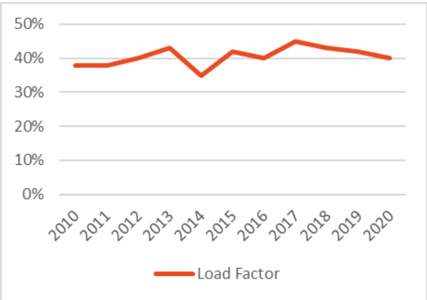
Furthermore, the greater focus given to the developing stage of wind farms also contributed to these evolutions[12]. Indeed, by adapting the specifications of the wind turbines to the characteristics of the farm sites, the turbines can have improved outputs and lower effects of atmospheric turbulence, which engender reduced maintenance and operating costs (O&M) and so a lower LCOE. These improvements stem from advances in project design software and wind resource assessment and characterization.

Fig 5 - Evolution of LCOE for offshore wind



Source: IRENA

Fig 6 - Evolution of load factor for offshore wind



Source: IRENA

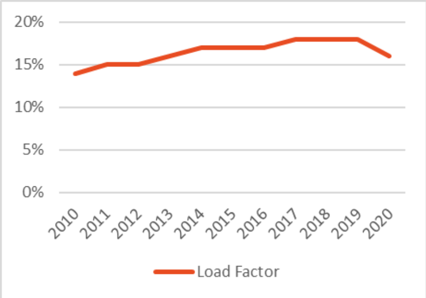
Thus, the average LCOE of onshore wind has been consistently decreasing in the past decade, having a CAGR of 7.92%, going from 0.089 USD/kWh in 2010 to 0.162 USD/kWh in 2020. Meanwhile, offshore wind turbines saw their LCOE decrease from 0.089 USD/kWh to 0.084 USD/kWh. Such reductions can be explained by several factors. The aforementioned trends in developing activities and wind turbine specifications contributed to more efficient turbines and so more profitable projects. Plus, as turbines grow in capacity, the number of deployed turbines decrease for a given project capacity, entailing lower installation and O&M costs. Moreover, O&M manufacturing improvements increased turbine lifetime and advances in data analytics contributed to a better maintenance and use of turbines. The growing number of companies providing O&M services was accompanied by better O&M and higher competition, and so decreasing prices. Finally, the phasing out of feed-in-tariffs agreements towards auctions led to increased competition amongst industry players further motivating cost reduction. However, due to the reduced number of existing offshore wind projects, the evolution of global weighted-average capacity factors of the technology has fluctuated considerably and offer difficult inference.

[11] U.S. Department of Energy, 2021. Specific Power | Electricity Markets and Policy Group. https://emp.lbl.gov/specific-power

[12] IRENA, 2021. Renewable Power Generation Costs in 2020. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Jun/IRENA_Power_Generation_Costs_2020.pdf

Solar PV

Fig 7 - Evolution of load factor for solar PV

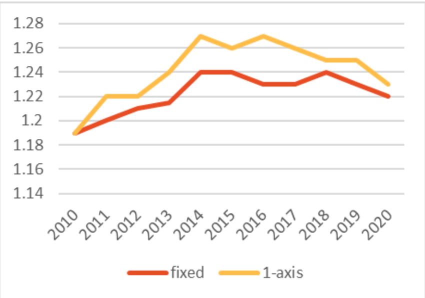


Source: IRENA

The global weighted-average capacity factor for new utility-scale solar photovoltaic systems (solar PV) has slightly improved from 14% in 2010 to 16% in 2020. An increase that is mostly explained by changes in average market irradiance and growing use of trackers and larger inverter load ratios.

To assess the potential of solar resources in the developing stage of a project, researchers tend to look at solar radiation, i.e., energy over surface area. The most used metric is Global Horizontal Irradiance (GHI) measuring all solar radiation incident on a horizontal surface. It is equivalent to the radiation coming directly from the sun (Direct Normal Irradiance, DNI) plus radiation deflected by the atmosphere and reflected radiations (Diffuse Horizontal Irradiance, DHI). Irradiation explains 71.6% of changes in solar PV output, a factor dependent on the geographical characteristics of the site[13]. Consequently, solar tracking solutions have been developed so that modules inclination adapts to the position of the sun to increase irradiance. As a result, the use of solar trackers has increased, improving the efficiency of solar PV.

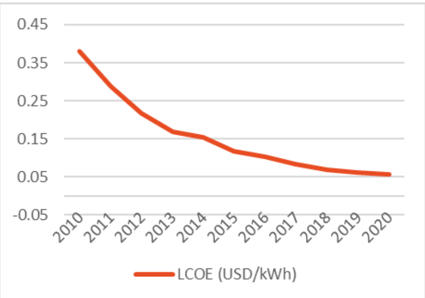
Fig 8 - Global-average ILR



Source: IRENA

Another important factor is the inverter load ratio (ILR), the ratio between DC capacity and AC rated-capacity. A higher ILR contributes to increase work time at maximum generation and reduce fluctuations in output. In the past decade, the global ILR followed a slight positive trend, going from 1.9% in both 1-axis and fixed solar PV to 1.23 for 1-axis and to 1.22 for fixed panels. Also contributing to increased load factor of the technology.

Fig 9 – Evolution of LCOE for solar PV



Source: IRENA

With the sustained technology advancements, the global weighted-average LCOE of solar PV plants decreased at a CAGR of 17.30% between 2010 and 2020, going from 0.381 USD/kWh to 0.057 USD/kWh. The main drivers for such an accentuated reduction were decreases in the equipment price (64%) deriving from production optimization and economies of scale. Solar modules (panels) have grown more efficient whilst experiencing a 93% price decrease between 2010 and 2020, and so are attributed 46% of the LCOE reduction[14]. While cost reductions of balance of system (BOS) hardware, that is, all components other than modules, explained 18% the LCOE decrease. 26% of the reduction resulted from development, EPC (Engineering, Procurement and Construction), installation and other non-hardware costs. The remaining 10% reduction arose from higher load factors, reduced O&M and financing costs.

[13] https://www.utilitydive.com/news/the-3-factors-that-determine-solar-plant-performance/417134/
[14] Iea.com. 2021. Projected Costs of Generating Electricity - https://iea.blob.core.windows.net/assets/ae17da3d-e8a5-4163-a3ec-2e6fb0b5677d/Projected-Costs-of-Generating-Electricity-2020.pdf.

Covid-19 Impact

Besides closing down borders, Covid-19 also temporarily closed industries, and with that, their respective energy consumption.

In 2020, we first came across it, and analyzing the impact it had on EDPR, we saw a decline in regional sales, although it was partly influenced by a sell down in mid/year 2020[15]. Overall industry demand diminished to "Sunday levels" according to IEA[16], due to a big decrease in industrial needs, which was just barely offset by a higher residential use. Lockdown measures started at different times in different regions therefore it is hard to attribute an overall decline, but we can check that when lockdown measures were softened, demand started increasing, with some months in 2020 seeing levels very close to 2019. According to the same study by IEA, the latter months of the year saw an increase of 10% vs 2019, which went in line with pre-covid growth trends. Even during lockdowns where demand was lower, in 2020 renewables share increased, due to lower operating costs and priority access through regulations.

We believe nowadays Covid-19 does not pose a risk for EDPR, mostly due to new vaccines and solutions appearing but also due to local governments knowing how to properly handle similar situations, knowing the impact it has on all industries.

Fig 10 -Established targets per country

	Capacity (GW)	Targets (GW)	
	2020	2025	2030
Spain			
Wind	27.26	40.63	50.33
Solar	11.50	21.71	39.18
Portugal			
Wind	5.24	6.80	9.30
Solar	1.03	6.60	9.00
France			
Wind	17.95	26.50	39.65
Belgium			
Wind	4.72	5.90	10.00
Poland			
Wind	6.61	12.31	13.40
Romania			
Wind	2.95	4.33	5.26
Solar	1.36	3.39	5.05
Italy			
Wind	10.85	15.69	18.40
Greece			
Wind	4.11	5.20	7.00
Hungary			
Solar	1.92	3.77	6.45
United Kingdom			
Wind	24.17	32.00	40.00
Solar	13.46	N/A	40.00
US			
Wind	122.50		300.00
Solar	95.00	**173.70**	400.00
Canada			
Wind	13.41	17.00	23.00
Mexico			
Wind	8.10	9.00	15.10
Solar	5.60	10.65	
Chile			
Wind	2.15	6.30	
Solar	3.21	7.78	
Brazil			
Wind	17.20	23.15	32.00
Solar	7.88	19.43	26.00
Colombia			
Wind	0.51		3.40
APAC			
Solar	22.53	75.60	

Sources: IRENA, Gov. publications, Analysts

Regulatory Framework

Government Regulations/Policies

The exceptional level of renewable energy capacity additions is expected to be maintained, according to a study, increases in power capacity in the upcoming two years will be 90% generated by renewables. This continuous effort has only been possible due to several undergoing agreements and regulations that promote such shift in the energy industry[17].

Most relevant effort in recent years was the Paris Agreement. It is a legally binding international treaty on climate change, adopted by 196 Parties at COP 21 in Paris 2015. The treaty's main purpose is to limit global warming to below 2ºC. The energy sector is responsible for more than 75% of the EU's greenhouse gas emissions. This has driven regions, cities, companies, and countries to establish

[15] https://www.edp.com/en/news/2020/12/28/edp-concludes-07-billion-sell-down-deal-a-wind-and-solar-portfolio-north-america
[16] IEA. 2021. Covid-19 impact on electricity –IEA: https://www.iea.org/reports/covid-19-impact-on-electricity
[17] IEA. 2021. Renewable Energy Market Update 2021 –IEA. https://www.iea.org/reports/renewable-energy-market-update-2021

carbon neutrality targets. The United States, currently EDPRs biggest market, also shares from the same problem, needing to cut down on emissions, in fact, the global greenhouse gas emissions continue to rise, and 73% come from the energy sector[18].

The U.K. has also set in place new limitations on the production of diesel cars, stopping it by 2030, and aiming to have every car on the road be zero emission by 2050.

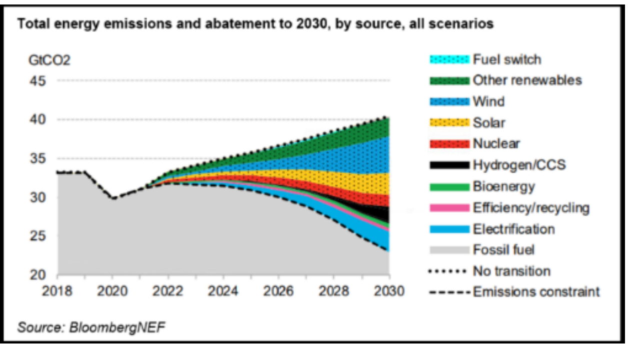
According to the International Energy Agency, if countries want to meet their 2050 goals, it will require a massive investment into renewables in the upcoming decade, specifically from 2025 onwards where it is expected that the annual clean energy investment will triple[19].

Most recently, the **COP26, climate summit of 2021, took place in Glasgow**, Scotland in November 2021 and new goals and targets have been set. Notoriously China and the U.S[20] (the two world's biggest CO2 emitters) agreed to join the joint venture to fight the decarbonatization of our energy sources, most of which, as mentioned previously, come from the energy sector production and consumption. In this same conference, the developing countries reassured their commitment to change by pledging up to a trillion dollar a year fund to help under-developed countries cope with the effects of climate change and reduce their CO2 emissions by investing in Renewable sources for a cleaner energy. Another interesting pledge came from several big car manufacturers[21] (i.e., Volvo, Mercedes-Benz etc.), who pledged to work towards selling only fully zero-emission new cars by 2035.

Even though a lot has been done recently, popular opinion stands that these targets will not all be met, or even, if all measures being taken are the correct ones. Recently, a study[22] conducted by Volvo showed that it would emit more greenhouse gas producing an electric motor compared to the same model but hybrid, by a whopping 70%.

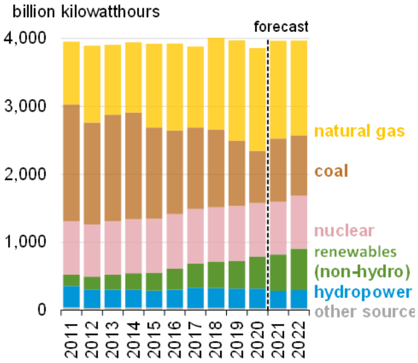
[18] https://ourworldindata.org/emissions-by-sector
[19] IEA. 2021. Net Zero by 2050 – Analysis - IEA. https://www.iea.org/reports/net-zero-by-2050
[20] https://www.bbc.com/news/science-environment-59238869
[21] https://www.autocar.co.uk/car-news/industry-news-environment-and-energy/major-car-firms-fail-back-cop26-ev-pledge
[22] https://insideevs.com/news/549267/manufacturing-evs-70percent-more-emissions/

Fig 11 - CO2 Emissions by energy source



A study by Bloomberg NEF, *New energy Outlook*[23], which was drafted in July 2021, before the COP26 efforts were put into place, had already estimated a growth of 505Gw and 455Gw per year, for wind and solar, respectfully. This provides us confidence that in the near future undoubtedly there has to be a global investment into renewable/clean sources of energy and a lot of it will be promoted as policies by local governments and global authorities (such as UN).

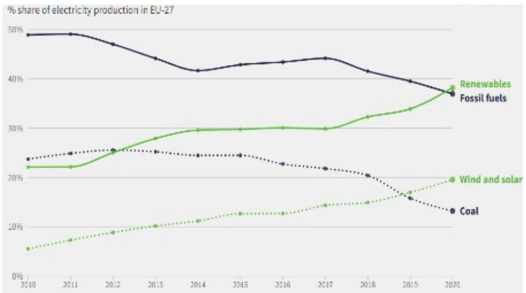
Fig 12 – Electricity by source in the US



Source: U.S Energy Info. Administration

As seen in fig 12 and 13, for both Europe and US respectively, demand is very far away from being met by the renewable lower cost options, therefore it is a fair assumption that all power capacity generated will be met with demand as there is still a big gap to fill for these alternatives.

Fig 13 – Electricity by source in the EU



Source: Ember

Remuneration Schemes

To boost investment in renewables, different policies have been deployed to increase supply.[24] To do so, governments tend to sign power purchase agreements (PPA) with energy companies. These are contracts in which buyers agree to buy electricity generated by producers over a specific term.

In earlier stages, feed-in-tariffs (FIT) were seen as necessary to spread and help the development of renewable technologies. FIT allow producers to be paid a pre-defined compensation per generation during an agreed period, ensuring revenues and decreasing the risk of projects. However, FIT can result in moral hazard, as producers may profit from better information concerning costs and so earn above what they would require. FIT were highly common in Europe and contributed to a more widespread use deployment of renewables. Together with obligations and quotas, it used to be the most employed incentive for onshore wind and solar projects.

[23] https://about.bnef.com/new-energy-outlook
[24] IRENA, 2019. Renewable energy auctions: Status and trends beyond price. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Dec/IRENA_RE-Auctions_Status-and-trends_2019.pdf

To avoid splurging and secure electricity at inferior prices, there has been an accentuated shift towards competitive auctions in detriment of FIT. Moving to auctions contributed competitive procurement, resulting in innovation and so lower costs across the value chain. As such, auctions and subsequent PPAs contributed to foster more efficient and cheaper technologies. Plus, auctions can be used to fulfil requirements such as commercial operational date (COD), i.e., the day a project becomes operational.

Other alternatives to FIT include contracts for difference (CFD). Through a CFD producers will earn the market price, but if the price falls below an agreed strike price, they have the right to a compensation to reach the strike price. In a two-way CFD in addition to receiving remuneration if market price is inferior to strike price, if it is superior the producer must pay the difference.

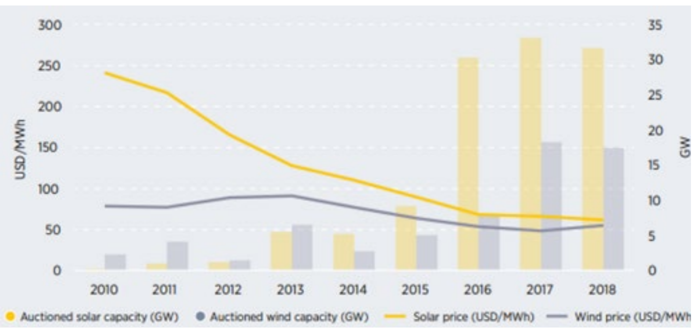
Additionally, in the US market EDPR is subject to special incentive programs which include the wind energy production tax credit (PTC) and the solar energy investment tax credit (ITC). Where in efforts to attain 100% carbon-free electricity by 2035 and to fightback delays in additions induced by the Covid-19 recession, eligibility for ITC & PTC programs and respective phasedowns were extended by 2 years.

Being subject to ITCs, energy companies receive a tax credit amounting to 26% of capital expenditures incurred in solar projects which begin construction until 2022[25]. With the incentive phasedown, projects beginning construction in 2023 receive a tax credit corresponding to 22% of capital expenditure (if COD is not prior to 01-01-2026) and from 2024 onwards the rate falls to 10%.

Wind farms benefiting from PTC earn a tax credit depending on their production over a 10-year period after COD. Farms starting construction until 2017 received 100% of a credit equal to 25$/MWh. From 2017 onwards, PTC started phasing out. Then, the credit received by projects starting construction fell to 80% in 2017, 60% in 2018, 40% in 2019 and 60% in 2020. In the past year the complete phase-out of the incentive was postponed to 2022 with new projects in 2021 earning a 60% tax credit[26].

As a result of government aids, technology improvements, decreasing LCOEs and a shift towards more competitive

Fig 14 – Auction info global average



Source: IRENA

[25] Solar Energy Industries Association, 2021. Solar Investment Tax Credit (ITC) |https://www.seia.org/initiatives/solar-investment-tax-credit-itc
[26] Rodgers, M. and Dubov, B., 2021. Stimulus Bill Brings Welcomed Changes to the Renewable Energy Industry | White & Case LLP https://www.whitecase.com/publications/alert/stimulus-bill-brings-welcomed-changes-renewable-energy-industry

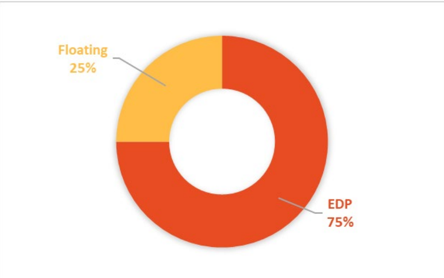
auctions, auction prices have been falling for both wind and solar projects. The auctioned price for wind additions fell around 25% between 2010 and 2018, while for solar the decrease was close to 75%.

Company Overview

Corporate governance

Following investigations of corruption, which in the past year led to the suspension of former CEO Manso Neto, earlier in April EDPR approved a restructuring of its governance bodies in a general shareholder's meeting. Thereafter: the board is organized in a two-tier model with the management team as an executive board and the BoD serving as supervisory board; the board of directors (BoD) counts twelve members: six of them being independent directors, including its chairman, and only two executive members; the former Executive Committee was discontinued, with its members being assimilated in the newly created Management Team (MT); EDPR possesses two committees: Appointments, Remunerations and Corporate Governance, and Audit, Control and Related Party Transactions.

Fig 15 – EDPR's share distribution



Source: Company data

Presently, the EDP group is the company largest shareholder with 74.98% of the shares with the remaining 25.02% being floating stock. Moreover, since January 2021, Miguel Stilwell d'Andrade has been the CEO of both EDP and EPD R. Hence, the most significant risk shareholders may face arises from concentrated ownership. As EDP can approve proposals without further approval, minority shareholders may be exposed to conflicts of interest.

However, having 10 out of 12 non-executive directors in the BoD may ensure the interests of minority shareholders. As non-executive members are expected to be unbiased, pursuing what is best for the company instead of what better suits the majority shareholder. It is also noteworthy that all EDPR committees are solely composed by independent directors.

Moreover, the two-tier model may ensure better monitoring of the MT decisions, being under BoD supervision. Nonetheless, albeit independent majority is presumed to pursue the company's best interests, the majority threshold of the BoD is not exceeded. Failing to lessen the potential risks of conflicts of interest in decision-making.

Members of the BoD earn fixed earnings while members of the management team also receive variable and multi-annual remuneration. Since the Management Team is responsible for controlling the activity and performance of the company, by instating variable remuneration linked with performance, its members have incentives to act in shareholders' best interests. To boot, the multi-annual variable remuneration being deferred for a span of three years, only to be paid whether there are no proofs of misconduct, further weakens motivations for misconduct. Still, the BoD and MT incentive schemes could be improved if payments were made in shares or linked with share price to further align incentives. As of now, its members may be considered to lack assets at stake, and instating variable remuneration so closely pegged with shareholder value could be a solution.

Strategy

Strategy Update 2021-2025

Integrated in market changes and the collective global efforts pushing for energy transition and carbon-neutrality in the electricity generation market, EDPR has delineated an ambitious strategic plan. In the past decade, EDPR experienced considerable growth, with installed capacity growing 78.64% from around 6.4GW in 2010 to 11.5GW in 2020. Nevertheless, EDPR desires to expand even faster, reaching an installed capacity of 18GW by 2023 and equal to 25GW by 2025. That is a combined growth of 117% in terms of capacity, translating into an average growth of 2.7GW per year.

Using these additions, EDPR plans to cement its presence in its most prominent markets, the US and Europe, reinforce its presence in Brazil and diversify into new markets in Latin America and in Asia Pacific (APAC), a region where EDPR started operating in June after the acquisition of a 28MW solar PV project in Vietnam. Moreover, EDPR seeks to increase the importance of solar power with additions similar to those of onshore wind, as well as exploring the emerging offshore wind technology through Ocean Winds.

Ocean Winds

Ocean Winds (OW) is a 50-50 joint venture between EDPR and the French electric utility company ENGIE, established in 2019 when the offshore wind assets and project pipeline of both companies merged. OW was created with the purpose of tapping into the fastest growing renewable technology market as one of its leading global players. OW will focus on the regions which are expected to grow the most, that is Europe, US and certain countries in Asia. As of now OW possesses projects in different stages of development amounting to a total of

6.6GW of installed capacity.

OW				
Project	Country	COD	Capacity (MW)	Share
Moray East	UK	2022	950	57%
EFGL	France	2023	30	80%
Le Tréport & Noirmoutie	France	2025	992	61%
Mouray West	UK	2025-26	871	62% (plus 33%)
Mayflower	US	2025-26	1336	50%
B&C-Wind	Poland	>2025	400	100%

Sunseap

On November 3rd, EDPR announced the acquisition of 87.4% of the Singaporean solar power producer Sunseap, for €600m. Sunseap's portfolio include 540MW of installed capacity, 127MW of secured capacity and 4.8G in pipeline spanning over 9 Southeast Asian countries. At the moment, distributed solar panels (DG) account for 72% of installed capacity, being the largest player of the Southeast Asian market (DG only), however the share decreases to 46% when considering the entire portfolio. As such, Sunseap provides an opportunity for EDPR to enter markets responsible for around 55% of expected global additions between 2020-30, with an already significant portfolio (equal to 42% of the previous year capacity).

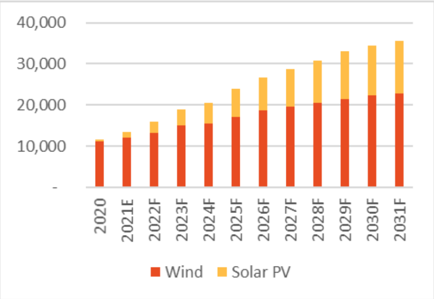
Forecast and Financial Projection

To be able to estimate the future value of EDPR, the company operations and financial statements had first to be projected. And, in order to forecast the different captions of the statements, our group determined several assumptions on expected trends and performances until 2031. Assumptions which were motivated by research, historical performance, and forecasts. Besides, a special emphasis was given to the value drivers of the company's core operations, as they constitute the means for EDPR to create value.

Core Drivers

- Installed Capacity

Fig 16 – Total Installed Capacity



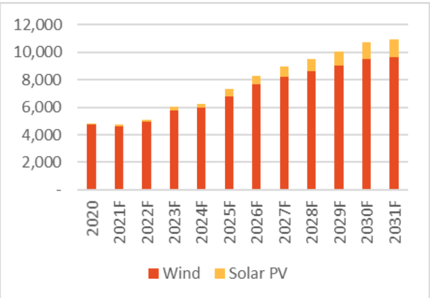
Source: Analysts Estimates

Firstly, using a combination of EDPR's strategic update, AR and recent news, we added the capacity secured that will be operational in the future to the current portfolio and removed the capacity of the projects sold in 2021. Secondly, as the target capacity for 2023 is already ensured and as projects require considerable time to be developed and constructed, no further additions were added until 2023, only what has already been projected will be up and running by 2023. Thirdly, after 2023 additions were estimated until 2030 based on either market targets and forecasts or goals delineated by EDPR.

Moreover, OW projects were included under the wind caption, but only the projects with secured PPA/tariff agreements were considered in this forecast (see *Ocean Winds*). Furthermore, when market size and or growth is mentioned in this section, note that it refers to size as in capacity and not as in value.

Europe

Fig 17 – Europe Total Installed Capacity



Source: Analysts Estimates

In collective efforts towards energy transition, the EU established several frameworks including the climate and energy targets for 2030. Hence, in 2019 EU members had to submit individual National energy and climate plans (NECPs) laying out solutions to accomplish said targets set by the Union[27]. Based on the NECPs submitted by each country, the wind and solar capacities targets for 2030 were used to estimate market growth rates. Despite being outside the EU, the UK government has also defined ambitious growth goals in renewable generation, especially concerning solar capacity almost tripling until 2030. Since EDPR planned to reinforce its position in the region, in most cases, the company was forecasted to grow in tandem with the national markets to maintain market share until 2030.

In Portugal incremental projects were only forecasted after 2025 after the completion of projects in development. The same rationale was applied to the Spanish wind capacity, and France.

However, growth in solar capacity in Spain was expected to start before, in 2024 and occurring around 2 times faster than the market. Because of EDPR's intention to diversify into solar and solidify position in its main markets such as Spain, which in the case of solar is expected to grow quickly.

[27] https://ec.europa.eu/energy/topics/energy-strategy/national-energy-climate-plans_en

In France it was decided to extend the growth rhythm of 2023-2028 until 2030. Albeit the country only presenting goals until 2028, the EU climate & energy framework in which it is inserted, concerns measures until 2030.

In Poland, other than projects already secured, no further additions were considered. Because the projects in development concluded until 2027 will more than double EDPR's installed capacity in Poland and the country government bodies predict very little growth from 2025 to 2030.

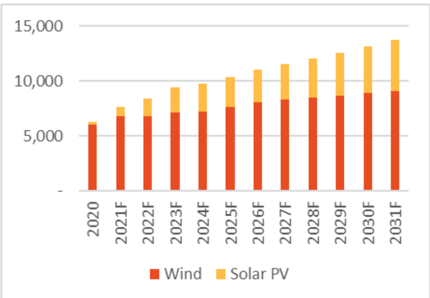
Greece is a recent market for EDPR where the company as specified ambitious targets. To estimate growth, we assumed: EDPR would miss its country targets of 500MW capacity by 2025 and 900MW by 2030 by a 10% margin, and those resulting additions would take place at a compounded annual growth rate.

In countries with no planned projects, capacity was expected to grow from 2024 onwards at the market pace. This method was applied to Belgium, Italy and Hungary.

Nevertheless, Romania was an exception. Since 2013, the company has maintained the same installed capacity, with assets still possessing on average 21 more years of useful life. As such, growth in wind capacity was assumed to start only in 2026 following the slower pace of the market in 2026-30. However, solar capacity was forecasted to start earlier in 2024, because the anticipated additions in the country are around 3 times larger than present capacity and EDPR plans on increasing the share of solar PV in its mix.

After 2030, the installed capacity growth in Europe was assumed to fall to 2% (close to g) in every country, as existing targets would have already expired, and growth would slow down.

Fig 18 – Total Installed Capacity in NA



Source: Analysts Estimates

North America

Due to the large impending additions in the US of wind power until 2026 and solar power until 2025, supplementary additions in wind were only considered from 2027, and from 2026 forwards in the case of solar. Besides, being a considerably mature market and already EDPR's largest one, with the phasedown of both PTC and ITC programs, growth was forecasted below the market. To boot, growth in wind power is more reduced as the company plans to focus growth on solar power.

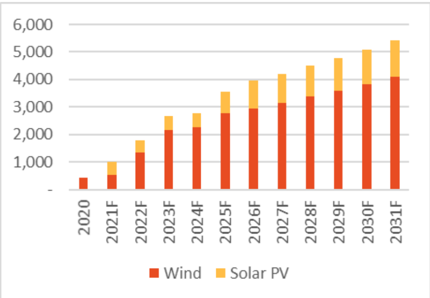
Based on projections of the Canada Energy Regulator, the growth of Canadian wind capacity additions until 2030 was extrapolated. Then the same growth rate was applied to EDPR in the country.

For Mexico, EDPR's additions were also assumed to follow the market additions after 2023. Which in the case of wind were extracted from government forecasts of capacity, and for solar they were based on IRENA's projections of installed capacity until 2025. For solar, we used a more conservative scenario, obtaining a 13.72% growth per year. Due to the lack of gathered information on other solar capacity estimations, government targets and policies, we extended as EDPR's growth.

Additions are assumed to continue at the same pace as the market experiences considerable growth and EDPR pursues efforts to increase solar capacity. While for the more mature markets of the US and Canada, the assumption of growth falling to 2% after 2030 was applied just as in Europe.

Latin America

Fig 19 – Total Installed Capacity in Latin America



Source: Analysts Estimates

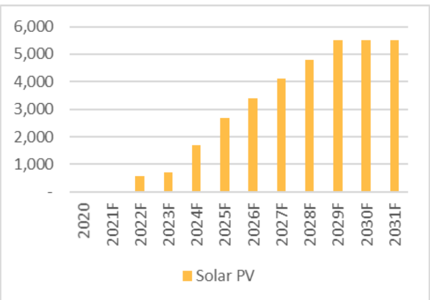
In Brazil additions were estimated to first absorb the conclusion of projects in development. Then, growth was assumed to follow the market. Which was estimated based on predictions on future wind and solar capacities. This resulted in wind capacity following the market rate in 2024 and solar in 2026

While in Chile and Colombia, after the expansions in capacity between 2022 and 2025, EDPR was assumed to grow in both markets at the same pace as in Brazil. This assumption was motivated by company's plan to not only strengthen Brazil but to explore diversification in the growing Latin American region.

Contrarily to the more mature markets of Europe and North America, the forecasted growth rates do not decrease beyond 2030. As these are less developed markets where governments have set considerable goals for renewable growth, natural resources have considerable potential (load factor), and growth has been increasing.

APAC

Fig 19 – Total Installed Capacity in APAC



Source: Analysts Estimates

In 2021, EDPR will add the 540MW installed capacity of Sunseap to the 28MW it acquired in June in Vietnam. In the following year, the 170MW of capacity secured by Sunseap will be added. The remaining projects in development divide into 2GW in advanced pipeline and 2.8GW in early-stage pipeline. Both types of projects were assumed to follow straight line additions. The advanced pipeline projects were assumed to be completed between 2023 and 2024 while those in early-stage from 2025 to 2028.

As mentioned above (*Sunseap* section), the acquisition of Sunseap in the past November, provided EDPR with growth surpassing the goals it had established for the region. Therefore, we assumed that no further projects (besides pipeline) would be pursued in the region which had been considered as enticing for low-risk diversification.

- Load Factor

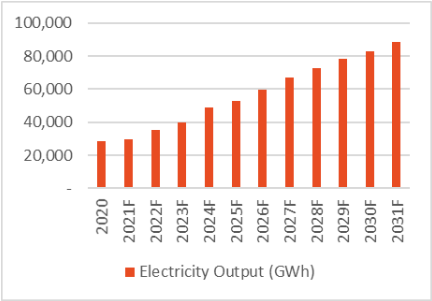
As technological advancements are expected to continue increasing the efficiency of wind turbines and solar panels, load factors are forecasted to continue their growing trend. To estimate their evolution for onshore and offshore wind we considered the load factor ranges predicted by IRENA for 2020[28]. Using the central value of each interval as the mean scenario, onshore projects can be expected to grow 1.67% a year until 2030, while offshore projects 1.63%.

Having difficulties finding global predictions concerning solar PV, we looked at forecasts for the US market. The NREL estimates that in a moderate scenario, the load factor for utility-scale solar PV would increase 1.13% a year between 2020 and 2030[29]. However, this conclusion is based on a base load factor of 25.2% in 2019, which is around 9% above the global average in 2020. Thus, as the US poses as one of the most developed markets, the 3rd largest by capacity with around 10% of world capacity in 2019, we assumed the global average load factor would increase faster. Therefore, as EDPR only manages utility-scale solar PV projects and solar is expected to grow more, we assumed load factors would increase by 2% per year at a national level.

Furthermore, for countries where EDPR has operated in the past, we considered future load factors to evolve in line with past values. While for countries where EDPR will start operations in a new technology or in countries where the company does not provide enough data to deduce the load factor for each energy resource, we assumed projects would be subject to the national average load factor[30]. But for the additions in APAC, as load factors vary between countries, the assumed load factor was calculated through an average of Sunseap and other recent projects in Singapore, Vietnam, Thailand, and the Philippines where most capacity exists and will be added.

[28] IRENA, 2019. Future of Solar Photovoltaic. <https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/Nov/IRENA_Future_of_Solar_PV_2019.pdf>.
[29] https://atb.nrel.gov/electricity/2021/utility-scale_pv
[30] https://www.irena.org/Statistics/Statistical-Profiles

Fig 20 – Total Electricity Generated



Source: Analysts Estimates

- Generation

To compute electricity generation during the forecasted period we assumed the output in a certain year to only depend on the installed capacity of the previous year, with additions made during the same year only starting operations in the beginning of the following year. Meaning that the installed capacity at the end of a year corresponds to the capacity used in the following year. This assumption was motivated by the fact that additions in capacity occur throughout the year and as such computing output with the capacity at the end of the year could tilt, output values, especially in years with considerable additions such as 2021.

Revenues/Sales

- **Average Selling Price**

Regarding the average selling price (ASP), we forecasted each region separately. Starting with North America, we used historic values of last 5 years to forecast a value for 2021, at which point ITCs and PTCs stop completely, as part of their phase-out (mentioned in *Remuneration Schemes* section), and from 2022 onwards there will be no support (or at least none announced at the time). Due to this, we considered the price to rise in 2022, by 2%, and from 2022 onwards it is an average of past 5 years, which tends to decline at a CAGR of 2% which goes in line with inflation forecasted for the US[31].

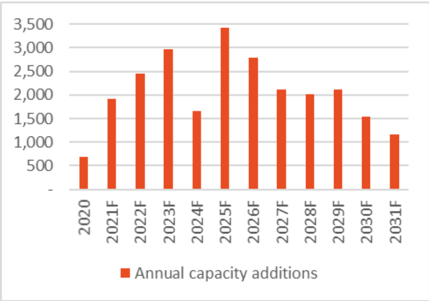
In Europe, our most mature market, we considered an average of past 5 years until 2025, and from the onwards, a decrease of 1% a year, in line with forecasted inflation for Euro[32].

For our most unstable region, South America, we considered the risk associated with the currency, Brazilian Real, especially since we used the value of Brazilian real in 2021 and converted prices from Colombian/Chilean pesos, to reais, to have an estimate for the region in the same currency. To try and have a more capable estimate for the region, and since the beginning of operations in Chile and Colombia, which are forecasted to grow at a higher rate, we calculated a weighted average using each country's respective capacity and prices from 2021. We kept the same weighted average formula for every year, considering the expected output of each country and their weights on the overall average, decreasing 2% until 2025, and 5% until 2030.

31 https://knoema.com/kyaewad/us-inflation-forecast-2021-2022-and-long-term-to-2030-data-and-charts
32 https://knoema.com/zobdrl/euro-area-inflation-forecast-2019-2024-and-up-to-2060-data-and-charts

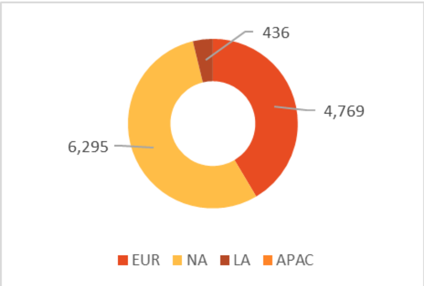
Lastly, for APAC, we considered prices to be an average of the past years, using the initial value taken from the 9M21 report of EDPR as a proxy for 2021 prices, decreasing 2% from 2025 onwards.

Fig 21 – Total Capacity Additions



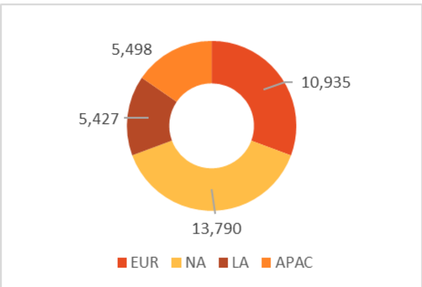
Source: Analysts Estimates

Fig 22 – Capacity by region in 2020



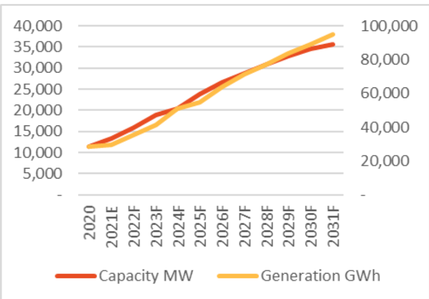
Source: Analysts Estimates

Fig 23 – Capacity by region in 2031



Source: Analysts Estimates

Fig 24 – Capacity vs Generation



Source: Analysts Estimates

- **Revenues**

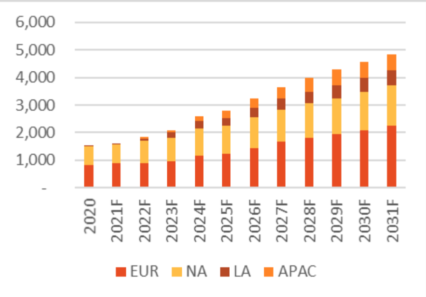
As a result of the assumptions, installed capacity increase 210% from 11.5GW in 2020 to 36.7GW, that is on average 2.2GW a year. Although the value may seem considerably high, it is noteworthy that most growth takes place in years where additions only or mostly relied on secured capacity and the completion of projects under development. Indeed 51.41% of installed capacity additions took place in 2020-25. Between 2020-23 when only secured capacity was considered, the pace of additions increased each year (CAGR 17.86%), almost reaching 3GW in 2023. Then, in 2023-25 capacity grew 12.71% a year, peaking in 2025 after a considerable slowdown in 2024. After which in 2025-31 capacity growth slowed down to 6.88% a year, as annual additions fell below 2GW in 2030. As one can see, from 2020 to 2031, with the diversification into new markets, the share of capacity represented by both North America and Europe reduced considerably.

With installed capacity and load factors following a positive trend, so did generation. In fact, according to our forecast, generation will follow very tightly the growth of capacity, with both growing at a CAGR of around 11 %. Generation and capacity are anticipated to experience a very stable and continuous growth. Thus, revenues also increased despite decreasing prices.

It is possible to observe that EDPR will continue to rely the most on Europe to harvest revenues, as the region continues to be responsible for around half of all revenues. Electricity sales in the region are forecasted to increase steadily. In comparison, revenues in North America increase at a slower rhythm. Even experiencing a small decrease in 2021 due to a lower load factor, as the load factor registered in the first 9 months is lower than its equivalent of the previous year. On the other hand, revenues originating from Latin America and APAC grow much faster due to their considerable expected growth in terms of capacity and high load factors in LA.

Operating Costs

Fig 25 – Revenues distribution



Source: Analysts Estimates

As technology advancements such as the ones discussed in (as mentioned in the *Costs* section) are expected to continue and competition amongst electricity producers and suppliers is expected to intensify (*Remuneration Schemes* section), industry costs are believed to continue to decrease.

EDPR's operating costs (OPEX), consist of supplies and services expenses, personnel costs and other operating costs. Being M&O costs, they depend on the electricity generation and installed capacity. And as the LCOE measures costs incurred in the production of electricity, we considered the evolution of LCOE as a suitable proxy for the evolution of OPEX.

To estimate LCOE values we used forecasts LCOE developed by IRENA for wind and solar power as previously mentioned. Based on the forecasted LCOE ranges, we considered that following the mean value of the predicted range, would constitute a reasonable scenario. As such we obtained a 3% yearly decrease of LCOE for onshore wind, 4% for solar PV, and 5% for offshore wind between 2018 and 2030.To tailor the effects of LCOE across the different technologies, we calculated a weighted LCOE evolution based on the forecasted additions, which was equal to 3.97%. Consequently, we assumed supplies and services to decrease at that pace until 2030, while personnel costs would start by decreasing at 2% and then at 3.97% from 2025 to 2030 as scale increases, and from 2030 onwards we assumed a lower rate of 2% for both.

PP&E

PPE is a very important value to forecast as there are other items, such as depreciation, which are estimated using PPE as a driver. In an industry that is so capital intensive, we considered relevant to properly estimate PPE. PPE includes costs attributable to the development of plants and according to the AR 2020, are only capitalized when the project is built. We therefore started by checking past PPE values and matching it with the respective capacity installed in MW.

	2016	2017	2018	2019	2020
Property, plant and equipment, net	13,437	13,185	13,922	13,264	13,492
Installed Capacity in MW	10,052	10,676	11,301	10,812	11,500
PPE *cost* per MW Installed	1.34	1.24	1.23	1.23	1.17

We arrived at an estimated cost of PPE per MW of installed capacity which didn't variate much each year, and has been decreasing, at a CAGR 2016-2020 of 2.6%, in line with expected lower costs already discussed in *Operating Costs*. Property, plant, and equipment was then forecasted using an expected cost per MW installed and the capacity already forecasted in *Installed Capacity*. For the expected cost, similar to the trend previously mentioned of -2.6%YoY, we kept it decreasing, although at a lower rate, due to two reasons. Firstly, this cost has reduced a lot in 2020 mostly because of Covid-19 impacts and the advantage on access to infrastructures given to renewables (section *Covid-19 Impacts*). Secondly, as mentioned in the *Costs* section, prices for new solar PVs and wind turbines have been declining, making it a cheaper technology. We therefore forecasted a decline in value of PPE/MW at a rate of 2% arriving at our final forecasted PPE.

	2021F	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F
Property, plant and equipment, net	15,414	17,876	20,788	22,174	25,361	27,764	29,163	30,592	32,057	32,897	33,318
Installed Capacity in MW	13,406	15,865	18,826	20,490	23,914	26,714	28,633	30,649	32,773	34,317	35,466
PPE *cost* per MW Installed	1.15	1.13	1.10	1.08	1.06	1.04	1.02	1.00	0.98	0.96	0.94
%g	-2.0%	-2.0%	-2.0%	-2.0%	-2.0%	-2.0%	-2.0%	-2.0%	-2.0%	-2.0%	-2.0%

The right-of-use account is mainly composed of Leases, which are expected to grow at the same rate as PPE. We analyzed past ratios and noticed that the historical value averaged around 5pp and used this historical value, as PPE increases and new capacity additions arise, it is expected that operations and leases expand at the same rate.

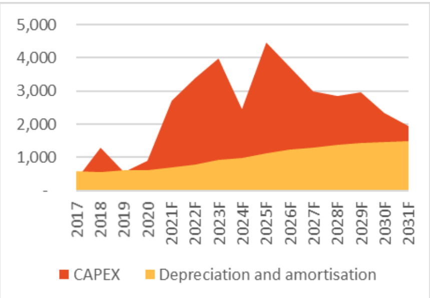
	2016	2017	2018	2019	2020
Depreciation and amortisation	(625)	(583)	(562)	(609)	(617)
PP&E	13,437	13,185	13,922	13,264	13,492
% PP&E	4.6%	4.4%	4.0%	4.6%	4.6%

Finally, the depreciation was calculated using PPE as the driver. We found historical values to be very similar as seen in the table above, ranging only 0.6% difference from the highest value to the lowest.

	2021F	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F
Depreciation and amortisation	(686)	(796)	(926)	(987)	(1,129)	(1,236)	(1,308)	(1,371)	(1,436)	(1,474)	(1,492)
PP&E	15,414	17,876	20,788	22,174	25,361	27,764	29,367	30,791	32,253	33,089	33,510
% PP&E	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%

We used the average %PPE and reached a value of 4.45% that we kept constant. As can be observed in table above, the depreciation grows YoY, in line with the expected growth of the installed capacity and consequently PPE.

Fig 26 – CAPEX and Depreciation



Source: Analysts Estimates

Arising from the important growth of installed capacity and subsequent increasing depreciation, the CAPEX is also estimated to grow considerably over the forecasted period. With growth booming in the next years, between 2021 and 2025, the company is expected to spend close to €17bn in CAPEX, that is 89% of the €19bn forecasted by EDPR. Operating in such a capital-intensive industry, where revenues are linked with capacity, considerable investment is required to achieve important growth. Indeed, to pursue expansion EDPR will invest above the core result and so experience reinvestment rates above 100%, until 2030.

Valuation

DCF Valuation

Using the forecasted financial statements, the Discounted Cash Flow Method was employed to estimate the future value of EDPR. And to discount the free cash flows of the forecasted financial statements, the cost of capital suited to EDPR's financing options was computed.

Cost of Debt

Due to a lack of rating of EDPR we had to estimate a synthetic rating for the company. Starting with an estimation based on the company's Interest Covering Ratio that is equal to 2.85, we were able to assign a BBB/Baa2 rating to the firm[33]. However, taking into consideration the ratings of the mother company the EDP group (BBB/Baa3), which owns close to 75% of EDPR, we assumed the latter to be exposed to similar default spreads and so to also have a Baa3 rating. As such, we assumed EDPR to have a synthetic BBB rating according to the S&P scale and a Baa3 according to Moody's[34]. Using that rate, we extracted the yield of 0.813% on a 10-year maturity from the Eurocomposite BBB yield curve. We considered a 10-year maturity to be adequate for the valuation, matching the maturity of the cash flows. Moreover, using Moody's investor services we obtained the annual defaulted corporate bond and loan recoveries, and the cumulative default rates for a Baa3 and a 10-year horizon. Which we used to compute a probability of default of 0.44% and a loss given default of 65.80% for EDPR. The resulting cost of debt for EDPR is equal to 0.52%.

Cost of Equity

To calculate the company beta, we started by regressing the excess return of EDPR against those of the MSCI World Index over the last 5 years to obtain a raw beta of 0.533. We decided to use the index in question as it constitutes a well-diversified global portfolio without idiosyncratic risks. Then, we adjusted the raw beta using Blume's beta adjustment formula[35], which presupposes that with time the company beta will tend towards the market, obtaining an adjusted beta of 0.689. As for the risk free, as a proxy we used the Spanish 10-year Government Bonds, which yield a 0.368% return. The rationale behind using Spanish bonds, came from the fact that EDPR's headquarters are in Spain and the company is subject to the tax rates applicable in the country. And for the

[33] https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ratings.html
[34] Moodys.com. 2021. Annual Default Study.
https://www.moodys.com/researchdocumentcontentpage.aspx?docid=PBC_1263901
[35] $\beta_{adjusted} = \beta_{raw} \times \frac{2}{3} + 1 \times \frac{1}{3}$

market risk premium a value of 5.00% was assumed as advised by KMPG[36]. Using the CAPM formula, the computed cost of equity for EDPR is 3.81%.

Cost of Instructional Partnerships

As Instructional Partnerships (IP) constitute a relevant source of financing for operations in the US, the cost of such funding was also calculated. We assumed unwinding expenses related with the return in IP to be the IP costs, which divided by the value of IP were equal to the cost of IP. We assumed this cost to be equal to the average of the past 5 years of 4.00%, as they only take place in the US market, and so are less fluctuating.

WACC

Having calculated the cost of the three sources of financing available to EDPR, we then computed the WACC. Using the following formula, we obtained a WACC equal to 3.386%.

$$WAAC = \frac{E}{(E+D+IP)} \times r_E + \frac{D}{(E+D+IP)} \times r_D \times (1-t) + \frac{IP}{(E+D+IP)} \times r_{IP}$$ [37]

Assuming the capital structure of the company to remain constant in the future, a 25% tax rate corresponding to the Spanish corporate income tax. While considering the recent Market Capitalization of the company and the Debt and Institutional Partnerships values of 2021E (as t0=2022)

DCF Conclusion

To calculate the terminal value, we considered the 10 years forecasted period until 2031 plus a final perpetuity from 2031 onwards. In order to determine the growth rate of the perpetuity, we found the GDP's forecast[38] for 2050, for the countries available, where EDPR has operations, which averaged to a compounded annual growth of approximately 1.74%.

Finally, our DCF analysis provides us with an expected share price in 2022 of **22.34€**.

[36] https://indialogue.io/clients/reports/public/5d9da61986db2894649a7ef2/5d9da63386db2894649a7ef5
[37] E refers to the market value of Equity, D to Total Net Financial Assets, IP to Instructional Partnerships, and r_E, r_D and r_{IP} to their respective costs
[38] OECD 2060 GDP Forecast https://data.oecd.org/gdp/real-gdp-long-term-forecast.htm#indicator-chart

Sensitivity analysis

		Growth			
		1.70%	**1.74%**	1.80%	1.90%
WACC	3.19%	27.44	28.57	30.71	34.49
	3.39%	21.48	**22.34**	23.96	26.78
	3.59%	16.70	17.38	18.63	20.79
	3.89%	11.27	11.76	12.66	14.19

A sensitivity analysis is a "what-if" analysis that searches to see, under different circumstances, the result of our expected share price. The DCF valuation was carried out until 2031, which meant that each year's cash flow was carefully projected, and the terminal value was calculated using the perpetuity formula from 2031 onwards.

As our independent variables, we chose to look into the effect a change to the Weighted Average Cost of Capital and our terminal growth, as they are usually the variables that the DCF is more sensitive to.

Initially, the WACC was sensitized by no more than 0.5% at its peak. A discounted cash-flow analysis is always highly sensitive to key variables changing and using a range bigger than 0.5% should be avoided[39] for the selected variables.

We noticed that for the interval chosen the growth was not as susceptible to change as the WACC. This is expected as EDPR core business relies heavily on funding and the ability to find capital, and its respective cost.

Our analysis indicates that even little changes in the WACC or perpetual growth rate, which may not appear to be substantial, will considerably outweigh the estimated fair share price from the DCF valuation. Increasing the WACC by 0.5pp while lowering the perpetual growth rate by 0.04pp, for example, reduces the DCF price by more than 45%.

However, the WACC is mainly subject to economic conditions, industry conditions and the risk-free rate. As it has been described so far, both the industry and GDPs are expected to rise, and risk-free rate is expected to continue to drop[40]. This provides us confidence that our WACC will not rise, as it is expected that it follows the same trend as its main drivers.

		Growth			
		1.70%	**1.74%**	1.80%	1.90%
WACC	3.19%	28.5%	33.8%	43.8%	61.5%
	3.39%	0.5%	4.6%	12.2%	25.4%
	3.59%	-21.8%	-18.7%	-12.8%	-2.7%
	3.89%	-47.2%	-44.9%	-40.7%	-33.6%

In this scenario, there is some confidence in affirming that the share price will yield a positive result in relation to today's price.

Nevertheless, because estimating the permanent growth rate or the cost of capital with an accuracy of only a few basis points is extremely difficult, the estimated fair share price should only be used as a guide, not as an absolute figure.

[39] https://www.fe.training/free-resources/valuation/dcf-sensitizing-for-key-variables/
[40] https://data.oecd.org/interest/long-term-interest-rates-forecast.htm

Multiple Valuation

Complementing our DCF valuation, we choose to perform a relative valuation.

Most commonly used Multiple is the P/E. From our understanding, a P/E multiple is impacted by capital structure, meaning companies whose unlevered P/E is > 1/Cost of Debt could artificially increase its P/E ratio by swapping debt for equity. Secondly, earnings are the denominator, which in some cases, include nonoperating items, or write offs, which are usually a one-time event and can lead to a misleading comparison. Therefore, we selected a multiple that for us made sense, it being EV/Sales. As our selected peers' main operations are comparable to ours, their FCF contribution comes mainly from Core operations (Sales). This multiple is also less sensitive to changes in capital structure. Usually, multiples valuation only analyses companies from a stationary perspective, looking into historical profits, not considering expected growth, industry or company wise. In order to contradict this and the effects that the past two years and the impact COVID-19 had on sales; we are analyzing forward-looking multiples of 2 years. According to McKinsey, *multiples* (must) *be based on forecast rather than historical profits*[41].

Previously considered competitors, such as utilities, like Siemens Gamesa, were not considered comparable peers, as our selection now focus on major operations and the remaining companies have other sources of revenue and operations that do not make sense to compare them to, as EDPR is only a producer. Therefore, we considered only choosing peers in similar markets and companies whose majority stake of operations is wind and solar development and production.

Fig 27 – Multiple Valuation

Company	EV/Sales FY22
EDPR	14.91
Boralex Inc	9.3
Transalta Renewables Inc	10.7
Encavis	12.2
Alerion Clean Power	11.7
Clearway Energy	11.4
Average	11.08
Median	**11.43**

Source: *Bloomberg*

We arrived at 5 comparable peers, as seen in fig 27. Most operations are split between North America and Europe as well. Computing the average of future 2Y forward-looking EV/Sales we got **11.08x** and a median value of **11.43x**. This provides an Expected share price of 15.6, **as overvalued,** which contradicts our DCF analysis. This can be justified by the fact that none of the comparable companies registered any mergers or acquisitions the size of Sunseap, which has an expected growth very hard to compare to. In comparison, EDPR's latest results, from 9M21 has an EV/Sales of **14.91x**, where EV grew due to a value not far from our DCF valuation which supported a multiple of EV/Sales of **14.91x** in 2022 as well, but is expected to lower over time, eventually converging to its peers' value, and is only

[41] https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/the-right-role-for-multiples-in-valuation

inflated in the next upcoming years due to the acquisition that took place, and which none of the same size is expected[42].

Final Thoughts and Recommendations

As a final remark, our analysis points out to EDPR being a strong player due to its positioning. The company in 2020 was the world's 4th biggest wind producer. The renewables segment also has a very positive outlook for the future of the energy industry, mostly because of undergoing global pressure to change the sector. EDPR from 2020 to 2021 had an amazing growth, based on the strategic plan to entry to new markets, and further development of early-stage markets (like South America). We feel not all of the value gained in the past year has been captured yet by the share price. It is also relevant to mention that our selected peers in *Multiple Valuation,* although similar in operations and energy mix, they do not carry a similar EV, as they are all smaller companies. Besides that, EDPR EV value, according to Bloomberg, nearly doubled from previous year, which is most likely the reason why this relative valuation provided results different from the DCF. Our final recommendation is **hold**, as we believe in 2022, the price share to be 22.34€, yielding a return of ~ 4.6%, as it should reflect further the expected growth and already secured capacity for upcoming years.

[42] "But I'm not expecting any acquisition of this size," Stilwell d'Andrade, CEO, in https://www.reuters.com/business/cop/edp-renewables-buys-majority-stake-sunseap-values-firm-816-mln-2021-11-03/

Appendix

Financial Statements

Appendix 1- Income Statement

Reformulated Income Statement - EUR in millions

€ in millions	2016	2017	2018	2019	2020	2021E	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F
Core Result																
Revenues																
Electricity sales and other	1,453	1,602	1,512	1,642	1,529	1,603	1,847	2,078	2,590	2,804	3,252	3,654	3,982	4,293	4,550	4,838
Europe (€)	913	943	891	925	824	906	902	974	1,182	1,228	1,447	1,661	1,821	1,950	2,090	2,253
North America (€)	508	598	578	651	669	659	795	848	959	1,015	1,097	1,177	1,237	1,305	1,378	1,455
Latin America (€)	34	63	50	74	37	39	96	188	279	286	363	395	429	467	507	552
APAC (€)	-	-	-	-	-	-	54	68	169	274	345	421	495	571	575	578
COGS																
Supplies and services	(305)	(327)	(345)	(309)	(304)	(341)	(387)	(441)	(461)	(517)	(554)	(574)	(590)	(605)	(608)	(616)
Personnel costs	(94)	(101)	(115)	(131)	(141)	(161)	(187)	(217)	(232)	(265)	(284)	(295)	(303)	(311)	(312)	(316)
Other operating costs	(135)	(128)	(128)	(136)	(123)	(123)	(140)	(158)	(187)	(192)	(216)	(231)	(241)	(249)	(255)	(267)
Own work capitalised	23	16	24	18	26	22	26	29	36	39	45	51	56	60	63	67
Gross Margin	**943**	**1,062**	**947**	**1,085**	**987**	**1,001**	**1,159**	**1,290**	**1,746**	**1,869**	**2,244**	**2,605**	**2,904**	**3,188**	**3,438**	**3,707**
Contract and insurance compensations	20	19	17	24	22	21	24	27	34	36	42	48	52	56	59	63
Provisions	(5)	0.2	(0.3)	(1.2)	(0.7)	(1.4)	(1.4)	(1.5)	(1.8)	(1.8)	(2.2)	(2.5)	(2.7)	(2.9)	(3.1)	(3.4)
Depreciation and amortisation	(625)	(583)	(562)	(609)	(617)	(686)	(796)	(926)	(988)	(1,130)	(1,236)	(1,307)	(1,370)	(1,436)	(1,473)	(1,491)
Pre-tax profit	**333**	**498**	**401**	**498**	**391**	**334**	**385**	**390**	**790**	**774**	**1,048**	**1,343**	**1,583**	**1,806**	**2,021**	**2,275**
Statutory Tax	(83)	(125)	(100)	(125)	(98)	(84)	(96)	(97)	(198)	(193)	(262)	(336)	(396)	(451)	(505)	(569)
Tax Adjustments	(0)	45	58	73	92											
Extraordinary contribution to the energy sector (CESE)	-	-	-	(3)	(3)	-	-	-	-	-	-	-	-	-	-	-
Core Result	**250**	**419**	**359**	**443**	**382**	**251**	**289**	**292**	**593**	**580**	**786**	**1,007**	**1,187**	**1,354**	**1,516**	**1,706**
Non-Core Result																
Revenues																
Gains on business combinations	4	5	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Gains on disposals	-	-	109	313	444	233	-	-	-	-	-	-	-	-	-	-
Other income	25	68	63	60	28	52	58	65	79	85	97	108	111	121	128	136
Share of profit from associates	(0)	3	2	3	(6)	-	-	-	-	-	-	-	-	-	-	-
Non-CoreEBIT	**29**	**75**	**174**	**377**	**468**	**285**	**58**	**65**	**79**	**85**	**97**	**108**	**111**	**121**	**128**	**136**
Financial income																
Foreign exchange gains	13	18	10	10	39	19	26	30	38	43	49	54	58	63	67	70
Other financial income	2.56	0.80	87.40	0.39	0.36	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
Financial (expense)																
Foreign exchange losses	(14)	(11)	(9)	(7)	(50)	(19)	(24)	(28)	(34)	(35)	(40)	(43)	(45)	(48)	(51)	(55)
Other financial expenses	(41)	(16)	(9)	(6)	(9)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)	(16)
Pre-tax profit	**(10)**	**67**	**252**	**374**	**449**	**269**	**44**	**51**	**68**	**77**	**91**	**104**	**109**	**121**	**128**	**136**
Statutory Tax	**3**	**(17)**	**(63)**	**(94)**	**(112)**	**(67)**	**(11)**	**(13)**	**(17)**	**(19)**	**(23)**	**(26)**	**(27)**	**(30)**	**(32)**	**(34)**
Tax Adjustments	16	33	12	22	18	20	20	20	20	20	20	20	20	20	20	20
Actuarial gains/(losses)	(0)	0	-	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Tax effect of actuarial gains/(losses)	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0
Fair value reserve (Equity instruments at fair value)	2	0	(0)	(0)	(3)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Fair value reserve (cash flow hedge)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax effect from the fair value reserve (cash flow hedge)	(23)	(20)	(63)	92	(8)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
Fair value reserve (cash flow hedge) net of taxes of non-current assets held for sale	8	3	16	(22)	3	2	2	2	2	2	2	2	2	2	2	2
Share of other comprehensive income of joint ventures and associates, net of taxes	1	14	(20)	(13)	14	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Reclassification to profit and loss due to changes in control	-	(4)	0	(1)	75	14	14	14	14	14	14	14	14	14	14	14
Exchange differences arising on consolidation	5	(105)	17	(6)	(200)	(58)	(58)	(58)	(58)	(58)	(58)	(58)	(58)	(58)	(58)	(58)
Non Core Result	**1**	**(30)**	**150**	**351**	**234**	**173**	**5**	**10**	**22**	**29**	**40**	**50**	**53**	**62**	**67**	**73**
Financing Result																
Financial Income																
Interest income	8	7	13	21	16	13	13	13	13	13	13	13	13	13	13	13
Interest	0	-	1	2	1	1	1	1	1	1	1	1	1	1	1	1
Fair value	31	16	20	6	19	18	18	18	18	18	18	18	18	18	18	18
Financial Expenses																
Interest expense	(189)	(167)	(170)	(185)	(137)	(158)	(150)	(247)	(366)	(430)	(556)	(658)	(728)	(883)	(941)	(941)
Interest	(56)	(60)	(84)	(85)	(47)	(62)	(58)	(96)	(142)	(167)	(216)	(256)	(283)	(344)	(366)	(366)
Fair value	(32)	(13)	(16)	(4)	(15)	(18)	(17)	(28)	(42)	(49)	(63)	(75)	(83)	(101)	(107)	(107)
Total	(239)	(217)	(236)	(246)	(162)	(206)	(193)	(340)	(518)	(615)	(804)	(957)	(1,062)	(1,296)	(1,383)	(1,383)
Statutory Tax	60	54	59	61	41	52	48	85	129	154	201	239	266	324	346	346
Other comprehensive income for the year, net of income tax	45	(118)	30	16	(99)	(25)	(25)	(24)	(24)	(23)	(23)	(23)	(22)	(22)	(22)	(22)
% revenues	3%	-7%	2%	1%	-7%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%
Financing Result	**(134)**	**(280)**	**(147)**	**(169)**	**(221)**	**(180)**	**(169)**	**(279)**	**(412)**	**(484)**	**(626)**	**(740)**	**(819)**	**(994)**	**(1,059)**	**(1,059)**

Appendix 2- Balance Sheet

Reformulated Balance Sheet - EUR in Millions	2016	2017	2018	2019	2020	2021E	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F
Core Invested Capital																
Net Working Capital	175	282	229	220	185	182	210	234	323	345	417	488	547	603	652	705
Operating Cash	29	32	30	33	31	32	37	42	52	56	65	73	80	86	91	97
Accounts receivable - trade, net	266	364	334	303	279	293	337	379	473	512	594	667	727	784	830	883
Inventories	24	29	36	34	55	63	72	82	89	98	106	111	114	117	118	121
Trade and other payables from commercial activities - current	(144)	(142)	(171)	(150)	(179)	(206)	(235)	(269)	(290)	(321)	(347)	(362)	(374)	(384)	(387)	(395)
Property, plant and equipment, net	13,437	13,185	13,922	13,264	13,492	15,414	17,876	20,788	22,175	25,364	27,747	29,349	30,773	32,235	33,070	33,491
Right-of-use asset	-	-	-	616	674	770	893	1,039	1,108	1,267	1,386	1,466	1,537	1,610	1,652	1,673
Intangible assets	210	250	251	290	314	359	416	484	516	591	646	684	717	751	770	780
Goodwill	1,385	1,296	1,327	1,199	1,223	1,368	1,525	1,699	1,890	2,105	2,346	2,613	2,911	3,242	3,611	4,022
Current Tax Liabilities	(88)	(90)	(87)	(93)	(110)	(115)	(133)	(149)	(186)	(201)	(234)	(262)	(286)	(308)	(327)	(347)
Trade and other payables from commercial activities - non-current & PPE	(1,130)	(1,033)	(1,424)	(1,579)	(1,606)	(1,835)	(2,129)	(2,475)	(2,640)	(3,020)	(3,304)	(3,495)	(3,664)	(3,838)	(3,938)	(3,988)
Total Core Invested Capital	**13,989**	**13,890**	**14,217**	**13,917**	**14,172**	**16,142**	**18,660**	**21,618**	**23,186**	**26,449**	**29,005**	**30,843**	**32,535**	**34,293**	**35,491**	**36,337**
Noncore Invested Capital																
Accounts receivable - other, net	338	235	540	556	999	1,047	1,206	1,357	1,691	1,831	2,124	2,386	2,601	2,804	2,972	3,160
Deferred tax assets	76	64	174	126	122	149	149	149	149	149	149	149	21	41	31	31
Assets held for sale	-	58	8	214	12	-	-	-	-	-	-	-	-	-	-	-
Financial Investments, net	348	312	357	476	488	537	618	712	788	888	1,008	1,139	1,281	1,446	1,633	1,843
Liabilities held for sale	-	-	-	(27)	(0)	-	-	-	-	-	-	-	-	-	-	-
Provisions	(275)	(276)	(295)	(278)	(315)	(299)	(344)	(387)	(483)	(523)	(606)	(681)	(743)	(801)	(848)	(902)
Deferred Tax liability	(365)	(356)	(463)	(355)	(427)	(511)	(511)	(511)	(511)	(511)	(511)	(511)	(74)	(142)	(108)	(108)
Other Liabilities	(1,413)	(1,031)	(1,094)	(1,169)	(1,021)	(1,167)	(1,353)	(1,573)	(1,678)	(1,920)	(2,100)	(2,221)	(2,329)	(2,440)	(2,503)	(2,535)
Total Non core Invested Capital	**(1,291)**	**(993)**	**(773)**	**(457)**	**(142)**	**(244)**	**(235)**	**(254)**	**(44)**	**(85)**	**63**	**260**	**758**	**910**	**1,178**	**1,490**
Total Invested Capital	**12,698**	**12,897**	**13,444**	**13,460**	**14,029**	**15,898**	**18,424**	**21,364**	**23,142**	**26,364**	**29,068**	**31,103**	**33,292**	**35,203**	**36,669**	**37,827**
Net Financial Assets																
Excess of Cash	(574)	(356)	(521)	(549)	(444)											
Collateral Deposits	(46)	(43)	(39)	(32)	(31)	(35)	(41)	(47)	(50)	(58)	(63)	(67)	(70)	(73)	(75)	(76)
Financial Debt	3,406	3,237	3,650	3,417	3,947	3,724	6,157	9,106	10,709	13,839	16,374	18,122	21,994	23,436	24,538	25,069
Total Net Financial Assets	**2,786**	**2,838**	**3,090**	**2,836**	**3,472**	**3,689**	**6,116**	**9,059**	**10,659**	**13,782**	**16,311**	**18,055**	**21,924**	**23,363**	**24,463**	**24,993**
Equity and Equity Equivalents																
Total Equity attributable to equity holders of the parent	6,125	6,335	6,509	6,973	7,348	7,391	7,490	7,487	7,664	7,764	7,938	8,230	8,550	8,889	9,321	9,949
Result Attributable to EDPR	214	226	451	688	463	296	176	74	254	176	252	368	397	416	509	705
Transactions with Shareholders	-	96	(224)	(475)	(174)	(77)	(77)	(77)	(77)	(77)	(77)	(77)	(77)	(77)	(77)	(77)
Non-controlling interests	1,448	1,560	1,613	1,362	1,276	1,452	1,452	1,452	1,452	1,452	1,452	1,452	1,452	1,452	1,452	1,452
Total Equity and Equity Equivalents	**7,573**	**7,895**	**8,122**	**8,335**	**8,624**	**8,843**	**8,942**	**8,939**	**9,116**	**9,216**	**9,390**	**9,682**	**10,002**	**10,341**	**10,773**	**11,401**
Institutional Partnerships																
Institutional partnerships deferred revenues	819	915	962	1,003	790	1,001	1,001	1,001	1,001	1,001	1,001	1,001	144	277	210	210
Institutional Partnership Liabilities	1,520	1,249	1,269	1,287	1,143	2,366	2,366	2,366	2,366	2,366	2,366	2,366	1,223	1,223	1,223	1,223
Total Institutional Partnerships	**2,339**	**2,164**	**2,231**	**2,290**	**1,934**	**3,367**	**3,367**	**3,367**	**3,367**	**3,367**	**3,367**	**3,367**	**1,367**	**1,500**	**1,433**	**1,433**
D/E	37%	36%	38%	34%	40%	42%	68%	101%	117%	150%	174%	186%	219%	226%	227%	219%
Transactions with Shareholders		96	(224)	(475)	(174)	(77)	(77)	(77)	(77)	(77)	(77)	(77)	(77)	(77)	(77)	(77)
Dividend Payment		(52)	(61)	(70)	(77)	(77)	(77)	(77)	(77)	(77)	(77)	(77)	(77)	(77)	(77)	(77)
Dividend Per Share	0.06	0.06	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08

Appendix 3 – FCF Map

Reformulated Income Statement - EUR in millions															
€ in millions	2017	2018	2019	2020	2021E	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F
Core Business															
Core Operating Cash Flow	1,002	921	1,052	998	937	1,085	1,218	1,580	1,710	2,022	2,314	2,558	2,790	2,989	3,197
Core result	419	359	443	382	251	289	292	593	580	786	1,007	1,187	1,354	1,516	1,706
Depreciation and amortisation	583	562	609	617	686	796	926	988	1,130	1,236	1,307	1,370	1,436	1,473	1,491
Investment Cash Flow	483	889	309	871	2,656	3,314	3,885	2,555	4,393	3,791	3,145	3,062	3,194	2,670	2,337
Investment in Net Working Capital	107	(53)	(9)	(35)	(4)	29	23	89	22	73	71	59	56	50	53
CAPEX/Investments in PP&E and Right-of-use asset	331	1,299	567	903	2,704	3,381	3,983	2,444	4,478	3,738	2,989	2,866	2,970	2,350	1,934
Investment in Intangible Assets	39	1	40	24	45	57	68	32	74	56	37	33	34	19	10
Investments in Goodwill	(89)	30	(127)	23	145	157	173	192	214	241	267	297	331	369	412
Changes in All Other Operating Assets and Liabilities	95	(388)	(161)	(44)	(234)	(311)	(363)	(202)	(395)	(316)	(220)	(193)	(196)	(118)	(71)
Core Free Cash Flow	**519**	**33**	**742**	**127**	**(1,719)**	**(2,229)**	**(2,667)**	**(975)**	**(2,683)**	**(1,769)**	**(831)**	**(504)**	**(405)**	**319**	**860**
Noncore Business															
Noncore result	(30)	150	351	234	173	5	10	22	29	40	50	53	62	67	73
Investment Cash Flow	298	220	316	314	(101)	8	(19)	210	(41)	148	197	498	152	268	312
Changes in Accounts receivable	(103)	305	16	443	49	159	151	334	140	293	262	214	203	168	188
Changes in All Other Non-Core Assets and Liabilities	401	(86)	301	(128)	(150)	(151)	(169)	(124)	(181)	(145)	(65)	283	(51)	100	124
Noncore Free Cash Flow	**(328)**	**(70)**	**35**	**(80)**	**275**	**(4)**	**28**	**(188)**	**70**	**(109)**	**(148)**	**(444)**	**(90)**	**(201)**	**(239)**
Free Cash Flow	**191**	**(38)**	**778**	**47**	**(1,445)**	**(2,233)**	**(2,638)**	**(1,163)**	**(2,613)**	**(1,878)**	**(978)**	**(949)**	**(495)**	**118**	**621**
Net Financial Assets															
Financing Result	(280)	(147)	(169)	(221)	(180)	(169)	(279)	(412)	(484)	(626)	(740)	(819)	(994)	(1,059)	(1,059)
Change in Excess Cash	218	(165)	(28)	105	444	-	-	-	-	-	-	-	-	-	-
Change in Collateral Deposits	3	4	7	1	(4)	(6)	(7)	(3)	(7)	(5)	(4)	(3)	(3)	(2)	(1)
Change in Financial Debt	(169)	413	(233)	530	(223)	2,433	2,949	1,603	3,130	2,535	1,748	3,872	1,442	1,102	531
Debt Cash Flow	**(228)**	**105**	**(423)**	**415**	**37**	**2,258**	**2,664**	**1,188**	**2,639**	**1,904**	**1,004**	**3,050**	**445**	**41**	**(529)**
Equity and Equity Equivalents															
Comprehensive Result	(226)	(451)	(688)	(463)	(296)	(176)	(74)	(254)	(176)	(252)	(368)	(397)	(416)	(509)	(705)
Change in Equity	210	174	464	375	43	99	(3)	177	99	175	291	320	339	432	628
Change in Noncotrolling assets	112	53	(252)	(86)	176	-	-	-	-	-	-	-	-	-	-
Equity Cash Flow	**96**	**(224)**	**(475)**	**(174)**	**(77)**	**(77)**	**(77)**	**(77)**	**(77)**	**(77)**	**(77)**	**(77)**	**(77)**	**(77)**	**(77)**
Institutional Partnerships															
Institutional Partnerships Result	117	89	62	68	51	51	51	51	51	51	51	(25)	(6)	(15)	(15)
Changes in Institutional Parneship Liabilities	(176)	68	59	(356)	1,433	-	-	-	-	-	-	(2,000)	133	(67)	-
Institutional Partnerships Cash Flow	**(59)**	**156**	**121**	**(288)**	**1,484**	**51**	**51**	**51**	**51**	**51**	**51**	**(2,025)**	**127**	**(82)**	**(15)**

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Buy	Expected total return (including expected capital gains and expected dividend yield) of more than 10% over a 12-month period.
Hold	Expected total return (including expected capital gains and expected dividend yield) between 0% and 10% over a 12-month period.
Sell	Expected negative total return (including expected capital gains and expected dividend yield) over a 12-month period.

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