

Climate change mitigation and the implications for the French energy sector

Jeremy Mueller

2020

Bachelor of Commerce Best Business Research Papers

UVic Libraries ePublishing Services

© 2020 Mueller.

Original citation:

Mueller, J. (2020). Climate change mitigation and the implications for the French energy sector. *Bachelor of Commerce Best Business Research Papers*, 13, 45–63.

Downloaded from UVicSpace Research & Learning Repository

dspace.library.uvic.ca



University
of Victoria

Libraries

Climate Change Mitigation and the Implications for the French Energy Sector

Jeremy Mueller

ABSTRACT

This paper discusses the impacts that mitigation guidelines presented by the UN and its bodies have on the energy sector within France in a variety of aspects including the impacts on business procedures, changes in revenues and changes in emissions by firms. Background on the UN-organized climate conferences (Conferences of the Parties) and agreements (Kyoto Protocol, Paris Agreement) as well as the implications and history of climate change are also included. The paper examines the historical situation of the French energy sector; two individual firms with different business strategies in the sector within France are later analyzed with respect to the timing of the different climate agreements set out by the UN and participating governments. Potential decisions of managers facing challenges in the two firms are discussed from multiple angles with following implications. France is compared to other nations and the global average in CO₂ emissions in which timing with global conferences and agreements is analyzed. What the future of the planet is dependent on and who has the power to influence it is also explored.

THE THREAT OF CLIMATE CHANGE

Climate change has been one of the greatest global issues for many years but was only recognized as so in recent decades (Intergovernmental Panel on Climate Change, 2015). It entails changes in climate patterns and is associated with changing global and regional temperature; these changes can be drastic for the planet, as “small changes in temperature correspond to enormous changes in the environment” (“The Effects of Climate Change,” n.d.). Some of these changes include loss of sea ice, accelerated sea level rise, and more intense heat waves among other environmental consequences (“The Effects of Climate Change”). Apart from habitat loss and a rising sea level, sea ice melting is a major issue because ice is capable of reflecting 50% to 90% of the solar radiation that reaches it, while oceans reflect only 6% and absorb the rest which heats the Earth, and in turn, melts more ice (“Thermodynamics: Albedo,” n.d.). As for the other two consequences, sea level rise leads to the submersion of cities and intense heat waves cause a variety of serious problems such as heat-related illnesses and cause catastrophic crop failures which may be primary food sources for certain countries and regions (“The Effects of Climate Change”).

The Enhanced Greenhouse Effect

It is important to understand that climate change is caused by the greenhouse effect, a natural process that has been for millions of years. It is also important to realize that there are two parts to the greenhouse effect: the natural and the anthropogenic (Wagg, 2015). The human-caused, anthropogenic side has been coined with the term “enhanced greenhouse effect” and is very likely responsible for a much greater proportion of the climate change that is seen today (Wagg, 2015). The 2014 Intergovernmental Panel on Climate Change (IPCC) report stated that “it is extremely likely that more than half of the observed

increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in greenhouse gas (GHG) concentrations and other anthropogenic forcings together” (Intergovernmental Panel on Climate Change, 2015, p.5). Due to the emission of fossil fuels, the enhanced effect results in much more GHGs in the atmosphere which trap more heat; this results in less solar radiation escaping into space and more being re-emitted onto the surface (Figure 1). From these emissions, the GHG that poses the greatest threat for Earth’s temperature rise is carbon dioxide (Lindsey, n.d.). While it does not absorb as much heat as other GHGs, it is “more abundant and it stays in the atmosphere much longer” and has been found to be responsible for “about two thirds of the total energy imbalance that is causing Earth's temperature to rise” (Lindsey) (Figure 2). Because of this, most goals of mitigating climate change focus on reducing carbon dioxide more than any other specific GHG (Lindsey).

Causation

The first prominent event that strongly contributed to the enhanced greenhouse effect was the First Industrial Revolution, which took place during the 18th century (“Changes Since the Industrial Revolution,” n.d.). The revolution entailed the transition from hand production methods to machine production methods; it greatly increased productivity and resulted in lower production costs as machines began to do much more of the work. The revolution served as one of the first stepping stones to get people to where they are today in production, but it came at a cost; the environment suffered much more than before.

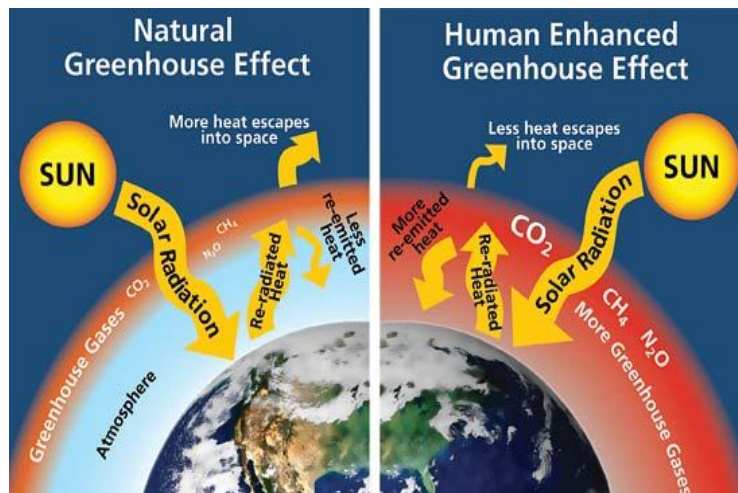


Figure 1. Wagg, G. (Author). Comparison of natural and human enhanced greenhouse effects. [Online image]. Retrieved from MrGeogWagg, <https://mrgeogwagg.wordpress.com/2015/06/24/greenhouse-effect-and-anthropogenic-warming/>

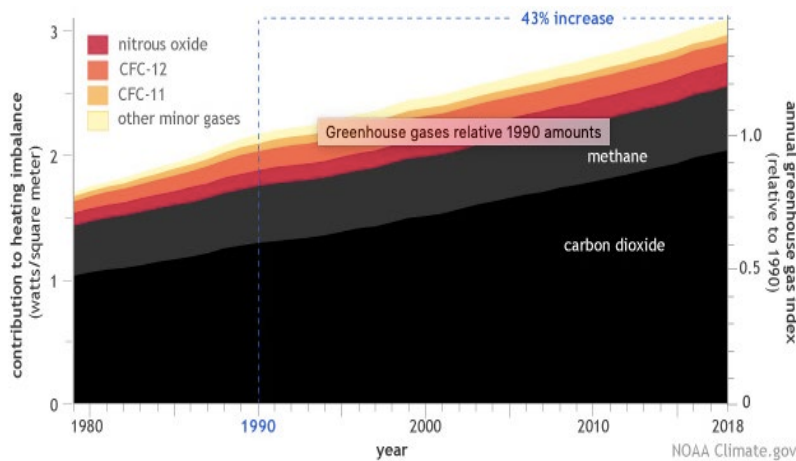


Figure 2. Lindsey, R. (Author). Influence of all major human-produced greenhouse gases (1979-2018). [Online image]. Retrieved from Climate.gov, <https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide>

The second major event that boosted atmospheric carbon dioxide levels was The Great Acceleration in the years following 1950 (“The Great Acceleration,” 2015). Humans began developing new technologies rapidly as the population continued to increase, but while humanity was making progress, the planet was paying a price. Higher levels of carbon dioxide began being released into the atmosphere by way of land use, coal, oil, gas, and cement (“The Great Acceleration”). The biggest contributor to climate change is the burning of fossil fuels, particularly for the energy sector (“Global Emissions,” n.d.).

Scientists are confident that the effects of climate change seen today are because of humans, as stated in the IPCC’s Fifth Assessment Report (Intergovernmental Panel on Climate Change, 2015). Carbon dioxide levels continued to fluctuate from about 175 to 300 parts per million (ppm), but during The Great Acceleration, carbon dioxide levels spiked; today, that amount has increased to over 410 ppm according to NASA (Figure 3) (“Climate Change: How do we Know?” n.d.). NASA shows that while the global temperature has been rising rapidly, solar activity (Figure 4) has remained constant and slightly decreased as of recent (“The Causes of Climate Change,” n.d.).



Figure 3. Atmospheric carbon dioxide concentration over time. [Online image]. Retrieved from NASA, <https://climate.nasa.gov/evidence/>

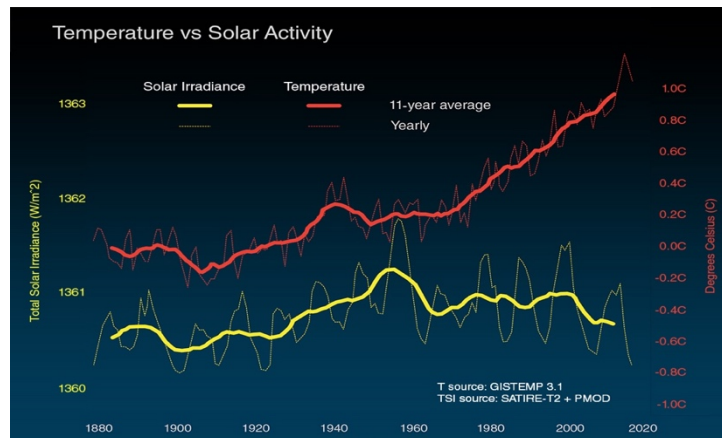


Figure 4. Comparison of global surface temperature and solar radiation received by Earth (1880-2019). [Online image]. Retrieved from NASA, <https://climate.nasa.gov/causes/>

Climate change is a pressing issue the world is facing, and more people are beginning to understand that if no action is taken, there will be devastating consequences in the long run. While eliminating all emissions is not a realistic option, mitigation is attainable; in many countries it is now compulsory. The purpose of this paper is to discuss the impacts that mitigation guidelines have on the energy sector within France in a variety of aspects including the impacts on business procedures, changes in revenues and changes in emissions by firms.

THE FRENCH ENERGY SECTOR PRIOR TO MITIGATION EFFORTS

The Energy Sector

A country's economic activities can be broken down into five primary sectors that produce the output to run an economy (and produce the emissions that enhance the effects of climate change); these include the energy sector, industry, agriculture (including forestry and land use), transportation, and buildings ("Global Greenhouse Gas Emissions Data," n.d.). According to the United States Environmental Protection Agency (EPA) and the 2014 IPCC report, the energy sector accounted for 35% of global GHG emissions in 2010, followed by agriculture at 24%, Industry at 21%, transportation at 14%, and buildings at 6% ("Global Greenhouse Gas Emissions Data").

France's Energy History

In France, before serious mitigation efforts (1995, when the first United Nations' Conference of the Parties took place), the country had much higher CO₂ emission levels. According to the World Bank, carbon dioxide emissions peaked at 529,155 kilo-tonnes in 1979 ("CO₂ Emissions – France," n.d.). This was primarily due to the fact that at the time, France was more-heavily reliant on oil. What dropped the country's total carbon emissions was not the result of actions to combat climate change, but because France had recently dealt with two oil crises (Lepoutre, Semeria, Beltran, Tardieu & Maisonneuve, 2015). The first took place in October of 1973, during the Arab-Israeli War; Arab nations that exported oil began charging four times the original price for all countries that supported Israel (Lepoutre et al.). The second crisis was due to the Iranian Revolution in which oil production decreased and prices rose nearly three times as high as the original over the next few years (Lepoutre et al.). The two crises enforced France's

motive to pursue energy independence so that it would no longer have to rely on the production of other nations to meet their energy demands. Doing so would make the country far less subject to supply shocks and extreme price increases and in addition, put it in a better position to export more energy to the world, and improve the energy trade balance.

In order to move towards energy independence, France began intensively focusing on the development of nuclear energy sources after the first oil crisis (Lepoutre et al., 2015). The crisis paved the way for the creation of a Paris-based intergovernmental organisation called the International Energy Agency (IEA); according to its mission, it “works with governments and industry to shape a secure and sustainable energy future for all” (“Mission,” n.d.). Its initial purpose was to respond to oil supply shocks like those in the cases of the 1970s’ crises but is now primarily an energy policy consultant for members as well as non-member states (“History,” n.d.). France’s shift towards nuclear energy was made at the expense of more than a decade of research on renewable energy which had not been progressing successfully. France’s move to nuclear power proved to be extremely effective; by 1990, the IEA reported that 35.9% of the nation’s total energy supply was attributed to the new energy source (Figure 5) (“Data and Statistics,” n.d.). This resulted in oil dropping to 36.9% of the total in 1990 (Figure 5), a substantial decrease since before the oil crises in the early 1970s. What this meant for the climate was less carbon dioxide emissions and re-emitted heat into the atmosphere for the same amount of energy creation in France; this demonstrated that sufficient energy could still be produced without excessively harming the well-being of the planet.

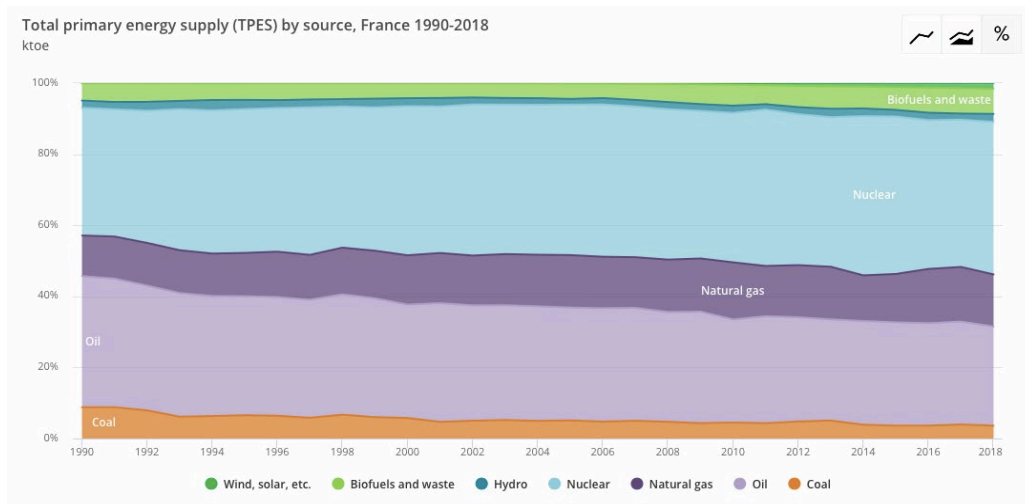


Figure 5. France’s total primary energy supply by source (1990-2018). [Online image]. Available from International Energy Agency, <https://www.iea.org/statistics/?country=FRA&isISO=true>

ORGANIZATIONS, CONFERENCES AND MITIGATION MEASURES

The United Nations’ Impact

Without coordinated global action against climate change, the planet would be in a far worse situation than it is now; thanks to the early efforts of the United Nations (UN), this is not the case. Much more action against climate change is still extremely necessary if the planet is to be sustained in the long run. In June of 1988, James Hansen, a NASA scientist, officially testified to the United States Senate that climate change (referred to as “global warming” at the time) was almost certainly caused by anthropogenic

activity and that global action would be required to deal with a global problem (Shabecoff, 1988). In November of the same year, the UN Environment Program (UNEP) and the World Meteorological Organisation (WMO) worked together to establish the IPCC (“UNFCCC – 25 Years,” n.d.). The purpose of the IPCC is to “provide policymakers with regular scientific assessments on climate change, its implications and potential future risks, as well as to put forward adaptation and mitigation options” (The Intergovernmental Panel on Climate Change, n.d.). The IPCC prepares regular reports on the different aspects of climate change and what they mean for humans. The most well-known reports are a series of comprehensive “Assessment Reports” that update the most-recent findings in climate science through large teams of nominated researchers (The Intergovernmental Panel on Climate Change). As of now, there are five such reports with the sixth currently being prepared and set for release in 2022.

Following the creation of the IPCC, the United Nations Framework Convention on Climate Change (UNFCCC) became open for signature in Rio and the Earth Summit in June of 1992 (“UNFCCC – 25 Years,” n.d.). This framework served as the bridge to bring nations together to initiate a joint effort against climate change; in 1994, the framework came into effect (“UNFCCC – 25 Years”). It set out plans to meet once a year (known as Conference of the Parties (COP)) with the parties that signed to the framework to discuss the current climate situation and form goals and assess the necessary action plans to achieve those goals (“Conference of the Parties,” n.d.). To be able to discuss the current situation of the climate, the meeting requires multitudes of information (primarily on emissions) from the parties in order to assess where they stand (“Conference of the Parties”). The first COP was held in Berlin during the spring of 1995 where the big takeaway was that the initial commitments of parties set out by the UNFCCC were found to be inadequate if they were to achieve the goals the framework set (“UNFCCC – 25 Years”). To achieve the targets, higher levels of mitigation would be necessary, and this led to the creation of the Berlin Mandate. Within it, it was decided that the majority of the increased contributions to the global climate effort should fall on the shoulders of developed countries because “the largest share of historical and current global emissions of greenhouse gases has originated in developed countries” and in addition they are in better positions to make emission adjustments (United Nations Framework Convention on Climate Change, 1995).

The Kyoto Protocol

The conclusion of the Berlin conference resulted in the formation of the Kyoto Protocol in Kyoto, Japan on December 11, 1997 at the third COP (“UNFCCC – 25 Years,” n.d.). The protocol was the first introduced global greenhouse gas emission reduction treaty (“UNFCCC – 25 Years”). It split countries into three groups determined by their level of development: Annex I countries, Annex II countries and Non-Annex countries (“Parties and Observers,” n.d.). Annex I countries were those that were industrialized and part of the Organisation for Economic Co-operation and Development (OECD) as well as any countries with economies in transition. Annex II countries include the Annex I countries of the OECD but exclude the countries with economies in transition. Lastly, the Non-Annex countries are those that are considered developing. According to the Kyoto Protocol Reference Manual, the protocol “[set] binding targets for developed countries, known as ‘Annex I Parties’, to limit or reduce greenhouse gas emissions” and it “established innovative mechanisms to assist these Parties in meeting their emissions commitments” (“Kyoto Protocol Reference Manual,” 2008, p. 4). The protocol was active from 2008 until 2012 in what was referred to as the “first commitment period” with the second taking place from 2013 until 2020 (“Kyoto Protocol Reference Manual,” p. 4). In addition to assisting parties with mitigation mechanisms, it also set emission targets and assigned amounts for each Annex I Party within the manual. An assigned amount is the maximum amount of emissions that a nation is permitted to emit during a commitment period in order to achieve its emissions target (“Kyoto Protocol – Targets,” n.d.).

Within the Kyoto Protocol Reference Manual, it states that France, among the majority of developed countries, was assigned an 8% reduction target in total emissions over the first commitment period in reference to their base year (1990) emissions (Figure 6); this target determined France’s assigned amount for the period (“Kyoto Protocol Reference Manual,” p. 13). Referencing the World Bank, it was recorded that France’s total carbon emissions in 1990 were 375,691 kilo-tonnes (kt), which means that in each year from 2008-2012 France’s emissions were not to exceed 345,636 kt (“CO2 Emissions – France,” n.d.). Data from the World Bank shows that France did not manage to meet this target through 2008 to 2010; however, it did in the final years of the commitment period in 2011 and 2012 (“CO2 Emissions – France”).

Table II-1. Quantified emission limitation or reduction targets as contained in Annex B to the Kyoto Protocol

Annex I Parties ^a	Emission limitation or reduction (expressed in relation to total GHG emissions in the base year or period inscribed in Annex B to the Kyoto Protocol) ^b
Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, European Community, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland	-8%
United States of America ^c	-7%
Canada, Hungary, Japan, Poland	-6%
Croatia	-5%
New Zealand, Russian Federation, Ukraine	0
Norway	+1%
Australia	+8%
Iceland	+10%

^a At the time of publication of this manual, the amendment to the Kyoto Protocol that contains an emissions target for Belarus (-8%) had not been ratified by a sufficient number of Parties for it to enter into force.

^b Countries with economies in transition have flexibility in the choice of base year.

^c Country which has declared its intention not to ratify the Kyoto Protocol.

Figure 6. Quantified emission limitation or reduction targets as contained in annex B to the Kyoto protocol. [Online image]. Retrieved from United Nations Framework Convention on Climate Change, https://unfccc.int/resource/docs/publications/08_unfccc_kp_ref_manual.pdf

The protocol also allowed countries with commitments to take part in “emissions trading,” which is when a country that has emitted less than it was required sells its excess capacity of allowed emissions to another country (“Emissions Trading,” n.d.). It was reported by the European Commission that close to half of Europe’s carbon emissions were affected positively by this trading scheme (“EU Emissions Trading System,” n.d.). The scheme allowed nations that were on pace to fail meeting their emissions targets to acquire Assigned Amount Units (AAUs) (assigned amounts divided into groups of units) (“EU Emissions Trading System”). Emissions trading served to create flexibility for the Annex I parties as the aggregate level of emissions in the atmosphere would still meet the minimum criteria set out by the UNFCCC. What this meant was that countries were able to emit more greenhouse gases if they traded with others that did not use up all of their emissions permissions, and this could lead to certain emitters exceeding their assigned amounts by buying AAUs from other countries with emissions to spare. Since there was no limit for how many AAUs a country could buy, this could result in more environmental degradation in the region in which the emitter is based, even though global aggregate carbon dioxide emissions would fall in line with the targets set in the protocol.

While the Kyoto Protocol was a big step forward and brought together the majority of the countries of the world for the good of the planet, its methodology was not without criticism. One of those according to British Economist, Nicholas Stern, was that there was no concrete action laid out by the UNFCCC for countries to follow to reduce their emissions (2007, p. 542). This ambiguity contributed to the protocol being rather ineffective in achieving strict emissions reductions, as it allowed countries to go about doing

so however they pleased and if they pleased. Had the protocol been brought into effect alongside specific required actions by parties, it could have proved to be more effective. Another criticism made by Stern was that the assigned reductions were perceived as unfair by developed countries (2007, p. 542). Developed nations that had historically emitted more of the total carbon were assigned stricter emission limits, while countries like China and India (who were, and still are the highest emitters of CO₂) were not required to curb emissions as Non-Annex countries since they were technically still developing (Stern, p. 542). While it can be perceived as fair to give developing countries their time to “catch up” to developed countries, it can also be perceived as the opposite as scientists now know that the planet cannot afford this. The decision to not impose restrictions on them sparked discomfort among developed nations; the United States, for example, decided that it was unfair for the two fast, emerging economies to continue their business as usual, so it elected not to ratify the protocol. The end result was that instead of having all three major emitters reduce carbon emissions, the UNFCCC had none. A third major criticism was that there was nothing impactful enforcing countries to cut emissions despite the fact that the protocol was legally binding; the UNFCCC relied on countries to take it upon themselves to be held accountable (“Compliance Under the Kyoto Protocol,” n.d.). The UNFCCC has stated that their Enforcement Branch on the Compliance Committee requires countries that are in non-compliance (exceeding their emissions limit) to make up “the difference between their emissions and assigned amount” plus an additional 30% in the second commitment period (“Compliance Under the Kyoto Protocol”). Those nations were also no longer permitted to partake in emissions trading and were required to submit a compliance action plan (“Compliance Under the Kyoto Protocol”). This consequence did not have much impact as parties were not necessarily obligated to ratify the second commitment period. It remains possible that the main reason so many parties agreed to ratify the protocol despite its flaws was because it happened to be the only serious solution around; never before had there been an international action plan against climate change until then, so it made sense for countries to be optimistic towards it initially.

The Mitigation Impact of the Protocol

The protocol had its flaws, but according to the IEA, total carbon emissions had decreased on a global scale in the first half of the first commitment period (Figure 7). This was a considerable data point because this considered the fact that most developing parties (like China and India) with high emissions were not required to ratify the protocol. This likely meant that the countries that had ratified made intense emission cuts early on. This could be confirmed by analyzing different countries emissions over the commitment period separately. It was found that France had not only decreased emissions substantially in the first commitment period, it had also decreased them even further in the second commitment period (particularly in 2014, one year after it began). Between 2007, the year before the first period, and 2014, partway through the second period, France’s total carbon emissions had decreased by 17.23% (Figure 8). Considering the recent growth in French economy (+1.73% in 2018), it confirms that France’s efforts in cleaner energy production (primarily nuclear) are able to both sustain growth and curb emissions simultaneously (“GDP – France,” n.d.).

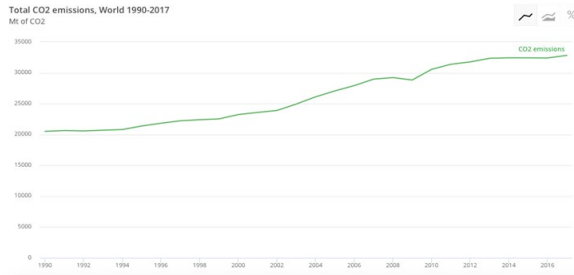


Figure 7. Total global CO2 emissions (1990-2017). [Online image]. Available from International Energy Agency, <https://www.iea.org/statistics/?country=FRA&isISO=true>

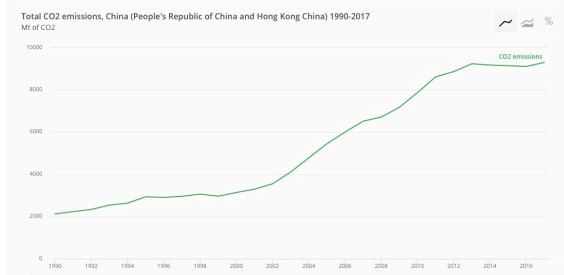


Figure 9. Total CO2 emissions by China (1990-2017). [Online image]. Available from International Energy Agency, <https://www.iea.org/statistics/?country=FRA&isISO=true>

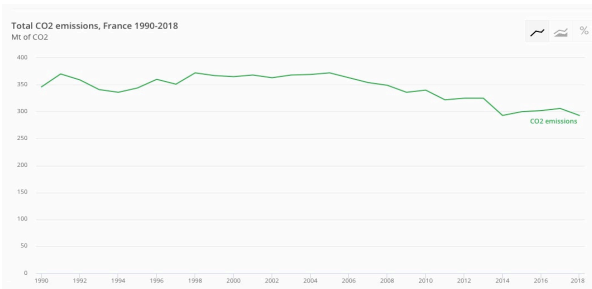


Figure 8. Total CO2 emissions by France (1990-2018). [Online image]. Available from International Energy Agency, <https://www.iea.org/statistics/?country=FRA&isISO=true>

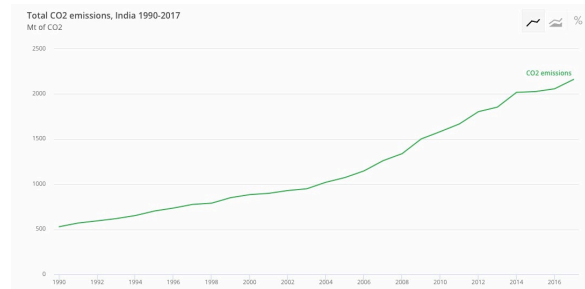


Figure 10. Total CO2 emissions by India (1990-2017). [Online image]. Available from International Energy Agency, <https://www.iea.org/statistics/?country=FRA&isISO=true>

In addition to France, other developed countries such as Italy, Spain, Germany, the United Kingdom, and many others showed similar trends in their total carbon emissions over the two commitment periods, which strengthens the likelihood that the Kyoto Protocol did have an impact early on (“Data and Statistics,” n.d.). After seeing that the global decrease was only temporary for 2009, and that most developed countries had begun cutting emissions through the second commitment period, it was no surprise to see that emerging countries like China (Figure 9) and India (Figure 10) contributed to adjusting the global carbon output by having increases of 29.57% and 32.02% respectively from 2007 through 2013 (“Data and Statistics”).

The Paris Agreement

While the continued decrease in total emissions for the majority of developed nations following the first commitment period seem to be directly related to the second commitment period, there was another major event that took place in 2015: the Paris Agreement. The agreement was similar to the Kyoto Protocol, but had a specific, long-term goal: to limit global temperature to 2 degrees Celsius, and soon after it had entered into force, even further to 1.5 degrees by 2050 (“The Paris Agreement,” n.d.). This time, emission cuts were not decided by the UNFCCC, but by the parties themselves and defined as “nationally determined contributions” (NDCs) which declare the intended reductions in GHGs (“Nationally Determined Contributions,” n.d.). Article 3 of the Paris Agreement states that the NDCs need to be “ambitious,” “represent a progression over time,” and set “with the view [of] achieving the purpose of this Agreement” (United Nations Framework Convention on Climate Change, 2015). While this agreement had a clearly defined objective of reducing the global temperature to a set level, unlike the Kyoto Protocol,

it had less enforcement associated with it; it was not legally binding in regard to reducing emissions. Countries were free to do as they pleased, and this worked according to the global carbon emissions graph, but only briefly; in 2017, emissions started rising once again (Figure 7). A noticeable trend when looking at emission levels of both the world as well as individual parties is that the first year an agreement is in force, there is more effort made to curb emissions; however, when looking even one year later, it is evident that the countries go back to their business as usual and decrease their efforts toward mitigation and change.

The Reality of Human Progress

The poor efforts to help the planet are fueled by countries' needs to produce, grow, and compete; to progress as an economy and society. The United States, for example, does not want to limit productivity because it fears China's economic growth rate will cause trouble for businesses through trade while China does not want to limit productivity so that it can catch up to the United States. It is important to note that without the UNFCCC, its conferences, and its mitigation targets, the state of the planet would be much more unfavourable. Having knowledge on how to mitigate climate change is one thing; having the means for collective action to use that knowledge in practice is what makes the United Nations and its intergovernmental bodies so important today. The implications for the necessity of mitigation, the history of the French energy sector, and the most impactful conferences and their mitigation objectives have all been analyzed in depth; the current state of the French energy sector can now be better understood at the firm level.

IMPACTS ON BUSINESSES AND PROCEDURES

As seen in the previous section, it is evident that France was and still is a key player in making mitigation efforts when compared to most countries. What this impact of mitigation meant for different energy companies was that they needed to change the way their business processes were executed. While France has a more beneficial environmental impact than most nations on average, there is room for improvement.

Case: Total S.A.

France is home to the 6th largest oil and gas company in the world: Total S.A. (Total) (Garside, 2019). As a leading global energy provider, the impacts the firm has on the environment are also substantially larger than most energy companies' in France. In turn, it is regarded as an energy superpower that has the ability to more dramatically reduce the effects of climate change; however, Total has not made outstanding change efforts and has come under fire recently for not complying with the French Duty of Vigilance Law as well as the Paris Agreement (Drugmand, 2018). It was reported that in October of 2018, multiple communities and environmental organizations within France confronted the company for inadequately responding to the current state of the climate crisis (Drugmand). In March of 2017, The French Duty of Vigilance Law was adopted, which requires that "large multinational companies that operate in France to establish a plan that identifies and prevents human rights violations and environmental damage or health risks" (Drugmand). While Total has created a vigilance action plan in its Registration Document of 2017, the challenging French communities and organizations stated that the plan was still incapable of meeting the minimum requirements by the French law in addition to being no aid in achieving the Paris Agreement's objective of holding the global temperature at 1.5 degrees Celsius prior to 2050 (Drugmand). According to a 2017 report from the UK environmental organization known as the Carbon Disclosure

Project (CDP), Total alone is responsible for over two-thirds of France's total GHG emissions, and in addition, it was found that the firm is within the top 20 largest contributing firms to global carbon emissions ("New Report Shows," 2017). Total has a climate action plan on their official website that focuses on five drivers to combat the climate emergency: enhancing energy efficiency, growing in natural gas, increasing low-carbon electricity activities, promoting sustainable biofuels and investing in carbon storage ("Integrating Climate into Our Strategy," n.d.). This plan did not satisfy protestors, however, as just recently in October of 2019, Total was set to be taken to court in January 2020 by six environmental NGOs ("Total Sued Under Vigilance Law," 2019). The reasoning for this legal action was due to the fact that Total had begun an oil project in Uganda, in addition to the firm's previous failures to address their non-compliant invigilance plan ("Total Sued Under Vigilance Law"). Total made it clear that it did not plan to reform its approach to combating climate change in a statement it released earlier in the year stating that their plan "clearly identifies the risks to human rights...and the environment that could result from [its] activities" ("Total Sued Under Vigilance Law").

From a manager's perspective, it is evident that this situation is highly unfavourable for the firm's public relations, especially in France, where many other companies are making beneficial differences to the environment. While the firm has the size and revenue advantage as of now, this is likely to mean less in the future if stricter climate combat laws are introduced. Managers of Total face a major decision to make: the firm can keep producing at an environmentally-degrading level to generate higher revenues, or it can either cut production down or transfer more production towards renewable energy sources and potentially bring in less revenue. A third factor managers may need to consider is the impact that stakeholder's may have on the firm, given their business plans. Total's shareholder's equity was among its highest historical levels one year ago on September 30, 2018 at \$120.62 billion USD, while its long-term debt totalled \$41.09 billion USD ("Total S.A. Debt to Equity," n.d.). One year later, its third quarter showed that equity had dropped to \$117.31 billion, while its debt rose to \$47.92 billion USD ("Total S.A. Debt to Equity"). To comfortably purchase capital and meet its expenses, Total needed to issue more debt to account for the loss in equity. While it is difficult to say if the drop in equity was directly related to the coinciding public relations issues of the energy giant since small fluctuations like these happened in the past, it remains a possibility, and managers should consider how the strategy of their business impacts their shareholders, and how shareholders may then impact the business.

Case: Engie

While it is still the largest energy firm in France, Total does not speak for the majority of the French sector; many firms (as supported by Figures 5 and 8), are making a positive environmental difference in their business procedures by turning away from carbon-dense production and placing a higher degree of importance on improving environmental well-being. One of those firms, Engie, has much more effective solutions to climate change. In addition to being a player in favour of the environment, it is also currently the largest independent electricity supplier in the world ("Electricity," n.d.). Engie was the result of a merger in 2008 between the large energy firms, SUEZ and Gaz de France; combined, Engie became one of the biggest players in the market ("The History of the Engie Group," n.d.). Engie was a big emitter of CO₂ a few years ago, as stated by its CEO, Isabelle Kocher, in the firm's 2018 Integrated CSR Report; however, in recent years the company has turned itself around and within 2 years, it cut its emissions by 40% compared to its 2012 base year ("2018 Integrated Report," 2018, p. 48). The company states that over 90% of its activities are now low carbon and that 100% of the electricity that it provides to both customers and businesses is green ("Our Climate Commitments," n.d.). In a section of Engie's website on its solutions for combating climate change, the firm states that "The choices made by our company impact not only on its financial results, but also on the communities in which it works, the environment, and more

generally, every aspect of society” (“Our Climate Commitments”). Given that Engie provides transparent CSR reports, focuses much of its efforts on switching to clean energy, and has public support in its efforts, it is evident that the company has, and continues to, reform its business activities in order to help the environment. Whether this change of strategy was inspired directly by the UN and the guidelines France agreed to remains possible. Kocher stepped up to her new role as CEO in 2016 and made an instant impact on the strategy of Engie. In 2016 and 2017, she was ranked as the 3rd most powerful woman in the world for her efforts for change according to Fortune magazine (“Most Powerful Women International,” n.d.). When she assumed her new role, she stated that Engie had to “take its responsibility” in fighting climate change as a world leader in energy; she believed that revolution in the energy sector was, and is, necessary to improve the current climate situation (Collingridge, 2017).

In this manager role, she had big decisions to make; it is one thing to implement the new strategy, and it is another to convince your employees to embrace the change. She fits the role of a good change champion because she carries a strong purpose with her motives – she did this to improve the future landscape of the environment by being one of the forward-moving energy players. Change is not easy, but sometimes it is necessary in order to get to somewhere better. As the leader, Kocher set the frame and made some big strategic changes: selling 20% of the firm’s assets primarily in coal production (amounting to roughly 15 billion euros) in order to reinvest in renewables, investing more in employee training with the goal of making staff more autonomous, and setting a goal of reducing direct CO2 emissions by 85% from the 2012 base year (Collingridge, 2007; “Climate and Reduction of Greenhouse Gases (GHG) Emissions,” n.d.). Kocher is a leader who values environmental change over profit maximization; the opposite of Total S.A., but shareholders are not align with Kocher just because she is putting more effort into sustainability. Since her change in direction in 2016, she has failed to deliver her projected returns for investors (Figure 11), which have continued to decrease; this has resulted in the French government, which holds the highest company stake at 24%, contemplating reducing its stake (De Beaupuy & Amiel, 2019). The government has doubts that Kocher’s plan to transform the industry into a “clean power champion” will increase profits; she now faces increasing pressure on the foundation of her business strategy (De Beaupuy & Amiel).

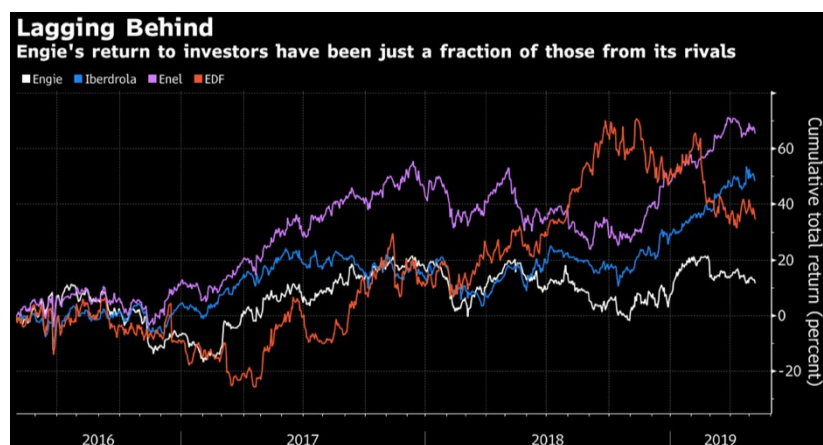


Figure 11. De Beaupuy, F. & Amiel, G. (Authors). Engie’s investor returns compared to competitors' (2016-2019). [Online image]. Retrieved from Bloomberg, <https://www.bloomberg.com/news/articles/2019-05-13/engie-ceo-s-strategy-has-investors-asking-where-s-the-payoff>

The Current State of the Firms

In her manager position, she faces a challenge: if she continues with this strategy, she will likely have further decreasing returns and lose support; if she changes her strategy back to the traditional way, she increases profits but goes back on what she set out to accomplish. What much of this information is showing is that it is currently very difficult to adjust a business to be more sustainably integrated and bring in high profits at the same time; if Total or Engie could excel at both, they likely would. While being sustainable is good for the environment, it is not typically the same for a business' bottom line; The U.S. Energy Information Administration's (EIA) 2019 Energy Outlook report showed average costs for different generating technologies ("Cost and Performance," 2019). In the report, it found that the average cost in USD per kilo watt (\$/kW) of oil and gas was nearly \$1,000/kW, while solar was about \$2,000/kW and hydropower was roughly \$2,700/kW ("Cost and Performance"). Numerous sources have shown similar comparisons between traditional fossil fuels and renewables, confirming that it is more expensive, on average, to rely on cleaner energy. However, the EIA did find that coal is currently around \$3,500/kW and renewables are projected to be cheaper in coming decades ("Cost and Performance"). At this stage, it appears that the choice is one or the other, and it is clear which target each firm has set to achieve. What this means for the environment is that unless many firms undertake what Engie has done, it will suffer; firms like Total are profit-seeking, so without stricter emission regulations, these firms will continue producing as efficiently as they are able. The guidelines inspired by the UN and its global conferences to help protect the climate are not strong enough to force Total to reform its business operations like Engie has. To compare the different strategies, below is a comparison of the two firms' revenues (Figures 12 and 13) and carbon emissions (Figures 14 and 15) over time:

Revenue of Total S.A. from 2010 to 2018

(in billion U.S. dollars)

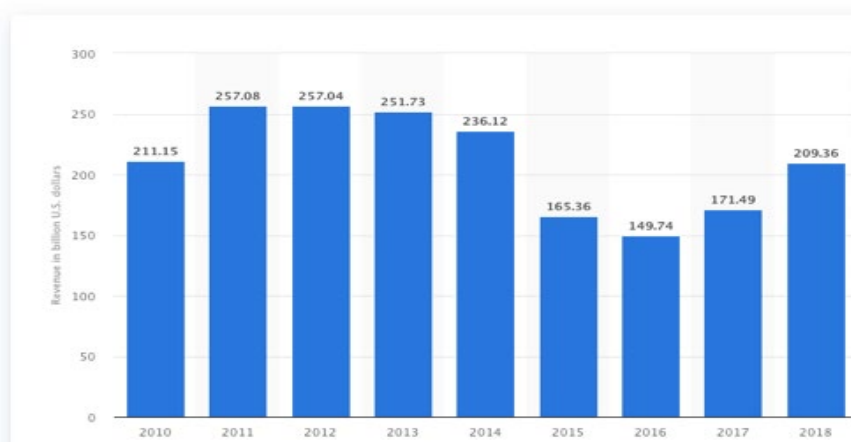


Figure 12. Samsó, R. (Author). Revenue of Total S.A. (2010-2018). [Online image]. Retrieved from Statista, <https://www.statista.com/statistics/268764/revenue-of-total-sa/>

Revenue of Engie from FY 2013 to FY 2018

(in million euros)

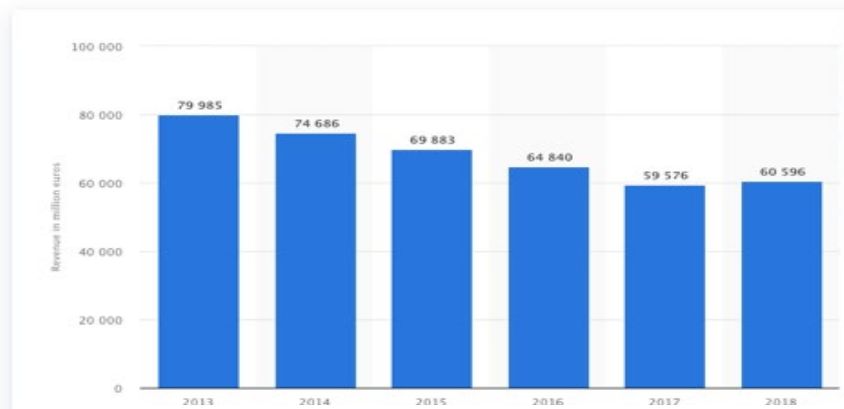


Figure 13. Wang, T. (Author). Revenue of Engie (2013-2018). [Online image]. Retrieved from Statista, <https://www.statista.com/statistics/268329/revenue-of-gdf-suez/>

Volume of greenhouse gas emissions released by Total S.A. million metric tons of carbon dioxide equivalents)*

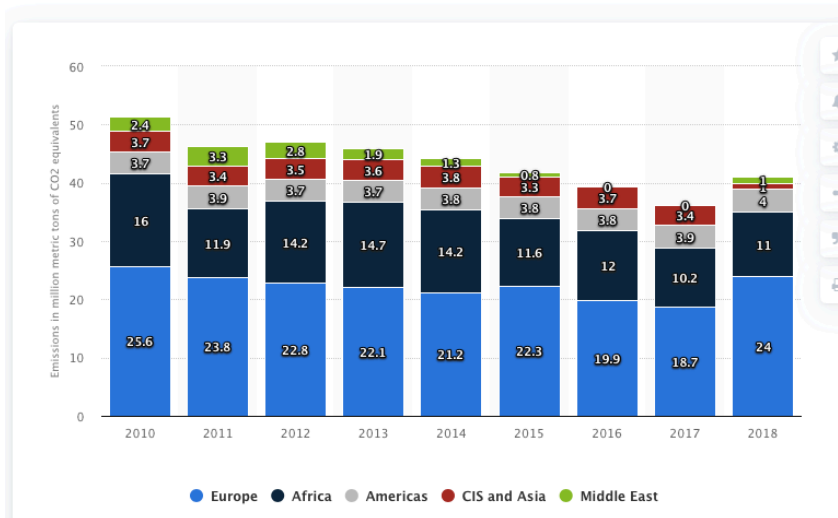


Figure 14. Wang, T. (Author). Total S.A. Greenhouse Gas Emissions by Region (2010-2018). [Online image]. Retrieved from Statista, <https://www.statista.com/statistics/555549/volume-of-greenhouse-gas-emissions-of-total-sa-by-region/>

Greenhouse gas (GHG) direct emissions of the ENGIE Group (in million metric tons CO₂ equivalent)

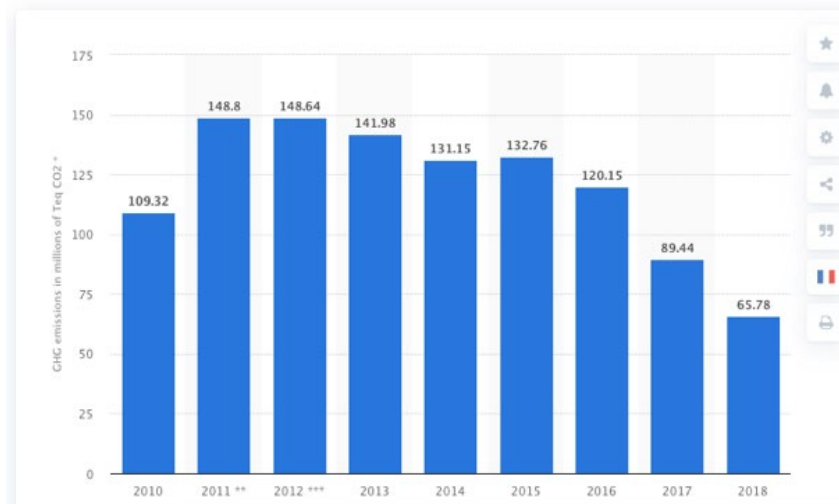


Figure 15. Samso, R. (Author). Engie Greenhouse Gas Emissions (2010-2018). [Online image]. Retrieved from Statista, <https://www.statista.com/statistics/1078742/engie-emissions-of-gas-at-effect-of-greenhouse/>

From the data, it is a likely case that climate change pressure (through government laws, public perception, and understanding of the need for change) has influenced each firm to trend in a decrease of emissions (Figures 12-15). While Total has not shifted its business strategy to aggressively accommodate for the current climate situation, it is still slowly moving in the right direction, along with the majority of firms in France (Figures 5 and 8). When looking at the total sources of energy supply in France, most of it is still currently nuclear (as seen in a previous section) because it had invested so much into it decades ago (Figure 5). According to the World Nuclear Association, nuclear power is the source of 75% of France's total electricity and the country remains the world's largest net exporter of the commodity in large part because of it ("Nuclear Power in France," 2019). What makes nuclear energy so valuable is that the reactors do not produce any CO₂; the fact that France relies so heavily on it helps to explain why its emissions are lower than the global average and why the annual total amount continues to diminish (Figure 8) ("Nuclear Explained," 2019). French energy firms seem to be taking steps in the right direction in being global leaders in combating climate change.

CONCLUSION

Firms of the French energy sector have made efforts to reduce the impacts of climate change primarily through limitations on emissions. Compared to the past, great strides have been made by business leaders in France and around the world. Firms like Engie display what it means to put the planet first and integrate sustainability into the strategy; what the implications are for businesses like these from a financial perspective vary with those like Total, who attempt to meet requirements, but still focus on profit rather than the environment. In both cases, emissions reveal a decreasing trend (Figures 14 and 15); the mitigation culture presented by the UN and its bodies onto France, among other nations, is a likely cause for the emissions shift. Without their actions, the state of the climate could be very different and likely for the worse. Looking to the future, France's government developed an action plan against climate

change in 2017 (“Climate Plan,” n.d.). Some of the objectives include turning away from fossil fuels, making France a leader in the green economy, and scaling up international action on the climate through supporting NGO climate activists and developing countries (“Climate Plan”). Steps are still being taken to put the planet in a better position, but more work is needed to be done; the UN has done a good job of bringing climate change into the light and sparking action on change, but without stricter emissions laws, it may not be enough in the long term. As seen with Total, firms similar to these will do the minimum to comply with environmental standards set by their governments and continue to optimize their business financially. The future lies with the governments, business leaders, and their firms of the world. Their decisions are what will decide how climate change is handled.

REFERENCES

- The causes of climate change (n.d.). Retrieved from <https://climate.nasa.gov/causes/>
- The causes of climate change. [Comparison of global surface temperature and solar radiation received by Earth (1880-2019)]. Retrieved from <https://climate.nasa.gov/causes/>
- Changes since the Industrial Revolution (n.d.). Retrieved on September 20, 2019, from <https://www.acs.org/content/acs/en/climatescience/greenhousegases/industrialrevolution.html>
- Climate and reduction of greenhouse gases (GHG) emissions (n.d.). Retrieved November 6, 2019, from <https://www.engie.com/en/analysts/environment/reduction-of-ghg-emissions/>
- Climate change: How do we know? (n.d.). Retrieved from <https://climate.nasa.gov/evidence/>
- Climate change: How do we know? [Atmospheric carbon dioxide concentration over time]. Retrieved from <https://climate.nasa.gov/evidence/>
- Climate plan (n.d.). Retrieved December 8, 2019, from <https://www.gouvernement.fr/en/climate-plan>
- Collingridge, J. (2017, April 30). French power broker charges into Britain. Retrieved November 6, 2019, from <https://www.thetimes.co.uk/article/french-power-broker-charges-into-britain-7hfctr6zb>
- Compliance under the Kyoto protocol (n.d.). Retrieved October 24, 2019, from <https://unfccc.int/process/the-kyoto-protocol/compliance-under-the-kyoto-protocol/introduction>
- Conference of the parties (n.d.). Retrieved October 8, 2019, from <https://unfccc.int/process/bodies/supreme-bodies/conference-of-the-parties-cop>
- Cost and performance characteristics of new generating technologies (2019, January). Retrieved from https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf
- CO2 emissions – France (n.d.). Retrieved September 21, 2019, from <https://data.worldbank.org/indicator/EN.ATM.CO2E.KT?locations=FR>
- Data and statistics (n.d.). Available from <https://www.iea.org/statistics/?country=FRA&isISO=true>
- Data and statistics (n.d.). [France’s total primary energy supply by source (1990-2018)]. Available from <https://www.iea.org/statistics/?country=FRA&isISO=true>
- Data and statistics (n.d.). [Total CO2 emissions by China (1990-2017)]. Available from <https://www.iea.org/statistics/?country=FRA&isISO=true>
- Data and statistics (n.d.). [Total CO2 emissions by France (1990-2018)]. Available from <https://www.iea.org/statistics/?country=FRA&isISO=true>
- Data and statistics (n.d.). [Total CO2 emissions by India (1990-2017)]. Available from <https://www.iea.org/statistics/?country=FRA&isISO=true>
- Data and statistics (n.d.). [Total global CO2 emissions (1990-2017)]. Available from <https://www.iea.org/statistics/?country=FRA&isISO=true>

De Beaupuy, F., & Amiel, G. (2019, May 13). [Engie's investor returns compared to competitors' (2016-2019)]. Retrieved from <https://www.bloomberg.com/news/articles/2019-05-13/engie-ceo-s-strategy-has-investors-asking-where-s-the-payoff>

De Beaupuy, F., & Amiel, G. (2019, May 13). French energy giant's transformation has investors asking: Where's the payoff? Retrieved November 30, 2019, from <https://www.bloomberg.com/news/articles/2019-05-13/engie-ceo-s-strategy-has-investors-asking-where-s-the-payoff>

Drugmand, D. (2018, October 25). French communities demand climate action by oil giant Total. Retrieved October 25, 2019, from <https://www.climateliabilitynews.org/2018/10/25/total-oil-france-climate-change/>

The effects of climate change (n.d.). Retrieved from <https://climate.nasa.gov/effects/>

Electricity (n.d.). Retrieved November 5, 2019, from <https://www.engie.com/en/businesses/electricity/>

Emissions trading (n.d.). Retrieved October 21, 2019, from <https://unfccc.int/process/the-kyoto-protocol/mechanisms/emissions-trading>

EU emissions trading system (n.d.). Retrieved October 21, 2019, from https://ec.europa.eu/clima/policies/ets_en

Garside, M. (2019, June 1). Top oil and gas companies by revenue 2019. Retrieved October 25, 2019, from <https://www.statista.com/statistics/272710/top-10-oil-and-gas-companies-worldwide-based-on-revenue/>

GDP - France (n.d.). Retrieved October 24, 2019, from <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=FR>

Global emissions (n.d.). Retrieved September 20, 2019, from <https://www.c2es.org/content/international-emissions/>

Global greenhouse gas emissions data (n.d.). Retrieved September 22, 2019, from <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>

The Great Acceleration (2015, January 16). Retrieved from <https://futureearth.org/2015/01/16/the-great-acceleration/>

History (n.d.). Retrieved from <https://www.iea.org/about/history>

The history of the Engie Group (n.d.). Retrieved November 5, 2019, from <https://www.engie.com/en/group/history-engie-group/>

Integrating climate into our strategy (n.d.). Retrieved October 28, 2019, from <https://www.total.com/en/commitment/environmental-issues-challenges/climate-change>

Intergovernmental Panel on Climate Change (2015). Climate Change 2014 Synthesis Report. Retrieved from https://ar5-syr.ipcc.ch/ipcc/ipcc/resources/pdf/IPCC_SynthesisReport.pdf

The Intergovernmental Panel on Climate Change (n.d.). Retrieved October 8, 2019, from <https://www.ipcc.ch/>

Kyoto protocol reference manual (2008, November). [Quantified emission limitation or reduction targets as contained in annex B to the Kyoto protocol]. Retrieved from https://unfccc.int/resource/docs/publications/08_unfccc_kp_ref_manual.pdf

Kyoto protocol reference manual (2008, November). United Nations Framework Convention on Climate Change. Retrieved from https://unfccc.int/resource/docs/publications/08_unfccc_kp_ref_manual.pdf

Kyoto protocol – targets for the first commitment period (n.d.). Retrieved October 18, 2019, from <https://unfccc.int/process-and-meetings/the-kyoto-protocol/what-is-the-kyoto-protocol/kyoto-protocol-targets-for-the-first-commitment-period>

Lepoutre, M., Semeria, M., Beltran, A., Tardieu, B., & Maisonneuve, C. (Eds.) (2015, April 20). The history of energy in France. Retrieved September 24, 2019, from <https://www.planete-energies.com/en/medias/saga-energies/history-energy-france>

Lindsey, R. (n.d.). Climate change: Atmospheric carbon dioxide. Retrieved September 19, 2019, from <https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide>

Lindsey, R. (n.d.). [Influence of all major human-produced greenhouse gases (1979-2018)]. Retrieved from <https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide>

Mission (n.d.). Retrieved from <https://www.iea.org/about/mission>

Most powerful women international (n.d.). Retrieved November 6, 2019, from <https://fortune.com/most-powerful-women-international/>

Nationally determined contributions (n.d.). Retrieved October 24, 2019, from <https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs>

New report shows just 100 companies are source of over 70% of emissions (2017, July 10). Retrieved October 28, 2019, from <https://www.cdp.net/en/articles/media/new-report-shows-just-100-companies-are-source-of-over-70-of-emissions>

Nuclear explained: Nuclear power and the environment (2019, January 16). Retrieved from <https://www.eia.gov/energyexplained/nuclear/nuclear-power-and-the-environment.php>

Nuclear power in France (2019, October). Retrieved from <https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/france.aspx>

Our climate commitments (n.d.). Retrieved November 5, 2019, from <https://www.engie.com/en/commitments/our-climate-commitments/>

Paris Agreement (n.d.). Retrieved October 24, 2019, from <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>

Parties and observers (n.d.). Retrieved October 9, 2019, from <https://unfccc.int/parties-observers>

Samsø, R. (2019, December 4). [Engie greenhouse gas emissions (2010-2018)]. Retrieved December 6, 2019, from <https://www.statista.com/statistics/1078742/engie-emissions-of-gas-at-effect-of-greenhouse/>

Samsø, R. (2019, November 6). [Revenue of Total S.A. (2010-2018)]. Retrieved December 1, 2019, from <https://www.statista.com/statistics/268764/revenue-of-total-sa/>

Shabecoff, P. (1988, June 24). Global warming has begun, expert tells senate. Retrieved October 3, 2019, from <https://www.nytimes.com/1988/06/24/us/global-warming-has-begun-expert-tells-senate.html>

Stern, N. (2007). The economics of climate change: The Stern review. Cambridge, United Kingdom: Cambridge University Press. doi:10.1017/CBO9780511817434

Thermodynamics: Albedo (n.d.). Retrieved September 19, 2019, from <https://nsidc.org/cryosphere/seaice/processes/albedo.html>

Total S.A. debt to equity ratio 2006-2019 (n.d.). Retrieved from <https://www.macrotrends.net/stocks/charts/TOT/total-sa/debt-equity-ratio>

Total sued under France's new duty of vigilance law (2019, October 23). Retrieved October 28, 2019, from <https://ens-newswire.com/2019/10/23/total-sued-under-frances-new-duty-of-vigilance-law/>

2018 integrated report (2018, May 18). Retrieved from https://www.engie.com/wp-content/uploads/2018/06/engie_ri_2018_va_vf.pdf

UNFCCC – 25 years of effort and achievement (n.d.). Retrieved October 8, 2019, from <https://unfccc.int/timeline/>

United Nations Framework Convention on Climate Change (2015, November). Paris Agreement. Retrieved from https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_english_.pdf

- United Nations Framework Convention on Climate Change (1995, June 6). Conference of the parties. Retrieved from <https://unfccc.int/resource/docs/cop1/07a01.pdf>
- Wagg, G. (2015, June 24). [Comparison of natural and human enhanced greenhouse effects]. Retrieved from <https://mrgeogwagg.wordpress.com/2015/06/24/greenhouse-effect-and-anthropogenic-warming/>
- Wagg, G. (2015, June 24). Greenhouse effect and anthropogenic warming. Retrieved September 19, 2019, from <https://mrgeogwagg.wordpress.com/2015/06/24/greenhouse-effect-and-anthropogenic-warming/>
- Wang, T. (2019, December 5). [Total S.A. greenhouse gas emissions by region (2013-2018)]. Retrieved December 6, 2019, from <https://www.statista.com/statistics/555549/volume-of-greenhouse-gas-emissions-of-total-sa-by-region/>
- Wang, T. (2019, April 25). [Revenue of Engie (2013-2018)]. Retrieved December 1, 2019, from <https://www.statista.com/statistics/268329/revenue-of-gdf-suez/>