

International Energy Industry Strategic Outlook – 2020

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Summary

Worldwide, the energy industry's suffering tremendous changes. Energy demand is rapidly increasing and cracks in the traditional model of extracting and distributing energy are starting to be exposed – including environmental ones. Renewable energy sources are appearing to be the solution and countries started to provide funding for renewable energy projects. The initial projects were showing inefficiencies and difficulty to achieve profitability (which still happens), but new technologies are providing more efficient and sustainable ways to generate electricity from renewable sources. Although efforts are being made, it's really difficult to change from a non-renewable focused strategy to a renewable focused one – mainly because of the large investments made for oil extraction and pressures from investors to generate current earnings and cash flow (which isn't currently provided by renewable energy projects). That's why large oil companies and OPEC countries are trying to make sure that demand for oil isn't going anywhere, at least in the medium-term, even if they're aware of the potential that renewable sources have. Therefore, this competition between non-renewable and renewable energy sources will exist for many years to come.

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Environmental Analysis

Covid-19

The Covid-19 caught the world by surprise, impacting economies worldwide, with Fitch Ratings expecting global GDP to fall by 4.6% in 2020. The GDP of the US and Eurozone are predicted to fall in, respectively, 5.6% and 8%, while China is predicted to grow 1.2%¹. These stats have been supported by the surge in credit to the non-financial sector in all the countries analysed. It is predicted that unemployment rates will increase significantly in Europe, however the rate will depend on how quickly subsidy schemes are unwound. In the US case, unemployment rate rose from 3.5% to 14.7% in April². The Coronavirus damages are wide, and only time will tell how the situation will develop. The unexpected money spent to deal with the situation and the fall of the world economy will impact the energy sector, since this sector is influenced by state support with various funds targeted to this sector, specially the renewable, that are now in risk due to the decrease of resources available.

Political Factors

EU: The European union (EU) is one of the biggest renewable energy supporters, making a big effort to achieve an increase on the shares of energy production from renewable resources by 20%, 30% and 55%, by 2020, 2030 and 2050, respectively³. The main reason for this commitment is climate change. The EU council established, in February 2011, that by 2050 GHG emissions should be reduced in 80 to 95%, taking in consideration the emissions of 1990. This long-term commitment to the renewable energy, should bring some confidence to the possible investors⁴. In 2018, renewable energy represented 18.9 % of energy consumed in the EU, on a good path to achieve the 2020 objectives⁵.

The political situation inside the EU is relatively stable, although UK has decided to leave the EU, it seems their leaving will be peaceful and the effects on the economy should be minimal for the EU, for now the biggest risk may be the cut of funds due to the less resources, previously provided by the UK. That might have some impact on the rate of renewable energy development, since this is a big target of the EU funds.

¹ <https://www.fitchratings.com/research/sovereigns/global-gdp-forecast-stable-as-coronavirus-disruption-eases-29-06-2020>

² <https://tradingeconomics.com/united-states/unemployment-rate>

³ <https://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+REPORT+A7-2013-0035+0+DOC+XML+V0//PT#top> n°33

⁴ <https://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+REPORT+A7-2013-0035+0+DOC+XML+V0//PT#top> n°33

⁵ https://ec.europa.eu/eurostat/statistics-explained/index.php/Renewable_energy_statistics

The external situation, in contrast is a bit unstable, China and USA trade wars have been recurrent in the past years and they don't seem to be ending soon, unfortunately this war already reached Europe, with various threats from the USA directed to the EU.

US: Since Donald Trump was elected president, the USA has been stepping away from the fight versus climate change. In 2017 Donald Trump announced that the country was to leave the Paris agreement, however the earliest he can formally start the process of withdrawing the US from the Paris accord is November 4th ⁶. In the past 4 years the US has changed routes and are not doing the same efforts to fight GHG emissions as the majority of developed countries are. The US have established that by 2025 the GHG emissions should be reduced by 26% to 28%, when compared with the years in between 1990 and 2006 (depending on the state)⁷. Regarding renewable energy production the US objectives vary by state, while some states like Arizona only targeted 15% of the production as renewable by 2025, some states like California targeted 44% for 2024 and aim to be 100% clean energy by 2045⁸. This mix of goals resulted in a very poor result with only 11% of US total energy production resulting from renewable sources in 2019⁹. The democratic party is the most pro-environment with more than 90% of its supporters saying that the country should protect the environment. In the other side only 50% of the republicans, the party currently in power, say that the US should do whatever it takes to protect the environment.

The US has engaged in a trade war vs China, due to claims of unfair practices. This situation had implications on the relationship of the US with the WTO, that have now lost the ability to intervene in trade wars, due to a US offensive that blocked WTO of appointing new members to the panel that hears the appeals of trade disputes. This situation created a lot of criticism, and leverage the tensions between US and China, with both making new reform proposals¹⁰.

China: China is formally a multi-party state under the leadership of the Communist Party of China (CPC). In the past year there's been a lot of tension between the government and its citizens. Protesters and dissidents in China espouse a wide variety of grievances, including corruption, human rights abuses, environmental degradation, ethnic protests, petitioning for religious freedom and civil liberties and protests against one-party ruling.

⁶ <https://www.bbc.com/news/world-us-canada-50165596>

⁷ <https://www.c2es.org/document/greenhouse-gas-emissions-targets/>

⁸ <https://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx>

⁹ <http://css.umich.edu/factsheets/us-renewable-energy-factsheet>

¹⁰ <https://www.reuters.com/article/us-trade-wto/us-trade-offensive-takes-out-wto-as-global-arbitrator-idUSKBN1YE0YE>

Before the corona virus outbreaks, China was fighting a trade war with the US, because of claims that competing with China was unfair, due to “unfair trade practises”¹¹. These wars could damage the economy of China.

Despite a controversial system, China has taken big measures to help the environment. These actions have the main objective of improving quality of life in the country, since the levels of pollution registered in the country are enormous and have huge effects on the health of the citizens. China by itself is responsible for 27% of GHG world emissions¹². China is, at the moment, the largest investor in renewable energy development, and aims to achieve a renewable energy share of production of 50% by 2050¹³. Despite these ambitious goals the recent increase in coal consumption and development is inconsistent with the Paris Agreement. To achieve the objectives agreed in Paris, China would need to reduce its coal power generation by 63% until 2030.

Economic Factors

EU: The EU economy is one of the biggest in the world, with a GDP of €19,100 billion in 2019¹⁴, and an employment rate of 6.2% in 2019¹⁵. In the past year it was registered a real GDP growth rate of 1.5%¹⁶, and the inflation rate was also 1.5%¹⁷. Although until now the prospects for the overall economy were positive, it seems this situation is about to change, the new coronavirus, stroke the world by surprise, suspending most economic activities and forcing governments to spend a huge amount of money unpredictably, this increase in spending and cut on revenues, should bring the EU economy down. Most interest rates applied by the BCE are already low (reaching negative values), due to the last recession, weakening the strength of monetary policy against the upcoming crisis. Some countries are still managing the last recession damages making them more vulnerable to a new recession. The BCE has launched a new asset purchase programme in the value of 750 billion, with purpose of buying debt and private securities until the end of the year to help countries cope with the outbreak of COVID-19. It is clear that the EU economy is at risk of falling dramatically, this situation does not bring confidence to the investors and the volatility of the stock markets is a proof of that.

¹¹ <https://www.whitehouse.gov/briefings-statements/president-donald-j-trump-confronting-chinas-unfair-trade-policies/>

¹² <https://climateactiontracker.org/countries/china/>

¹³ <https://www.sciencedirect.com/science/article/abs/pii/S221146451630152X>

¹⁴ <https://tradingeconomics.com/european-union/gdp>

¹⁵ <https://www.statista.com/statistics/268830/unemployment-rate-in-eu-countries/>

¹⁶ <https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tec00115&plugin=1>

¹⁷ <https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tec00118&plugin=1>

US: The US GDP was \$21,247.1 billion, or €19,652.1 billion, in 2019¹⁸, and the unemployment rate 3.5%. The real GDP growth of the United States was 2.3%¹⁹, and the predicted inflation rate on this year was 1.8%. These statistics indicates that the US economy is strong and stable, however this situation is changing a lot, due to the outbreak of COVID-19. Facing this situation FED is trying to minimize the damages, in march, they decided to lower interest rates to close to 0, indicated that they would be buying at least \$700 billion worth of treasury bonds and announced that they would be using its emergency authority to set up a vehicle for lending directly to businesses, in the commercial paper²⁰. This uncertainty over the future does not bring confidence to investors, and it's getting harder and harder to avoid a new recession, putting at risk the current growth of the country. Later on, Donald trump sign a \$2.2tn bailout, to help the US economy²¹.

China: The Chinese GDP was \$14,200 billion²². The GDP annual growth was 6.1% in 2019, the lowest growth in 29 years²³. The rate of GDP growth has been decreasing continually since 2010, and it seems to be stabilizing at 6%, which is an incredible number when compared to EU and US, however nothing compared with the huge growths China had showed in the past²⁴. The unemployment rate on the country was, at the start of 2020, about 3.62%²⁵ and the annual Inflation rate on 2019 was 2.9%²⁶, however in the past year monthly inflation increased rapidly. At the start of February 2019, it was 1.49% and at the end of December 2019 was 4.50%, the monthly inflation rate picked at January 2020 with a value of 5.4%, and the latest values show a decrease to 5.3% in February 2020²⁷.

To minimize the COVID-19 damages the Chinese central bank had allocated \$26.3 billion of its \$42.88 billion re-lending quota, to support firms. Chinese banks have also issued \$15.4 billion in loans at favourable rates to small and agricultural firms. However, in February Chinese banks only spent \$129 billion in new loans, down from a record of \$476 billion in January. This situation shows that the measures taken by the central bank weren't enough to invert the trend, however the Chinese government says that Chinese regulators will keep trying to boost bank lending and lower finance costs, mainly for smaller and private companies. The central bank decreased the amount of cash that banks must hold as reserves for the second time this year, releasing \$78.6 billion to help

¹⁸ <https://countryeconomy.com/gdp/usa>

¹⁹ <https://www.statista.com/statistics/188165/annual-gdp-growth-of-the-united-states-since-1990/>

²⁰ <https://www.cfr.org/in-brief/how-fed-dealing-coronavirus-crisis>

²¹ <https://www.theguardian.com/us-news/2020/mar/27/washington-coronavirus-stimulus-bill-vote>

²² <https://tradingeconomics.com/china/gdp>

²³ <https://www.scmp.com/economy/china-economy/article/3046476/china-gdp-growth-last-year-was-61-cent-slowest-rate-29-years>

²⁴ <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=CN>

²⁵ <https://tradingeconomics.com/china/unemployment-rate>

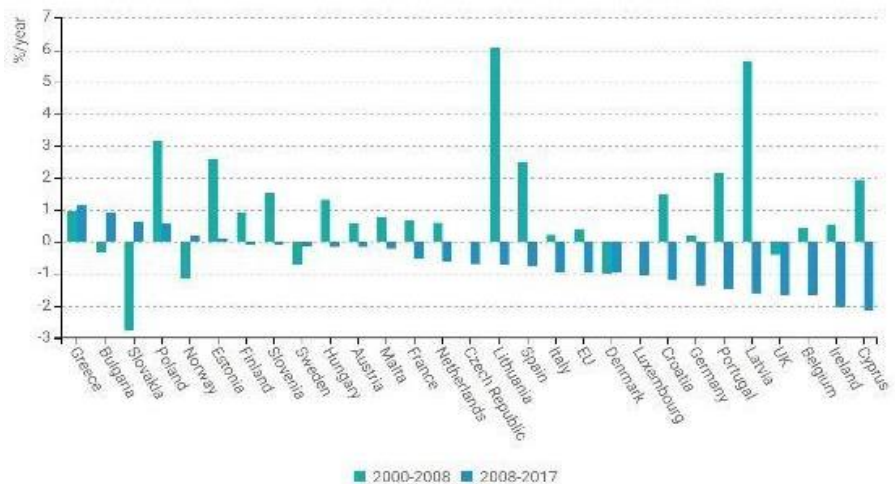
²⁶ <https://www.inflation.eu/inflation-rates/china/historic-inflation/cpi-inflation-china.aspx>

²⁷ https://ycharts.com/indicators/china_inflation_rate

minimize coronavirus damage to the economy²⁸. For now, Chinese economy seems to be rebounding, but slower than expected²⁹.

Socio-cultural Factors

EU: EU population has changed a lot in the past years, from 2008 to 2018, the share of the population age 65 or more increased in 2.6 p.p., representing 19% of the EU population in the same year, signal that the EU population keeps on getting older. It is predicted that this number will only increase, and the share of people aged 80 or more should reach 14.6% by 2100³⁰. The EU population has a decent level of



Title: Trends in electricity consumption per dwelling

Source: Enerdata

education although there is still a some of room to improve, in 2018 more than 40% of the population between 30 and 34 years old had a tertiary education, and 81% of the population between 25 and 54 years old had at least an upper secondary level of education, while only 66% of the population with 55 to 74 years old had one, meaning that the education level of the population is getting better. The country's tertiary gross enrolment rate was 69% in 2018³¹.

The EU population is getting increasingly aware of the world environment situation making them sensible to matters involving pollution. Since one of the biggest responsible for GHG emissions in Europe is the energy industry³², there is an increasing pressure on the industry to become greener, not just from part of the governments but also from the general population. There is an increasing sensibility to energy domestic use, not just by buying more efficient electro domestics but also by diminishing the unnecessary use of energy.

US: US population is transforming. It's predicted that between now and 2050 the elderly population will be more than double. By that year 1 in 5 Americans will be elderly. The period with the biggest growth will be between 2010 and 2030, when the number of elderlies will grow by an average of 2.8

²⁸ <https://www.scmp.com/economy/china-economy/article/3075285/coronavirus-chinas-central-bank-will-use-variety-measures-cut>

²⁹ <https://www.scmp.com/economy/china-economy/article/3076128/coronavirus-chinas-economic-emergence-lockdown-continues>

³⁰ https://ec.europa.eu/eurostat/statistics-explained/index.php/Population_structure_and_ageing

³¹ https://data.worldbank.org/indicator/se.ter.enrr?name_desc=false

³² <https://ec.europa.eu/eurostat/statistics-explained/pdfscache/1180.pdf>

percent annually. The fastest growing elderly group are those aged 85 and over, between 1960 and 1994, their numbers rose 274%, in contrast, the elderly population in general rose 100%, while the rest of the population only grew 45%³³. The rate of people with at least a tertiary level of education has been increasing at a very impressive rate, 36.6% of women had completed four years or more of college in 2019, compared to 3.8% in 1940. A significant increase can also be seen in males, with 35.4% of the male population having completed at least 4 years of college, up from 5.5% in 1940³⁴. The country's tertiary gross enrolment rate was 88% in 2017³⁵. This transformation is also seen in terms of ethnicity with the US becoming more and more diverse, in the years 2015-2016 the country saw a 3% increase on the Asian population to 21.4 million, a 2% increase in The Hispanic population to 57.5 million, a 1.2% increase in the African-American population to 46.8 million and a 0.5% increase in the white population to 256 million. This diversification on origins is creating a country more and more culturally diverse, mixing different opinions, that are changing the way people think as a society.

China: The number of Chinese citizens aged 60 or above reached 17.3% of the total population and it's expected to peak at nearly 35% in 2050³⁶.

The level of education in China is growing a lot, within 20 years the number of Chinese students enrolled in degree programs abroad jumped by 590% to more than 900,000, making China the largest sending country of international students worldwide. China's own education system has simultaneously undergone an unprecedented expansion and modernization, becoming the world's largest education system. The number of tertiary students increased from 7.4 million in 2000 to nearly 45 million in 2018, a making the country's tertiary gross enrolment rate jump from 7.6% to 50%³⁷. Although not at the same level of the developed countries Chinese citizens are becoming aware of the current environmental situation.

Technology

The technology in the energy industry has been developing quickly. Less than a decade ago, there were doubts about the rentability of solar and wind power, due to high generation costs. However, the situation is very different now and it will keep changing. In the last years there has been a lot of

³³ <https://www.census.gov/population/socdemo/statbriefs/agebrief.html>

³⁴ <https://www.statista.com/statistics/184272/educational-attainment-of-college-diploma-or-higher-by-gender/>

³⁵ https://data.worldbank.org/indicator/se.ter.enrr?name_desc=false

³⁶ <https://gbtimes.com/chinas-elderly-population-continues-to-rise>

³⁷ <https://wenr.wes.org/2019/12/education-in-china-3>

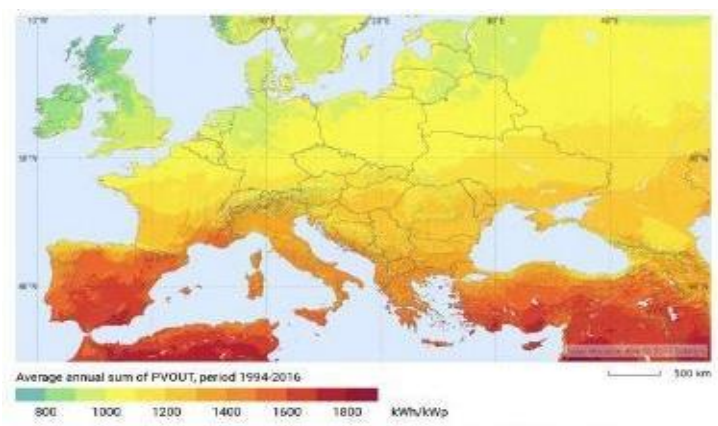
advances in the industry's technology. Today renewable energy is becoming more competitive, challenging the old technology based on fossil fuels.

One of the biggest challenges in the energy industry is energy storage. Storing energy is very difficult, and the answer to one of the biggest renewable energy weakness, the fluctuation of energy production. Since we can't store energy efficiently, on the peak hours of the energy production (that in the case of solar power coincide with the less demand hours for energy by dwelling), we let some of it go to waste. If we were able to store this energy, we would be able to use it when the energy production is lower. This flexibility would increase efficiency, making the industry more profitable and reliable. The lithium-ion batteries have received the most attention until now, but other types of batteries are becoming more and more cost effective. This technology will improve stability, grid reliability and power quality in the long term.

Devovement in Artificial Intelligence and analytics are helping owners and operators optimize their renewable energy output. The Nascent blockchain is a new technology that enables excess output from wind and solar to be discharged as needed into a networked pool of home battery storage systems in real time.

In the solar energy industry, there has been an ongoing race in terms of solar cell efficiency, this race lead to major breakthroughs, especially with the perovskite that is usually emitted by solar panels. There is also a new tech concept revealed that captures and utilizes the waste heat that is usually emitted by solar panels. This new technology can reduce solar costs even more and double the efficiency of solar cells³⁸.

In the nuclear power sector, there has been some major breakthroughs, namely the new nuclear reactor created by TerraPower, a company owned by Bill Gates. This new technology is safer, affordable, clean and secure. Not just that, but this power plant would use nuclear waste from existing reactors, solving the increasing problem of too much nuclear waste. One of the biggest problems with the old nuclear power plants is the chance of a nuclear meltdown³⁹.



Title: Photovoltaic Power Potential, Europe

Source: Solargis

³⁸ <https://theenergybit.com/2019/02/01/technological-advances-in-renewable-energy/>

³⁹ http://www.terrapower.com/wp-content/uploads/2020/01/TP_2020_TWR_Technology.pdf

With this said it is obvious that there has been a huge development in technology in this industry, and not just on the renewable sources side. There will be an increasing competition between the two sides of the industry, that could lead to even bigger innovation.

Environmental Factors

EU: The EU has a very large size ranging from Portugal to Finland, which makes the weather very different from country to country. The southern countries like Portugal, Spain, Italy and Greece benefit from the Mediterranean climate (temperate), having a very big photovoltaic power potential, due to high levels of irradiation both normal and horizontal⁴⁰. The northern countries like Finland and Sweden are affected by the continental weather suffering with very rigid winters, and hot summers. The countries in between all range from temperate to continental, some of them being a mix of the two due to their large size in latitude. Another fact to take in consideration is the large coast owned by EU, making Eolic energy viable in most countries. With such a big area, the European Union can explore all renewable resources: solar, hydroelectric, wind, geothermal (in Volcanic islands, for example), ocean and the non-climate dependent ones like biomass.

The European Investment Bank (EIB) helps finance energy projects by providing not just loans but also advice and expertise on administration and project development. In 2018, EIB loans helped the construction of 26 000 km of power lines and generate 25 228 MW of electricity, out of which 86% came from renewable sources. The “European Fund for Strategic Investment” (EFSI) is a joint initiative between the EIB and the commission, with the objective of mobilizing private investment in projects which are important for the EU, like areas of energy efficiency, and renewable energy, both essential to the decarbonization of the EU economy.

The EU also has legislation around carbon emissions, one of the main ones being the EU emissions trading system (ETS). This is the first and still the largest international carbon market. It is based on the “cap and trade” principle: a “cap” is set on the total amount of GHG emissions that can be emitted by the more than 11 000 installations, like factories and power plants. Each installation buys or receives “emission allowances” auctioned by the Member States. These credits can then be traded with other installations if unused. Over time, the overall amount of allowances is progressively reduced. There are also two funds, a modernisation fund and an innovation fund, that will help lower-income Member states upgrade their energy systems and foster innovation by funding renewable energy, carbon capture and storage (CCS) and low carbon projects. It’s also important to take in consideration that the EU taxes on energy accounted for more than three quarters of the total

⁴⁰ <https://solargis.com/maps-and-gis-data/download/europe>

revenue from environmental taxes (77.7%)⁴¹, in 2018 the total revenue from environmental taxes was €324.6 billion, meaning that €252.21 billion resulted from energy taxes. These taxes focus mainly on GHG emissions, making renewable energy a more attractive option when making new investments⁴².

US: The US is a huge country, and most of it has a continental climate, with frigid winters and hot summers. However, there are exceptions. The west coast climate is cool and damp in the northern area and Mediterranean in the southern area. On the coast of the Gulf of Mexico, the climate is mild in the winter and hot in the summer⁴³. These various climates and different geographic conditions allow the US to explore all different types of renewable energy.

To help companies succeed in the exploration of renewable sources, the energy department has created the Energy Efficiency & Renewable Energy (EERE) funds⁴⁴. Only in 2016 the US had spent \$18.4 billion in energy subsidies, from what \$11 billion went to renewable energy and \$3 billion to energy efficiency⁴⁵. Although Donald Trump has shown intention on cut back funding, that hasn't happened until now and it's most likely not to happen in the near future.

It's worth pointing out that the US has lowered some of the taxes applied to the energy production from fossil fuels, these incentives will cost the US \$11.6 billion, from 2017 to 2021, and will make renewable energy less attractive⁴⁶. The US is now the developed country with less taxes on carbon emissions. For every ton of fossil fuel carbon that's emitted the US only collects \$6.5, while in Europe the country who charges less is Belgium with \$60⁴⁷. The US also has an Emissions trading schemes, however this policy is at a state level, and not at a federal one⁴⁸.

It's clear that the US is investing in renewable sources, but not heavily. In 2018 the 2 biggest sources of energy were petroleum (37%) and natural gas (31%), coal and nuclear contributed with 21%, and all renewable sources only produced 11%⁴⁹. These statistics are a result of the low commitment that the US has putted into reducing GHG emissions.

China: China is a huge country and due to that is affected by diverse types of climate. The eastern and southern China have tropical climate. In the west there are two types of climate: the temperate

⁴¹ https://ec.europa.eu/eurostat/statistics-explained/index.php/Environmental_tax_statistics

⁴² https://ec.europa.eu/eurostat/statistics-explained/index.php/Environmental_tax_statistics

⁴³ <https://www.climatestotravel.com/climate/united-states>

⁴⁴ <https://eere-exchange.energy.gov/>

⁴⁵ <https://www.forbes.com/sites/uhenergy/2018/03/23/renewable-energy-subsidies-yes-or-no/>

⁴⁶ <https://www.taxpolicycenter.org/briefing-book/what-tax-incentives-encourage-energy-production-fossil-fuels>

⁴⁷ <https://www.washingtonpost.com/news/wonk/wp/2013/01/31/how-the-world-taxes-fossil-fuels-in-three-charts/>

⁴⁸ <https://www.lexology.com/library/detail.aspx?g=0f6bf054-27dd-4cc0-b856-107b1ad0854e>

⁴⁹ <http://css.umich.edu/factsheets/us-renewable-energy-factsheet>

continental climate and highland climate. Because of its topographic variety and terrain conditions, its climate is very diversified and complex⁵⁰.

China's National Energy Administration (NEA) is currently considering how to sustainably continue its support of renewables without feed-in tariffs (FITs). While this financing mechanism has been integral to the deployment of the country's over 100 GW of renewables over the past 10 years, China wants to change it with the objective of being more efficient. In 2017 the Renewable Energy Development Fund reached a deficit of \$16.4 billion, mainly because of the rapid solar energy developments and their required initial investments. In 2018 the fossil fuel subsidies were estimated in \$260 billion, nearly as high as the new investments in renewable energy with a value of \$279.8 billion⁵¹.

To try and decrease GHG emissions China has put in to place an Emissions trading system (ETS), similar to the European one⁵². However, it doesn't have a carbon tax.

Legal Factors

EU: The European Union has a lot of labour laws, when compared to emerging countries, like India or China. In recent decades the EU policies have tried to achieve high employment rates, strong social protection, improve living and working conditions and protect social cohesion⁵³. Since EU countries are very different from one another, there is a lot of variation in how the countries decide to achieve the EU directives. This is clear when we look at the minimum wage in EU countries. The minimum wage varies from €312 to €2,142⁵⁴, in Bulgari and Luxembourg, respectively. This by itself might seem scandalous, but we need to take in consideration that the average costs of living in these countries is very different and so are the economic situations of this two governments.

In terms of data protection, the EU also have a wide variety of rules, aiming to make Europe fit for the digital age. Being one of Europe fundamental rights, all citizens have the right to protection of their personal data. These rules impact the energy sector due to the limit on data that this companies can save, making it more difficult to manage energy flows.

US: The US have over 180 federal employment laws, the main objective of this laws is to protect the rights of the workers. In general, employers can't discriminate employees on the base of race,

⁵⁰ <https://www.topchinatravel.com/china-guide/china-climate.htm>

⁵¹ <https://www.pv-magazine.com/2018/12/13/new-renewable-funding-mechanisms-highlighted-for-china-report/>

⁵² https://icapcarbonaction.com/en/?option=com_etsmap&task=export&format=pdf&layout=list&systems%5B%5D=55

⁵³ <https://ec.europa.eu/social/main.jsp?catId=157&langId=en>

⁵⁴ https://ec.europa.eu/eurostat/statistics-explained/index.php/Minimum_wage_statistics#General_overview

colour, religion, sex, sexual orientation, pregnancy, nationality, age, disability, or genetic information. In addition to the federal laws, there are various state laws created with the same objective⁵⁵. The Fair Labour Standards Act obligates companies to pay the federal minimum wage stabilised of \$7.25 per hour, however many states and local communities have raised their minimum wage independently, the highest minimum wage is in Washington DC, where the minimum wage was established as \$13.25 per hour⁵⁶. In addition to the minimum wages there are also laws regarding max regular hours of work, overtime remuneration, and mandatory breaks⁵⁷. In terms of Data protection there is no single data protection legislation in the states, however there are hundreds of laws enacted on both federal and state levels to protect the personal data of US residents⁵⁸. One of the main objectives is to restrict the disclosure of consumer information, and the way it is acquired.

China: The labour law in China is constantly changing, and many times its complex and ambiguous, and has very lax intellectual property laws, making it unattractive to several companies. The minimum wage is low, established at \$322.38 for full-time employees, and it was increased the last time in 2019. In the same year, the Chinese government substantially reduce social insurance burdens on small employers by not implementing large back payment orders for unpaid or underpaid social insurance contributions⁵⁹. Data privacy laws were established in china 30 years later than the EU and the US⁶⁰. China mixed the minimalist approach of the US laws with the strict EU ones, creating a protection not as relaxed as the US but also not as rigid as the EU⁶¹.

⁵⁵ <https://iclg.com/practice-areas/employment-and-labour-laws-and-regulations/usa>

⁵⁶ <https://smallbiztrends.com/2019/01/minimum-wage-2019.html>

⁵⁷ <https://iclg.com/practice-areas/employment-and-labour-laws-and-regulations/usa>

⁵⁸ <https://iclg.com/practice-areas/data-protection-laws-and-regulations/usa>

⁵⁹ <https://nhglobalpartners.com/china-employment-law/>

⁶⁰ <https://epernot.com/data-privacy-law-china-comparison-europe-usa/>

⁶¹ <https://epernot.com/data-privacy-law-china-comparison-europe-usa/>

Industry Competitiveness

Porter's 5 Forces

Bargaining Power of Suppliers

Most companies in the oil and gas industry are fully integrated in all its segments, from production to retail, having low reliance on suppliers. This situation gives suppliers low influence on the prices in the industry. On the other side, oil rich countries and organizations like OPEC increase their bargaining power through changing the amount of raw materials that they are allowed to extract, increasing or lowering prices. Other countries directly influence the industry due to having state-supported companies in the energy industry. All these factors make the bargaining power of suppliers low and of OPEC countries high.

In the renewable energies, their macro influence on this sector is a lot smaller than the one of its substitutes. Nevertheless, the suppliers' bargaining power is still generally low due to the fact that the products are very homogeneous, the number of suppliers is large and the tendency for companies to be fully vertical integrated is still observable (although less than in the non-renewable sector). On the other side, contracts normally have clauses that penalize buyers if they do not comply with it, making long term deals beneficial for the supplier – which increases suppliers' bargaining power.

Bargaining Power of Buyers

The main buyers in the industry of fossil fuels are refineries, National Oil Companies, Distribution companies, Traders and countries. These buyers have a low bargaining power due to the fact that oil prices are determined by oil benchmarks that cannot be affected by the buyers in a sustainable way, like Brent Blend, WTI and Dubai/Oman. One way to increase the bargaining power of buyers is to buy enormous amounts of stock, however, due to the consequently high cost only countries have the resources to do so. To the smaller players, like companies, the only bargaining power they can take advantage of is the quality of the feedstock they are going to buy. However, this situation is now changing, due to the development of renewable energy, there is now a different product that can substitute oil and gas in some areas. Making the bargaining power of the buyers in these areas considerably higher. As it stands, the high buyer demands are putting a lot of pressure on renewables. The chase for the lower prices offered by fossil fuels producers makes it very hard for

renewable energy companies to assure a good profit margin, endangering the profitability of these companies.

Threat of New Entrants

The major barriers found by companies trying or thinking of investing in the non-renewable energy market are mainly supply-side ones. The immense start-up costs reduces significantly the number of companies that actually go through the process of making the investments. Besides that, proprietary technology, patents and high fixed operating costs makes potential investors start from a situation of disadvantage.

This sector also faces another obstacle, which are the legal and environmental regulations. Since companies are obligated to comply with these, the ones with low start-up capital are forced out of the sector.

There are a few added challenges to the renewable market besides the ones that are consistent with the non-renewable one, such as high capital costs and environmental regulations. The low return for investments, misconceptions with the reliability of clean energy technologies and doubts about possible technological advances (that could put the current technology of the company obsolete in a very short period) are some of the major barriers found by companies when coming into this segment.

Threat of Substitute Products

In the energy sector the threat of substitute products can be considered high or very high. Even though the global energy production and consumption main source is still fossil fuels there has been a substantial shift to renewable sources, which increases customers' disposition to switch products.

The main risk of substitution for fossil fuels comes from the electricity sector, in the last decades more and more renewable sources such as solar, wind, hydro and so forth have been used to produce electricity, rising the share of clean energies in the total production. Currently more than 60% of the total electricity production nowadays comes from fossil fuels (coal, oil and natural gas) but those numbers are diminishing every year contrasting with the rise of solar and hydro energy used. The other segments that present a big risk to fossil fuels are the heating and transport ones. In the heating segment, oil and gas are being mostly replaced by biomass and solar energy and in the transport segment the major change has been the replacement of oil-run vehicles to electric ones.

The energy market is changing rapidly, and the rise of renewable alternatives is going to play a big role in the reduction of fossil fuels' usage.

Rivalry Among Competitors

Around 40% of the total revenues in the energy sector come from the four biggest companies in the industry (concentration ratio), making it an oligopoly. Nevertheless, rivalry among existing competitors differs according to the segment considered (renewable or non-renewable). In the non-renewable market, the demand growth has been in decline for oil and coal, contradicted by the rise in natural gas. This makes the sector an overall mature industry, in which competition is high, consequence of constant market share and price dispute, high fixed costs (operational and storage) and costly industry exit. In addition, it's a market where many state-owned companies operate, that have access to different financial resources causing a disadvantage to the private companies who seek competitive prices.

In the renewable market, the demand growth has risen significantly allied with innovative technology and solutions. Currently the competition isn't as severe as in the non-renewable segment, since this is a growing market with space for development. Nonetheless, and as for now, this growth is motivated by environmental concerns and not economic return, as many investments are backed by states to lower the negative effects of the considerable operational and capital costs. Moreover, companies from this sector have various strategies and origins based on continuous technological advances, which makes competition extremely hard to predict and oppose, causing a disruption in the market.

SWOT

Strengths

- S1:** General need for energy production, as energy users rise substantially in the world and specially in Asia
- S2:** Numerous sources of energy, renewable and non-renewable
- S3:** Rising number of investments in the electric vehicle market
- S4:** Renewable sources of energy are unlimited
- S5:** Good cost-benefit for investments in fossil fuels
- S6:** Ease in fossil fuels' location, storage and transportation

Opportunities

- O1:** Technological innovation, which would potentiate capital investments and operating costs reduction
- O2:** Creating an international market interconnection
- O3:** Decentralized production and storage
- O4:** Development of the WPT (Wireless Power Transfer) technology

Weaknesses

- W1:** High dependence on importation, for most European countries
- W2:** Grid capacity issues and storage
- W3:** Not enough incentives and options for consumers to switch to renewable sources of energy (price wise)
- W4:** Too diverse, national policies
- W5:** High level of inefficiency in energy production and use from renewable sources
- W6:** Fossil fuels are limited and are extremely damaging to the environment
- W7:** Low usage rate of mixed (alternation of sources) solutions for energy consumption

Threats

- T1:** Lack of infrastructures to meet up with the rising global demand
- T2:** Commodities price volatility
- T3:** High cost of investments to make clean, reliable and affordable energy
- T4:** Reduction in investments in fossil fuels in the future (which will lead to an increase in prices in the long term)

To Consider: Many elements are placed into a specific section of the SWOT analysis according to the point of view used, which doesn't necessarily overrule the option to feature them in another section, if a different approach applied. For example, the "Good cost-benefit for investments in fossil fuels" is a strength from a fossil fuels' perspective, however it can be seen as a threat from a renewable energy's viewpoint.

S4 & O3: Autonomous Microgrids

The implementation of microgrids would be beneficial for several occasions and situations, such as temporary events (festivals or fairs), business parks, residential areas (small group of buildings) and remote villages. Since renewable sources of energy are unlimited and numerous, by creating a systematic and flexible model, which links various energy generators (PV panels, biomass installations, wind turbines, and others) it would be possible to attain conventional AC grids, and therefore decentralized production and self-efficiency communities.

The creation of pre-conceived “equipment kits”, which would allow the replication of these units in various places, could also become a great opportunity for specific segments of the energy sector.

W7 & O1: Mixed Solutions

In stationary points of energy consumption, with installation capacity for different sources of energy production (for example, solar energy and wind power) could be applied a model that allied the constant energy availability with the most efficient accessible source.

It can be considered the following application: in the winter there is likely to exist greater wind energy production capacity, making it the predominant source to use, on the other hand in the summer the primary source would be solar energy. In case of failure of both wind and solar energy, there would still be possible to access the main/ external grid.

The general use of this model can only be achieved if technological innovation is connected to a significant reduction in capital investments and the later operating costs.

S3 & O4: Wireless Power Transfer in Electric Vehicles

In later years, climate change concerns increased the public sensitivity and consequently their preferences, regarding their choice in vehicles. Currently there has been a substantial shift in the vehicle market, with the rise of the electric segment, which is characterized by continuous innovation and fast growth.

One of the main problems usually presented with electric vehicles is their performance and drive range, by developing and applying WPT (Wireless Power Transfer) technology, various problems would be solved, such as the necessity to use physical cables and sparking due to plugging/unplugging, their drive range limitations and battery capacity requirements. The attractiveness of this segment would increase greatly by the future possibility for dynamic charging (charging while driving), ending consumers' necessity to stop to charge their vehicle.

W1 & O2: European Energy Network

Considering the innumerable available renewable sources of energy in every EU member and the common energy required targets, the creation of an international market interconnection would diminish EU's energy dependency rate (that of 2017 was 55%).

Cross-border collaboration and interconnection would enable an efficient sharing of resources and the reduction in capital investments and operating costs. This would only be possible if a converging in national policies occurred.

Expanding energy production inside the EU, would significantly impact infrastructures requirements, price converging, broaden availability for all the consumers and rise European employment.

Main Players' Positioning

Following the trend of the report, we next analyse some of the largest companies in the energy industry that either have a full vertical integration strategy - with a diversified portfolio of energy sources that has oil as its largest source - or that have a full vertical integration strategy with a strong bet on a varied portfolio of renewable sources, from a strategic and financial point of view.

Royal Dutch Shell

Description: Royal Dutch Shell is an international energy company established in 1907 whose business is the exploration, production, refining and marketing of oil and natural gas, as well as the manufacturing and marketing of chemicals. The company's headquarters are in The Hague, the Netherlands and its Chief Executive Officer is Ben van Beurden. By 2018 revenues, Shell was the third largest company in the world, with operations scattered in over 70 countries. These are divided into three groups: Upstream, Integrated Gas and New Energies and Downstream.

Strategy: Shell's business strategy consists in three clear ambitions: to prosper in the energy transition, provide affordable energy and sustain a strong societal licence to operate. To accomplish these ambitions, the company strengthened its strategy by focusing strongly in the development of its Power business since it sees a huge potential growth opportunity in the tackle of climate change and the rise in electricity demand. The company is actively seeking to increase the investments in

renewable power and cut sturdily the intensity of the greenhouse gas emissions of its energy products. As part of this objective the company launched a worldwide programme called nature-based solutions that uses trees and other plants to remove carbon dioxide from the atmosphere.

The need for oil and gas will remain for decades to come, but Shell is already shaping its businesses to deliver more and cleaner energy. By still developing conventional oil and gas resources, the company is generating the financials necessary to invest in cleaner forms of energy.

Financial: In the last five years the company's financial leverage averaged 2.1 and stood at 2.2 (the same as the industry) in the year of 2019, indicating a reliable capital structure and asset financing.

Regarding short-term liquidity, Shell presents a current ratio of 1.2, which is higher than the industry's average, demonstrating a positive capability to fulfil current liabilities. However, this value is the company's five years low, which could indicate a downwards trend, that could end in deteriorating effectiveness in meeting current obligations.

The cash ratio of the company sits side by side with the industry average at 0.3 meaning that there's suitable cash balances to pay off 30% of its current debts with only cash and cash equivalents.

At the end of 2019, the company reported \$344.9 billion in revenues, decreasing from the 5-year peak in December 2018 of \$388.4 billion, presenting a growth rate YoY of -11.2%. The revenue CAGR (5y) shows a considerable decline at -3.9% that can cause great concern since the industry stands at 6.7%, meaning that while the industry is growing at a rapid pace, the company is falling short when compared with the rest of its competitors. This was triggered primarily by a major decline in revenues in 2015 (\$265 billion) and 2016 (\$233.6 billion).

Even though that revenues have been in decline for the past five years, EBIT has been growing continuously, reaching a 6.8% YoY growth rate in 2019 and a CAGR(5y) of 0.5%, a lot higher than the one reported for revenues. This can be considered a product of the continuous decrease in total operating expenses. Both EBITDA and EBIT follow the same upwards trend reaching \$48.675 and \$30.175 billion respectively in 2019, yet EBITDA grew at a somewhat faster rate than EBIT, reaching a CAGR(5y) of 1.9%.

The net income of the company had a significant decrease in 2019 presenting a 32.16% decline from 2018, reaching \$15.842 billion at the end of the year. This followed the company's five-year peak of \$23.352 billion in 2018 and its lowest of \$4.575 billion in 2015.

Shell's free cash flow at the end of 2019 was \$24.01 billion, representing a 30.28% decline from the previous year. The Cash flow from operating activities in 2019 was \$42.2 billion, compared with

\$53.1 billion in 2018, revealing a 20.5% decrease caused by lower earnings and an adverse working capital effect. The Cash flow from investing activities in 2019 was an outflow of \$15.8 billion, compared with an outflow of \$13.7 billion in 2018, this increase was mainly a result of lower earnings from the sale of equity securities, partly counterbalanced by higher earnings from sale of assets in 2019. From the financing activities in 2019 was registered an outflow of \$35.2 billion, which came as an increase from the outflows registered in 2018 (\$32.5 billion) and in 2017 (\$27.1 billion). This increase was caused by higher repurchases of shares and interest paid compared with the previous years. Taking all of this into account the decline in the free cash flow in 2019 was mainly caused by the decline in the operational cash flow.

Conclusion: Considering that Royal Dutch Shell is an oil major, the oil price plunge in 2016 took a toll on the company's revenues, which have been recovering since, showing its effectiveness of adaption to the volatility of the sector. Overall, the company's financials present a situation very similar to the industry's average, showing a stable position regarding their capital structure and its ability to fulfil current liabilities. Even though that from a strategic point of view the company is set to invest in renewable sources of energy, this hasn't occurred to the scale previously projected, showing a sign of difficulty in investments outside the fossil industry. Shell's profitability has been increasing in the last few years, which lead to higher dividends paid to the shareholders. The activity of the company in the last few years has been in a steady phase, shown by the low variations in its cash flows, however the effects of COVID-19 in the industry are still unknown, which could potentiate a significant alteration of the present situation.

EDP

Description: EDP-Energias de Portugal SA is multinational vertically integrated utility company founded in 1976, headquartered in Lisbon, Portugal whose business consists in the provision of electricity generation, supply and distribution. The company operates in three segments: Renewables, Networks and Customer Solutions and Energy Management. The Renewables segment engages in generation of electricity through renewable energy sources. The Networks segment engages in electricity distribution and transmission business, including last resort suppliers. The Customer Solutions and Energy Management segment includes electricity generation from energy sources non-renewable, especially coal and gas; electricity and gas trading and energy solution services.

Strategy: The strategy of the company involves the accomplishment of five goals: to present an accelerated and focused growth; to optimize continuously its portfolio, to have a strong balance sheet and low-risk profile, to be an efficient and digitally enabled organization and have an attractive

shareholder remuneration. To attain these, EDP is accelerating significantly its investments, with a great focus in renewables while remaining with its strategy of asset rotation (capital recycling) to stimulate growth. Moreover, the company is going to reinforce efficiency and cost reduction programs and implement a digital transformation plan to evolve to a more flexible and global organization. To optimize its portfolio and achieve a strong balance sheet, the company is targeting a solid investment grade with a stout cash flow generation and low risk profile. From the shareholders perspective EDP is increasing its profits and pay-out ratio.

Financials: The financial leverage of the company as of 2019 was 2.35, which is slightly higher than the industry's average. In terms of short-term liquidity, the company registered in 2019 a current ratio of 1.0 and a cash ratio of 0.2, both lower than the average of the industry (1.1 and 0.3 respectively), representing a fragile position in liquidity and capacity to service short-term liabilities.

The revenues reached its lowest value in five years at €14.091 billion, even lower than the previous minimum of €14.595 B in 2016. The growth rate YoY was -6.2% and the Revenue CAGR (5y) was -2.5%, showing an opposite trend when compared to the industry's 6.9%. EBITDA amounted to €3.706 billion in 2019, increasing 12% from the previous year and recovering from the low of €3.317 billion in 2018, result of a positive contribution from all three segments. Since there was a strong EBITDA performance, EBIT also saw a growth of 16% when compared with 2018. The CAGR(5y) for EBITDA is 0,2% contrasting with the CAGR(5y) for EBIT of -0.1%, which could indicate the rise of depreciations and amortizations because of the recent investments made during the last five years.

From December 2015 to 2019 the gross profit margin of the company hasn't suffered much fluctuations, averaging 33.2 % during these years and attaining the value of 33.6% in 2019

At the end of 2019, the company registered a negative free cash flow of -€ 258.48 million, again consequence of the recent investments made by the company. The operating activities generated a cash flow of €2.221 billion in 2019, decreasing from €2.938 billion in 2018. The outflow from the investing activities registered a cash flow of -€1.645 billion in 2019 vs the -€1.178 billion in 2018, mainly due to the purchase of assets regarding the new transmission lines in Brazil. The significant change was registered in the cash flow from financing activities, that went from €-2.335 billion in 2018 to -€834 million in 2019.

Conclusion: The liquidity of the company, observed by its current ratio and cash ratio show a riskier approach than the average of the industry, though this is a consequence of the new investments made. Nevertheless, the current investments being made in the renewables segment (purchase of assets) and the asset rotation strategy adopted by the company, resulted in higher outflows from the investing activities, diverging with the decrease of the net outflow from the financing activities,

consequence of the new loans. In 2018 and 2019, EDP reported a considerable fall in its net income which still didn't result in lower dividends paid, since its dividends policy resulted in higher payments to stockholders than the net income of those years. The large interest and the current and past investments made in renewables sources of energy is putting the company in advantageous position considering the world necessity to switch to clean energy, yet the repercussions of COVID-19 on the financials and overall strategy of the company are still unpredictable.

Exxon Mobil

Description: Exxon Mobil Corp. engages in the exploration, development, and distribution of oil, gas, and petroleum products. It operates through the following segments: Upstream, Downstream and Chemical. The Upstream segment produces crude oil and natural gas. The Downstream segment manufactures and trades petroleum products. The Chemical segment offers petrochemicals. The company was founded by John D. Rockefeller in 1882 and is headquartered in Irving, Texas.

Strategy: Exxon it's committed to a long term strategy, focused on meeting the world's increasing demand for reliable and affordable energy, while also reducing emissions and risks associated with climate change. According with this strategy the company is investing through the commodity cycle to take advantage of high-value opportunities and, in this way, grow earnings and cash flow potential. Exxon is also using the strength of their portfolio and financial capacity to enable a continuous evaluation of the pace of the investments and company priorities to ensure value preservation. According with this strategy the company is prioritizing capital-efficient development at scale on their projects, this called cube development, accesses multiple shales layers simultaneously, saving money, maximizing value of resources and reducing surface footprint. This process is already being applied on the Permian Basin, and its planned to be extended to other projects.

Financials: ExxonMobil presents a financial leverage of 1.9 vs an industry 2.2, showing that even though the company is dependent on debt to finance its assets, its less dependent then its competition, proving to be more financially independent.

In terms of liquidity Exxon reported a current ratio of 0.8. This value indicates that the company doesn't have enough current assets at the moment to ensure the payment of its current liabilities, placing the company in a sensible situation. This ratio gets worse when compared to its peers, that have an average current ratio of 1.1, proving to be in a better position than XOM to pay their respective short term debt. This company presents a cash ratio of 0.2, the same value as the

industry average, showing that the company is in a relatively good position in terms of ability to pay current debts with cash and cash equivalents, when compared with its competition. This ratio works more like a safety fund to pay unexpected obligations than to repay expected debt, therefore, even though the ratio is low, it's not something very concerning.

In terms of income, it reported an 8.5% fall in revenues, in 2019, after a 17.8% increase in 2018. However, in the past 5 years Exxon had a revenue CAGR (5y) of -6.9%. The Operating income has followed the variations of the revenues, reaching in 2019 a value of \$11,631B, only outperformed by one company. EBITDA also followed the same evolution being, in 2019, \$30,529B. The EBITDA CAGR(5y) was -9.9%, aligned with the variation of revenues, and the EBITDA CAGR(3y) was 9.5% showing that the recent performance of the company is improving. Exxons net income was \$14,774B in 2019, falling 31%, when compared with the previous year. This company has also reported a 51.56% fall in net income in 2016, however a strong increase of 151.4%, in 2017, compensated the previous decrease.

At the end of 2019, ExxonMobil reported \$5,355B in free cash flow, representing a 67.43% fall, and \$29.72B in operational cash flow, falling 17.49%. This decrease in free cash flow is justified by an increase in CAPEX that led the net investing cash flow to decrease more \$6.63B reaching - \$22.926B. This situation combined with a decrease in net income made the company issue more \$8.66B in debt making the net financing cash flow increase 65.41%, stopping the free cash flow to fall into negative levels.

Conclusion: Exxon Mobil Corp. seems to be recovering from the damages registered in 2016, where the company revenues and overall financials were very damaged, this situation is clear when we see the difference between EBITDA CAGR(5y) and EBITDA CAGR(3y). However it's important to understand the macro conditions involving the company, with commodity prices on a near-decade low, and a serious threat of an upcoming financial crisis due to COVID-19, the company will have to face some issues in the next few years. Even though Exxon is the leader in the market with the biggest market capitalization, a weak financial position, that struggles to match industry standards, and an unstable growth of results, puts this company in a sensible position making it a risky investment.

PetroChina

Description: PetroChina Co. Ltd. engages in petroleum related products, services and activities. It operates through the following business segments: Exploration and Production; Refining and Chemicals; Marketing; Natural Gas and Pipeline; and Head Office and Other, being present in both

downstream, upstream and chemical segments. The company was founded on November 5, 1999 and is headquartered in Beijing, China.

Strategy: PetroChina strategy is divided in 4 segments: Resources; Marketing; Internationalization; Innovation; In the Resources side PetroChina is switching the focus from scale-focused to quality-focused. To achieve this objective the company is promoting new technologies to increase the recovery rate of old oil and gas fields and also giving equal importance to conventional and unconventional oil and gas resources as well as other energy resources. The new marketing strategy is based in transforming the company from guaranteed supply to marketing competition, enhancing sense of competition and improving marketing capacities. The new marketing projects will focus on scaling the company from the domestic market to global markets. The internationalization strategy will be based in promoting the company's philosophy, management and technologies in the international market. Finally, the company will focus more on innovating, by diminishing investments in infrastructure and increasing in innovation. It is also worth pointing out that the company will not only focus on R&D but the all company spectrum, like culture and business models.

Financials: PetroChina reported, at the end of 2019 a financial leverage of 2.2, the same value of the industry. Proving to be a solid company in terms of balancing debt to better finance their assets.

The company presents a current ratio of 0.7 showing that the company lacks current assets to cover current liabilities. This situation is aggravated when taken in consideration that the industry average of this ratio is 1.1, meaning that PetroChina's competition is better suited to pay their debts. PTR has also reported a 0.1 Cash ratio vs an industry average of 0.4 showing a lack of resources to deal with unexpected problems when compared with the industry where it competes.

In terms of income the company reported RMB 2,516,810 M in revenues, at the end of 2019, growing 5.97% when compared with the previous year. Although PTR revenues have been increasing, achieving a revenue CAGR (5y) of 2%, the growth of revenues still lacks behind the industry. The industry revenue CAGR (5y) is 6.7%, 4.7pp bigger than PetroChina. The operating income has also increased over the past 5 years, in 47.44%, however not as much as revenues. In the past year, even though revenues increased 4.69%, operating income decreased 11.99%. This shows that the operational margin has decreased in the past years. However, in absolute values PTR is still the company with the biggest operating income, with a value of RMB 133,622 M. EBITDA followed the same variation of the operating income, achieving a value of RMB 345,469 M. Over the past five years PTR presented an EBITDA CAGR of -0.5%, however over the past 3 years this EBITDA CAGR was 9.9%, which is mainly justified by a constant increase in revenues started in 2017, after a big fall in revenues in 2015 and 2016. This situation indicates that the company has been

performing better in recent years. In terms of net income, the company reported RMB 67.010B, a decrease of 17.54% in comparison with the previous year.

At the end of 2019, PetroChina reported RMB 62,844 M in free cash flow, representing a 35.3% decrease in comparison with the previous year. PTR also reported an increase in the net operating cash flow of 1.8% reaching a value of RMB 359,610 M. The fall in free cash flow is caused by a 17.54% decrease in net income, and a 13.41% increase in Capital expenditures as well as a 428% increase in the purchase of new investments. These operations lead the net investing cash flow to be -RMB 332,948 M in 2019. To balance the situation PTR issued new RMB 201,562 M in long term debt as well as RMB 634,896 M in short term debt. After paying finance related liabilities PTR reported RMB 51,500 M in net issuance/reduction debt. These actions led the net financing cash flow to increase 89.54%.

Conclusion: PetroChina has been recovering from 2015 and 2016 fall in revenues at a good pace. However the net income of this company has decreased in the past year, this situation is not alarming due to the nature of the industry being very volatile and influenced by a lot of macro conditions that may benefit or damage the companies at a certain time. The finances of PTR are a bit fragile. Although financial leverage seems to be good, the cash ratio and current ratio show that the company is not in a good position to face near future liabilities. In terms of investment cash flows, the situation is normal when taking in consideration that the strategy of this company is to expand itself to new markets. The increase in financing cash flow is normal due to the increase in investments, however taking in consideration that the financial leverage is equal to the industry average, PetroChina could start having more problems in finding new loans at a good price, which can be a challenge in the future. The fact that PetroChina is an oil & gas giant with a market capitalization of \$346Bn, will be a big advantage to face the uncertain times caused by covid-19.

Conclusion

The energy industry is undergoing major structural changes. Energy firms, mainly oil extraction and refining ones, are facing enormous external pressure from stakeholders such as regulators and customers to change their strategy to a more environmentally sustainable one. On the other side, investors' pressure to generate profit, capex required to change to a renewable energy strategy and the huge profits that non-renewables can generate in comparison to renewables are barriers that make companies want to stick with non-renewables such as oil and gas.

It's largely accepted by the scientific community that the use of non-renewable sources of energy have a huge negative impact in the environment, but we saw the difficulties that companies which have already built large amounts of infrastructure around exploration and extraction of oils and gas have in investing in renewables largely enough to fundamentally change their core strategy. A common strategy that these oil giants have, coupled with diversifying their energy portfolio with some minority stakes in multiple renewable energy sources, is to create a budget towards environmentally not-for-profit projects (example, planting trees) as a way to diminish their carbon footprint – which is criticized by a lot of people due to not addressing the industry's major structural problems.

Without divesting from their major assets, oil & gas companies can address this issue through leveraging technological developments to improve their operations and also to cooperate with renewable energy companies as a way towards sustainable diversification with the construction, for example, of more efficient energy networks and deliver the customer with affordable and sustainable mixed solution products.

The current pandemic and new trends from the investors' side - such as Environmental, Social and Governance investing – will have a major impact on the volatile energy industry. Competition and market disruption will grow as new, creative and well capitalized companies enter the market (especially in the renewables side). Thus, the large oil & gas companies will have to adapt to prosper.