

# “How Governments can Effectively Realize a Global Energy Transition”

Under what conditions can governments design the most effective strategy to accomplish a global energy transition towards renewable energy sources?

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# Introduction

*“To truly transform our economy, protect our security, and save our planet from the ravages of climate change, we need to ultimately make clean, renewable energy the profitable kind of energy.”* — Barack Obama (Goldenberg, 2009)

The climate change crisis has gained a tremendous amount of exposure, credibility, and public acknowledgment, following which many new initiatives have arisen. Of the broad range of environmental issues, those related to the energy sector are the most well-known and have caused the most environmental damage. Specifically, the energy sector accounts for 38% of the global cost of environmental externalities (Trucost, 2013). These are the external damages on the environment caused by the production and consumption of energy, that require additional costs in order to make up for what is lost. Most commonly we hear about the need to reduce the emission of greenhouse gasses (GHGs). More generally, there are parts of the energy sector that affect our planet negatively, while nobody makes up for what is lost.

Though it may not be possible to reverse the damages, governments can minimize future damages by reducing the emission of GHGs as much as possible. For example, Germany has greatly acknowledged the role of the energy sector in combating the climate crisis. Based on the fact that their energy sector accounts for as much as 85% of the country’s GHG emissions, the German government has made it the primary target (Roehrkasten et al., 2016, p. 51). All in all, it is clear that the energy sector is one of the world’s biggest polluters (Trucost, 2013) and needs to undergo a change in order to protect our planet. I will continue along with the premise that this change should be in the form of an energy transition. In specific, governments should make a shift towards a world of renewable energy sources because an energy transition has been considered essential for global climate change mitigation (Carlarne, 2010).

Sustainability is a rather new policy objective that has been pushed to the front by the public. Besides a government’s interest, public interest can also heavily influence what policy choices are being made (Prontera, 2009, p. 7). The wave of climate protests all around the globe shows the growing acknowledgment of the crisis and the want for governments to intervene. As a result of the change in public perception, environmentalism has been put on the agenda of policy-makers by changing the objectives in the energy sector. This illustrates how public perception of a problem, or general social and economic demands (Prontera, 2009, p. 13), can have substantial influence over policy design. Thus, as the public interest in solving the energy crisis increased, more and more governments have shown an interest in making an energy transition.

Now that the energy crisis has earned itself a seat at the table, there has been an increase in energy-related policies (Stavins, Zou, Brewer, Conte Grand, den Elzen, Finus, Gupta, Höhne, Lee, Michaelowa, Paterson, Ramakrishna, Wen, Wiener, & Winkler, 2014, p. 1012). An example of how sustainability, as an objective, has translated into politics is the Paris Agreement that was signed in 2015 (UNFCCC, 2016). This agreement identifies climate change as a common issue among all the participating nations, indicating the fact that many governments have gained an

interest in becoming more environmentally friendly. In order to have a strong response to climate change, the target of the agreement is to keep global temperature rise below two degrees Celsius compared to the pre-industrial levels. In addition, participants are encouraged to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. (UNFCCC, 2016). Over time, many more agreements with similar climate goals came into being and it seems as if the whole world is on track to reduce GHG emission. However, change is happening at drastically different speeds all over the world, with the EU leading the charge. To sum up, there appear to be a number of past agreements that express a common want and need to combat climate change, however, the enthusiasm for making the needed energy transition does not always translate well into domestic policy. Therefore, the question this thesis aims to answer is under what conditions can governments design the most effective strategy to accomplish a global energy transition towards renewable energy sources.

## Methodology

There has been an increasing interest to reduce the environmental harm caused by the energy sector, pushing for an overall shift to sustainable energies. This following section will explain how the energy sector has changed throughout history, what characteristics of the energy sector give rise to difficulties, and how governments can deal with the complexity of the energy sector. After that, a case study will illustrate the differences between the energy transition of Germany and China in order to identify points of failure and success.

### a. Literature Review

#### Changes in the energy sector over time

In order to understand why some countries are more successful in making an energy transition than others, we need to start by looking at the history of the energy sector and the different objectives for which governments have used energy over time. In doing so, we can understand the motivations behind a government's policy choices in the energy sector and how political interests have changed over time. Looking back, the industrial revolution, starting in the 18th century, can be marked as the starting point of the energy dependency that has held a tight grip on governments' policy-making processes. The reasoning behind this is that having an adequate energy supply is essential for some of the fundamental aspects of a nation, such as having a well-functioning economy and maintaining national security. Being able to trade goods and having the resources to defend oneself was seen as a sense of security and gave governments political power. This is in line with the realist interpretation of International Relations which explains a government's actions from a competitive and conflictual point of view (Korab-Karpowicz, 2018). Because society was not as stable as it is today, it is not surprising that such rivalry was the motivation behind many government choices, including those related to the energy sector. In general, the theory suggests that governments' actions are influenced by their need for political power because such power is believed to bring security which is regarded as

the main role of a government. Thus, in order to stay safe and relevant in the international community, there are a number of basic functions that need to be fulfilled that cannot be done without a large enough energy supply.

In order to secure a country's energy supply, international cooperation took place through bilateral agreements with the countries that supply the raw materials, such as oil, gas, and coal (Prontera, 2009, p. 6). This system of energy supply and demand was put to the test during the two World Wars, pointing out the countries' dependency on energy. By putting up trade barriers, a country could be cut off from their nation's energy supply, leaving it unable to defend itself. At that moment in history, the role of energy as a tool in national security was the most prominent. Not surprisingly, energy became a primary concern of governments in this time of conflict. To achieve the desired energy security, governments did not only focussed on having a reliable supply but after the energy crisis of 1973, it was also about diversifying the types of energy sources (Prontera, 2009, p. 11). That entailed having multiple different energy sources by having other options to fall back on which would, in turn, increase energy security. This has led to much fragmentation within the energy sector, a topic to which will be discussed more in-depth in the next section.

Decades later, the world has drastically changed. Not only has the fear-filled post-WW mentality fallen to the background by establishing better international relations, but governments are also being faced with new challenges such as climate change and the further digitalization of our society (Beier, Niehoff, Ziems, & Xue, 2017, p. 228). As a result, energy has obtained a new role, namely that of being a tool that has the potential to make our practices more environmentally-friendly. Alongside this new objective, our concept of security has changed (Valentine, 2011, p. 4572). Rather than having to be reliant on the energy supply of another country, governments can become more self-sufficient through the production of renewable energy sources. Due to the diversity of renewable energy sources, any country should have the resources to produce at least one type of renewable, whereas the production of finite sources is restricted to only those places where it can be found. If we add the environmental objective on top of that, we can understand why an energy transition towards a planet running on renewables has started to become a priority for many governments, especially in the well-developed parts of the world, the main reason being that our understanding of the role of energy has changed. As a result, the energy sector is becoming more concerned with sustainability and efficiency, and less with national security.

## The rise in multilateral agreements

The change in energy objectives has been depicted in policy documents. Alongside the development of an environmental objective in the energy sector and an overall desire to fight climate change, there has been a growth in multilateral agreements to improve sustainability on the international level (Stavins et al., 2014, p. 1012). Important examples of these are the Paris agreement, the Kyoto Protocol, and EU policies. Multilateral agreements are an important tool that shapes domestic energy policy-making, as they prescribe a rather broad target upon which each country can build its own strategy. For example, an agreement may describe a target of reducing GHG emissions by a certain percentage before a set time. From here, many of the

details on how to reach the decided-upon targets are left to the participating governments to decide upon. This is important to address because this is where many of the issues related to making a successful energy transition arise. Governments have to decide on things such as in which part of the energy sector to intervene and what energy sources to pursue. Thus, because these choices can have an impact on the success or failure of an energy transition strategy, the process of moving from a prescribed target towards a domestic strategy for change should be done more carefully by policy-makers.

In order to analyze a government's strategy, it is critical to understand the following two distinctions that can be made. First, it is important to distinguish between official and unofficial policies, which are, respectively, policies aimed at the energy sector and those policies that merely affect the energy sector and energy balance (Prontera, 2009, p. 3). An official energy policy includes a particular strategy designed by the government to manage the energy sources in the country, including the type of investments that will be made and how to coordinate production. These policies are aimed specifically to influence the energy sectors and those official policies are used when a country wants to make the transition towards renewables, as structural changes have to be made in the sector itself. Nevertheless, by affecting the policy environment, unofficial policies do have the ability to impact the energy sector and influence the effect of a policy. Among other things, unofficial policies can influence energy-related companies, which in turn influence the energy sector. Therefore, the design of the official energy policy should also consider the unofficial policies that may affect its impact.

Second, we can also distinguish between a general policy and the subset of more specific policies that govern different aspects within the energy sector (Prontera, 2009, p. 3). There are, for instance, subsets for different energy sources, but also for different topics like Research & Development or energy efficiency. The same division is also used by professionals such as the International Energy Agency for analytical purposes, making it even more critical to understand this difference in order to do a comparative analysis. This will become more apparent when analyzing the energy transition strategies in Germany and China. To add to this, one can also distinguish subsets for smaller sectors within the whole energy sector. Examples of those types of subsets are the sector for electricity, gas, or renewables. The reason for defining these subsets is that it will make it easier for policy-makers to establish a specific target rather than a general one. Such specific targets are generally chosen to fit with the country-specific environment, making the transition easier to achieve.

## Problematic aspects of the energy sector

When designing the strategy for an energy transition, governments may run into many different dimensions of the energy sector. Prontera (2009) outlined a number of characteristics of the energy sector that influence the decision-making process and how these may slow down a country's effort of making the needed energy transition. As not all of these are relevant to the process of making an energy transition, I will discuss the following: the international dimension, the strategic dimension, the cognitive dimension, the wide temporal horizon and uncertainty, high technical-scientific content. The struggle of high interdependence of the energy sector with other sectors will be discussed in the following sector. Of these dimensions, most are repeatedly

found back in related literature, albeit in a different term. Sometimes they even overlap and interact.

The international dimension is one of the most straightforward factors that influences domestic policy-making because most energy issues directly relate to the relationship of a state with the other states in the international system (Prontera, 2009, p. 3). This is simply due to the fact that many of the primary energy sources for all industrialized countries are concentrated in limited geographical areas. Because these energy resources are also scarce, one of the main concerns of industrialized countries remains that of energy security. This includes ensuring adequate supplies, diversifying the sources of energy, and/or the area from which they are drawn. This need for energy security comes back in many of the other difficulties, as this has been one of the key policy drivers in the energy sector.

The strategic aspect of energy policy-making refers to the strategic weight of energy issues. It is crucial to address the fact that energy policy is indispensable for the pursuit of a great number of other goals that are typical of all modern societies. Without an adequate energy policy, even the basic functioning of an industrialized or developing country is unthinkable, and this value that energy has is only increasing exponentially if we look at the large number of functions that states nowadays have. Therefore, governments cannot take large risks and find it difficult to cooperate and to produce common decisions and policies.

The next characteristic of energy policy-making, the cognitive dimension, refers to the perception of the nature of the problem. In the previous section we already touched upon the importance of public opinion and how it has changed over time. A specific energy problem can be looked at as an economic problem, a problem of national sovereignty and security, or as an ecological one. As these can have contradicting motivations, the interpretation of the energy problem can thus influence what solution is pursued and the connected policy design.

Next is the characteristic that when making energy policy, governments have to work with large temporal horizons while also dealing with the struggle of uncertainty. What this means is that the investments that have to be made in order to make the transition are often for long term projects, while there is no certainty of success. In political systems where leadership changes every few years, this may lead to the problem of 'dyscrasia' (Lewanski, 1997, p. 37). This refers to the situation in which the timeline of political processes is not in line with the timeline of making an energy transition. So, while the temporal horizon of political actors usually does not go far beyond his time in office, the energy problem requires a commitment to a long term strategy. The policy-making process is also affected by uncertainty, as energy transition usually means moving away from a system that we have become accustomed to over a long period of time.

Due to this, governments tend to put energy security first (Prontera, 2009, p. 14), as making an energy transition is very risky and therefore undesirable. Changing the whole structure of a sector that the basic functioning of a country entirely relies upon, therefore, is the opposite of attractive for investment. The European Commission highlights this problem in their Directive 2009/28/EC, where they set mandatory targets regarding the supply of renewable energy sources (Michalena & Hills, 2016, p. 717), by stating that "the main purpose of mandatory national targets was to provide certainty for investors and to encourage technological development to promote energy production from all types of renewable sources."

The fact that the energy sector involves a lot of high technical-scientific content has a number of consequences for policy-making. First of all, a policy needs to be simplistic in order to reach a wide audience or else we risk demotivation to the cause by those who are not specialists. Secondly, policy design is affected by where the information comes from because only those who have the right knowledge are able to best make policy decisions. Lastly, but most importantly for an energy transition, is that technological innovations can redefine the sector and broaden the possibilities of being more sustainable. Not only does this refer to the production of renewable sources, in which we are particularly interested, but it can contribute to the energy sector as a whole by improving energy-efficiency. Hence, making an energy transition is fundamentally connected to the level of technological progress that has been made. On a positive note, it is expected that over the next 30 years, the world will only invest around \$2 trillion in electrical capacity from fossil fuels and more than \$11 trillion in developing zero-carbon technologies (BloombergNEF, 2019). Ultimately, making an energy transition is restricted by technological capacities which can influence the speed at which change can be made.

## Interdependence with other sectors

The struggle of high interdependence with different sectors is particularly relevant for energy issues. It follows that to generate an adequate understanding of the effects of energy policies, we must also pay some attention to the processes that take place at the same time in other connected policy areas. The increased awareness of this struggle of strong interdependence has recently led to policy integration between energy policy and some sectors that are close to it. In particular, energy policy has an interdependent relationship with the following sectors:

- External Relations or foreign policy, both because of its international dimension and because energy policy also tends to follow the logic of power politics in a sector where various nations were present.
- The transport sector, because energy is needed for the mobility of goods and people. It is one of the largest consumers of energy products and is responsible for the relocation of raw material and other necessary material for the production of energy.
- The industrial sector, also due to its high level of energy consumption. Besides that, many parts of the energy sectors are made up of big firms that work in the field of research, production, transportation, or distribution of energy. As a result, the industrial sector serves as both a target of energy policy and as a policy tool to achieve certain objectives.
- Next, the environmental sector, because the production and use of any energy source should also be evaluated according to its environmental impact. This happens, for example, when new power plants are planned to be constructed. Also, the environmental sector influences the energy policy-objectives by pleading for more sustainable energy practices.
- Lastly, there is also interdependence with the management of the territory because many activities tied to production, transport, and distribution of energy have an impact on the territory by simply taking up space. Especially at the local level, the effect that the



construction of nuclear, hydro, and wind plants has on the territory holds a lot of weight. This can often lead to what we know as the not-in-my-backyard (NIMBY) syndrome, which tends to conflict with increasing the production of renewables.

Due to this interdependence, the energy sector has become entangled with many different institutions that need to be answered too (Yu, Xue, Stückrad, Thomas, & Cai, 2020, p. 9). In China, for example, research found that more than 20 institutions were involved in energy policy-making during the period 1995 to 2014. Moreover, it was found that the policies they produced lacked consistency which led to insufficient investment in the wind-energy industry (Yu et al., 2020, p. 10). This shows us how inconsistent targets and an excess of institutions stand in the way of effective measures for change. Contrastingly, countries may also deal with a complete lack of monitoring. This calls for an overall need to improve administration after having implemented new policies.

## Adding structure to the complexity of the energy sector

After having presented all of these potential issues, an analysis of the energy sector may seem overwhelming. Though, in order to track and encourage a global energy transition, an analysis of the current policy environments is necessary. The first step in doing so is to add structure to the complexity and inconsistency of the energy sector within and between countries. This will help unify the terms in which governments and relevant institutions report about their energy sector, allowing for a comparative study.

Generally, we can divide the policy-making process into two distinct areas: external and internal (Prontera, 2009, p 16). The former is related to energy security, whereas the latter focuses on the domestic functions of energy such as production, transport, distribution, sale, energy-saving, etc. Energy security here refers to all policies with the main purpose of assuring enough energy flow to support the functions of the country (Prontera, 2009, p 16). Even though these policies influence how we should then use that energy domestically, internal policy-making is the area where governments can control energy transitions the most as it is subject to more change in terms of the actors involved, the instruments, and the processes of policy-making (Prontera, 2009, p. 19)

Furthermore, target indicators can help to add structure by specifying a government's targets and how targets may differ between countries, enabling the identification of critical issues (Yu et al., 2020, p. 1). In other words, indicators are a representation of the essential components of a country's energy strategy and policies, which measure the current state of the energy transition and help develop a plan for the future. This is where the division between a general policy and its subsets comes into play because indicators such as 'energy consumption' stem from the subsets of the energy sector. Besides being a great tool to collect data, indicators may also serve as the basis for a deeper understanding of how the energy sector relates to a country's economic and environmental sector (Yu et al., 2020, p. 1), meaning that indicators can provide more information about how a specific country deals with trade-offs and how these three sectors connect. This is valuable for the purpose of making an energy transition because, in order to achieve the right policy effect, there needs to be an understanding of the context to which the policy is applied.

However, a comparative analysis can be difficult due to the fact that target indicators often differ from country to country. In an attempt to deal with this diversity, Yu et al. (2020) identified eight main indicators: emission reduction, energy consumption, energy efficiency, energy production, energy security, energy structure, power production, and sectoral targets (p. 5). If such a set of indicators is widely adopted and applied, a global comparative study of the status of energy transition can take place. They argue that “it is essential to examine the indicators used in national strategies and policies as a target for energy transition, in order to reach a systematic understanding of the evaluation structure in other countries” (Yu et al., 2020, p. 2). To sum up, target indicators help us understand the status of energy transition globally, which we could use to plan for the future and perhaps align targets.

## b. Case Study

So far, it has become clear that many governments are trying to reach a particular climate goal and face a lot of challenges in doing so. The following section will be a comparison of the energy transition of Germany versus that of China to help further understand why some countries have been more successful than others. With the help of indicators, an analysis will be done on the countries’ energy policies and targets, how they changed over time, and how they differ from country to country.

### Germany

Germany is considered a frontrunner in the global climate negotiations and a great source of inspiration for other countries that aim to achieve a similar energy transition. The history of German energy transition already started in 1991, namely with the Electricity Feed-in Act that governed the development of renewable energy. This was followed by the 2000 Renewable Energy Sources Act which managed and encouraged renewable energy development in Germany. In this act, they set targets for reaching the minimum share of renewable energy in the electricity sector for 2050, which has already led to a growth of more than 30% in the period 2000 to 2018.

Nowadays, the Energy Concept stands at the core of Germany’s energy transition. This strategy and guide were adopted in September 2010, including a number of short-term and long-term goals for each decade up to 2050. The main goals of the German energy transition strategy, the ‘Energiewende’, are reducing domestic consumption of high-carbon and nuclear energy, and increasing its use of renewables (Yu et al. 2020, p. 3). In the long-term, Germany wants to be energy-efficient and have an environmentally friendly industry, while at the same time maintain competitive energy prices and a high level of prosperity (Yu et al., 2020, p. 3). Such a point of view supports my personal belief of what the energy sector will look like in the future and is in line with the theory of how change can be best achieved by emphasizing what is staying the same (Venus, Stam, & van Knippenberg, 2018). Germany does this by using heavily-used terms such as competition and efficiency in order to resemble a system that we are familiar with. In line with its progressive view, Germany has set up an institution to monitor the progress being made under the concept ‘Energy of the Future’. Such a monitoring institution is

another factor that I deem necessary in order for policy objectives to translate into domestic policies effectively because a lack of follow-up can affect how serious an issue will be taken.

Most recently, following the Climate Change Conference in Paris, Germany adopted its Climate Action Plan 2050 in November 2016. In this plan, they continue to emphasize the importance of “efficiency first” and continue to follow the main principles laid out in their long-term strategy. To align their 2050 goals with those of the 2015 Climate Change Conference, it set up a target for reducing GHG emissions both in general and per sectors (Yu et al. 2020, p. 3). This translation of a common target into domestic legislation, while still adhering to its main principles, is a prime example for other governments who are struggling to do so.

## China

China's energy transition differs tremendously from that of Germany. To start with, the Chinese energy transition began a lot more recently. Similarly to Germany, the main goal of China's energy transition strategy is to reduce domestic energy consumption and increase the use of low-carbon energy sources, accompanied by the creation of the right institutional environment (Yu et al., 2020, p. 2). An important tool for China's domestic policy is the Five-year Plan (FYP), which mainly provides assistance for macroeconomic activities and public services for a five year period, and starting in 2005, they also issued three specific Energy FYPs. The Energy 13th FYP, that set targets for the period 2016-2020, laid out the first mandatory coal cap. While this Energy FYP focuses on decreasing the use of coal, the development of renewable energies is also regulated by a Renewable Energy FYP (Yu et al., 2020, p. 3).

Besides the FYPs, China also has its Strategic Energy Action Plan for the period 2014 to 2020 that focuses on the reduction of energy consumption and aims “to promote efficient, independent, green, and innovative energy production and consumption” (Yu et al., 2020, p. 3).

In addition, they also put out the Energy Supply and Consumption Revolution Strategy for the period 2016 to 2030, which is the first and only policy to go further than the Energy 13th FYP as it even has targets for 2050. According to this long-term target, energy consumption will be stabilized and the use of fossil energy will be under 50 percent (Yu et al., 2020, p. 3). This re-illustrates their main focus on reducing the consumption of high-carbon energy sources. The promotion of sustainable energy only became a priority recently.

## Comparative analysis

Because Germany was one of the first to wholly embrace the need for sustainable energy, it has become an example to the rest of the world on how to deal with the difficulties that come along with energy transitioning (Roehrkasten en Steinbacher, 2016, p. 54). Particularly, they are proof of how even a well-developed country that had previously been dependent on fossil fuel can create new and innovative ways to satisfy their energy needs without it affecting their economic status (Roehrkasten et al. 2016, p. 55). Overall, China and Germany seem to have a somewhat similar ideal of reducing the harm done by the energy sector, though, when looking at their policies more closely, we can uncover a number of intrinsic characteristics that differ for each country and have impacted their respective policy objectives.

Let us first look at the difference in focus for a number of targets in China and Germany that become apparent when comparing the policy documents. Both set a cap for increasing the share of sustainable energy sources in their primary energy consumption and plan to enlarge the corresponding production capacities. Despite their similar target, the two countries have a different perspective on how the energy transition should be approached domestically. One example is that the two countries differ in their perception of energy security and how this links to making an energy transition (Yu et al., 2020 p. 4). Among the Chinese policy documents, the concept of energy security has been mentioned in at least three documents which indicates that China is quite concerned with energy security. Alternatively, there seems to be no mention of energy security in any of Germany's documents. This suggests that China is more concerned about security during an energy transition than Germany is. Though there can be many explanations for why this is the case, for the purpose of this paper it is merely important to address the fact that different countries adhere different levels of importance to certain subject matters. This helps to understand why domestic policies differ from country to country and why some countries are failing to make an energy transition.

This is even more clear when it comes to both countries' stances on nuclear energy. On the one hand, in Germany's policy documents, it is very clear that renewable energy is their direction of choice. On the other hand, China's national policy documents seem to mention the concept of 'non-fossil' or 'low-carbon' energy much more than that of renewables (Yu et al., 2020, p. 4). These terms might seem to refer to the same set of energy sources at first thought, however, the latter also includes nuclear energy. The reason nuclear energy does not fit within the concept of renewable energy is because it uses certain finite materials for production. The distinction between renewable energy and 'low-carbon' energy is important to keep in mind because it reflects the difference in opinion on whether or not nuclear energy is an environmentally-friendly alternative. From the policy documents it is clear that Germany wants to reduce the use of both high-carbon and nuclear energy by shifting toward the use of renewables, whereas China solely aims to move from high-carbon to low-carbon alternatives, indicating that the use of nuclear energy will continue. For Germany, the phasing out of nuclear energy is actually one of the main motivational factors for expanding the use and production of renewables (Yu et al., 2020, p. 4). It should be mentioned that this should not be generalized as a comparison between the East and the West, as other Western countries such as France share China's stance on nuclear energy. Opposite of Germany, China perceives nuclear energy as an essential source of energy for energy security, electricity supply, and environmental protection. This idea is concretized by the continuously increasing installed capacity of nuclear power generation and an increase in both the amount of nuclear consumption and the share of nuclear power in primary energy consumption (Yu et al., 2020, p. 4). Understanding the different perceptions of governments for the same concept adds to a better understanding of the policy choices that have been made in the energy sector, and it can unveil certain beliefs that have to be taken into consideration when designing a strategy for change.

What is also important to consider when designing a strategy for a particular goal, often prescribed by a multilateral agreement, such as the Paris Agreement or Kyoto Protocol, is that countries have very different historical, economic, and social backgrounds upon which their nation is built. This not only restricts them in pursuing sustainable alternatives but also shows

what areas to focus on the most. China provides a great example to make this more clear. Besides their own energy consumption, it is also the world's largest export of CO<sub>2</sub> emissions embodied in goods and services. (Liu, Davis, Feng, Hubacek, Liang, Anadon, Chen, Liu, Yan, & Guan, 2016, p. 201). This is because a large part of the energy-intensive products that China produces, such as cement, plate glass, rolled steel, and cooper, are exported to the rest of the world. As a result, China's exports are emitting more GHGs than the country itself, accounting for around 8.7% of the value of world trade (Yu et al., 2020, p. 3). This raises many questions regarding China's liability for the damages resulting from their industry. It seems unjustifiable to hold China's energy sector to the same standards because they cater to the demands of people all over the world. At the same time, China should put the most effort into making the energy transition because their industry causes so much more environmental damage. All in all, the context in which an energy transition takes place needs to be considered when designing a strategy.

Some of the previously mentioned problematic aspects of the energy sector become clear when comparing the energy policies of China and Germany. To start, we can tell by looking at the energy policies of Germany and China over time, that the motivation for producing environmentally-friendly energy sources differs drastically between the countries. This is where the importance of 'understanding history' comes in. The initial reluctance to change seems to stem from an outdated perception of what the role of energy is and what the policy objectives should be. China had to be faced with the direct consequences of climate change and air pollution for them to take it seriously enough, whereas Germany already deemed the production of sustainable energy important enough three decades ago. Only when the Chinese reliance on their coal-based economy led to severe environmental problems like acid rain, awareness among the leaders finally caught up (Yu et al., 2020, p. 7). This is reflected by the Energy 12th FYP released in 2010, which emphasized those aspects which had been neglected before. Not surprisingly, these are in line with the causes of the environmental distress that the country was dealing with at that particular time. Thus, China seems to have a more responsive rather than preventive approach by solving problems as they come along, rather than having a temporal horizon that looks at the long term.

Though, this is not surprising when considering the country's background and rapidly-growing economy. Around the same time, China's coal-based economy started to boom, environmental considerations started becoming a global priority. Because China was still developing its own economy, it was only able to set specific medium- and long-term targets. An attempt was made at creating a long-term vision, however, as the energy sector was subject to constant change, the targets did no longer match the future situation. The lack of long-term targets is thus not necessarily bad but just has some implications. On the bright side, the adaptability of a country's target indicates a willingness to change and learn. Unlike in Germany, China's main policy document, the FYP, is released every five years, making it possible to consider the most recent changes and developments in the country and align the new targets accordingly. On the less bright side, inconsistencies between targets over time makes it difficult to pinpoint what the exact strategy of a country is. Administrative work, therefore, requires constant updating of the current status which may call for the introduction of new institutions that (Yu et al., 2020, p. 8).

In conclusion, by merely looking at these two countries, we already notice a number of differences that highlight the difficulties governments face in making an energy transition. It implies that when designing a strategy and the corresponding policies, one should pay attention to factors such as a country's stance on energy matters, its motivational factors, and the policy environment in order to make an energy transition most feasible

## Conclusion

### a. Recommendations

#### The ideal: a fitted recommendation

As discussed in the 'Literary Review', designing an energy strategy involves dealing with complex problems and the interdependence of the energy sector with various other aspects of public policy (Prontera, 2009, p. 16). On top of that, a country's socio-economic factors can influence the impact of a given policy from one place to another. Together, this complexity and diversity make designing one universal 'right strategy' rather difficult. Nonetheless, there are some recommendations to be made to address the structural problems that many governments face, which will help to make an energy transition more feasible for countries that are still lagging behind. These recommendations are concerned with what should be involved in designing a strategy so that an effective energy transition can take place. Ideally, we would have a specialized, recommended strategy for each country per specific time unit. However, the feasibility of such a framework is very small at the moment as it will require an enormous amount of continuous research and resources.

Nevertheless, it could be possible that we will have technology in the future that is able to collect data from all the countries that are trying to make an energy transition, compare their environments and policies, and form a personalized recommendation. Among other things, this would entail creating some sort of global map of the energy sector and policy environment by using the target indicator of each country. To repeat, energy indicators represent an essential component in the energy strategies and policies related to energy development, transition, and regulation, and each indicator specifies a quantitative target of the country (Yu et al., 2020, p. 1). Besides using indicators to recognize a strategy, we can use them to determine whether the current energy system is sustainable and use the indicators to address critical issues within it. Thus it can help us measure the current state and the vision for the future. One downside is that indicators often vary across countries for historical, social, economic, and cultural reasons, making a direct comparison between countries difficult (Yu et al., 2020, p. 1). This stressed the need for a common and independent organization that can set up a set of possible indicators that can be universally applied. From here, strategies can be compared and better strategies can be formed.

## Understanding the motivation for change

My belief is that in order to effectively make a change, one has to be properly motivated. Therefore, one thing that we need to understand before designing a strategy is what a country's motivation for change is, or maybe even whether motivation is still in absence. We can already see from merely looking at the difference between the energy transition in Germany versus China that the motivation of the two countries is drastically different, which is reflected in their policy choices. We can safely assume that as a nation, Germany regards the environment as valuable and which should, therefore, be protected. This explains why they started their shift towards renewables ahead of most other countries. Contrastingly, China had to experience some sort of loss, in this case, the deterioration of their environment leading to many health issues, in order to take the energy problem seriously. One could also argue that a difference in motivation may be due to an older, outdated understanding of the role of energy. Exactly because having a secure energy supply is necessary in today's society, only proper motivation will overcome the struggle with uncertainty and risk that stands in the way of making an energy transition. Without the proper motivation, other objectives, such as economic prosperity, will be chosen over that of making an energy transition and preserving the environment.

A part of motivation is the need to make sustainability attractive, especially in those cases where motivation is very low or even absent. Many governments and businesses are easily encouraged by financial incentives and are under the impression that an energy transition will imply a loss for them, causing them to be hesitant to invest in it. Often, this fear is unjustified. For example, Bloomberg (2019) predicts that by 2050, the costs of solar and wind energy will fall well below that of coal or gas. This, of course, does not take away from the initial investments that are required but should make governments realize that they will be better off that way in the future, both financially and environmentally. Besides a financial incentive, attention should also be paid to the cultural and social framework within which the change will take place. This applies particularly in the instances where change is highly visible, affects tradition, or in other ways affects aspects of a culture or social group. The logic behind this stems from a general theory that change is best achieved when those who are undergoing the change can see all the things that stay the same, rather than what will change (Venus et al., 2018). Thus, an energy transition strategy should aim to respect social and cultural norms as much as possible for it not to stand in the way of the environmental objective.

## The importance of cooperation

For those countries who are motivated and committed to making the transition, cooperation can be a useful next step. Here, cooperation not only refers to cooperation between different countries but also cooperation within the country itself, such as between the government and its citizens and businesses. Look, for example, at the Dutch farmer who claimed he designed a new innovative tool to help solve the nitrogen problem. His machine neutralizes ammonia by filtering it through an organic plant extract (NH Nieuws, 2019). How it works is that the machine sucks up the air around it, and through a nature-inspired process it is able to filter 7.500 cubic meters an hour. The farmer has already tested his machine extensively himself,

and to his belief with great success. His main indication that it works is that it completely eradicates the smell of the ammonia, leading him to believe that it has been neutralized. In his news article, he also expressed his frustration about the total neglect of the government for his idea. Because of this, there is no investment, and without investment, the product cannot undergo better testing and the production cannot be scaled up. This is a perfect example of how the government fails to cooperate with its citizens, and as a result, is missing out on part of a possible solution. Not only is it reasonable to believe that citizens have the competence or even more competence than the government to come up with a solution, but usually those proposals have already been used in the field, as is the case with the ammonia neutralizer, which confirms the applicability of the solution in the real world.

Cooperation between countries has a similar purpose, namely that of exchanging successes and failures and sharing new technologies. After an agreement has been reached to combat climate change, countries should continue to exchange information rather than completely go their own way to figure it out domestically. It could even be profitable to cooperate in order to achieve the common goal of sustainable growth in the utilization of renewables and the reduction of high-carbon fossil energy consumption. This would require mutual learning and joint research, which calls for a better understanding of the policy environment in both countries (Yu et al., 2020, p. 2). To do so, one can make use of the map of target indicators to find which country matches your environment the most, in order to increase efficiency for cooperation. Looking at the Netherlands again, the government states that their climate policy is based on both national and international research (Government of the Netherlands, 2020). However, for international research, they refer to the scientific reports by the Intergovernmental Panel on Climate Change (IPCC), rather than direct cooperation with other countries. Whether or not this matters is not a conclusion I can draw, but it shows that international cooperation is not yet happening to its full extent.

## Establishing a common goal

Something that I believe to be beneficial but not necessary, is that we establish one “common” vision of what the future will look like. Hereby I do not intend to suggest that every country should have the same strategy, produce the same energy sources, and tackle the same sectors or subset. Instead, there should be a consensus on what to pursue and what not. A good example, but also one that shows how implausible it can be to reach an agreement, is the choice of whether or not nuclear energy can be part of the solution. This difference in opinion is very clear between China and Germany, but even within a rather homogeneous group of countries such as the EU, we see that the opinions are divided. One of the reasons that this particular issue needs to be agreed upon, is that a nuclear crisis in one country will have spillover in many others.

On top of that, having a common goal will help to improve cooperation and reduce fragmentation. The explanation of the former is rather straightforward, as ideas have better justification to be exchanged in the presence of a shared goal. Regarding the latter, having a common goal helps to direct the development of new technologies in a unified direction and reduce fragmentation. The reason fragmentation exists in the energy sector can partly be



explained by governments seeking to improve energy security. By investing in more than one renewable source, there are alternatives to fall back on when one of them does not work out. As a result, the renewable energy sector is at a financial disadvantage compared to that of traditional energy sources. Therefore, in order to diminish this disadvantage and to drive out the use and production of fossil fuels, efforts should be unified and focussed on perfecting a small number of renewable energy technologies rather than spreading attention to all possible alternatives (Valentine, 2011, p. 4577). That way, there will be feasible, well-developed alternatives to choose from that form real competition to the old system.

## Strict monitoring of progress

Lastly, in order to keep the governments' attention on solving the energy problem, there should be an increase in the monitoring of progress and mandatory reports to help the implementation of their strategy. This ought to be done by an independent international authority that both monitors and verifies the domestic data. Besides the fact that being monitored can help motivate governments to act, it is also a way to dial down the complexity of the energy sector by having a centralized authority keep track. Some countries do this very well already, but as we see in China, the number of different organizations that work within one country can make it incredibly difficult to assess the situation (Liu et al., 2015, p. 280). Instead, by centralizing the data collection and analysis, governments and relevant institutions are better aware of whether a strategy is working and what still needs to be done in order to achieve a successful energy transition.

Besides being a tool to stimulate the translation of energy goal into domestic policies and keep track of progress, a monitoring institution can help with another problem, namely that of 'dyscrasia'. To quickly repeat, this is the phenomenon where the timeline of political processes, such as an election cycle, is not in line with the process of an objective, in this case making the energy transition. So, an effective policy needs to have the property of staying in place even after the incumbent's election cycle, so it cannot be undermined once the leader is out of office (Pani & Perroni, 2018, p. 150). If the right monitoring institutions are in place, these can help to establish a form of path dependence to make sure the next incumbent continues along with the same objective.

## b. Discussion

At this point in time, there is no way to be sure which specific characteristics of a policy are essential in making an energy transition. This would require an understanding of the entire causal mechanism that is involved, which I expect will differ from country to country, rendering it close to impossible to uncover. Though, perhaps there will be new technologies in the future that can make such an analysis happen. Along a similar line, the effect of a policy will not only differ from country to country, but within a country as well. Of course, there are differences between regions but also differences over time. In developing countries, the political, economic, and social environment is constantly changing as well. This makes it even more difficult to plan

for the future. Thus, the necessary characteristics are both extremely hard to uncover and ever-changing, which has led to a rather underwhelming set of recommendations.

Next, there are two assumptions under which this thesis is written. Besides these two assumptions, the recommendations will only hold up if the technologies to produce and store renewable energy sources continue to be developed. Most importantly, the possibilities to store renewable energy sources need to increase drastically in order for a global energy transition to be possible. To start off, it should be acknowledged that this paper is written under the assumption that renewable energy is the direction in which we ought to go. This means that most scientific arguments have been left out, specifically regarding the pros and cons of different energy sources, as this is outside the scope of this thesis. Instead, I focussed on the role of energy in politics and how governments have managed or not managed to realize the need to make an energy transition.

Second, it must also be acknowledged that this thesis assumes that government intervention has the ability to achieve the desired effect. Contrary to this belief, others believe that the desired outcome can be achieved through market liberalization instead (Blazquez, Fuentes-Bracamontes, Bollino, Nezamuddin, 2018, p. 4), which puts emphasis on the weight of consumers to push for change in the energy sector. However, this thesis builds upon the view that consumers cannot be expected to make a shift on their own and that the government has the responsibility to intervene. This does not take away from the fact that governments can intervene with policies that promote competition, which is different from market liberalization.

As briefly mentioned before, resulting from the upsurge of environmentalism, the understanding of the concept of energy security has changed. However, that does not say that all countries' energy supply will be self-sufficient. Different countries have different capacities, and their geographical features will determine which zero-carbon energy sources can be produced domestically. Because there are quite a few alternative sources to pursue, and innovation is still booming, many countries will have the ability to produce at least one type of energy. Though, this domestic supply may not be enough. This means that most countries will still have to rely on imported energy, however, the bargaining power will no longer lay in the hands of the few, but in the hands of the many, namely in those countries that commit to generating clean energy. As soon as governments understand that energy security can go hand in hand with the development of sustainable energy sources, the global energy transition will be pushed forward.

When taking into consideration the context of a policy, the question may arise of whether an energy transition strategy should aim to fit within the industry of a country, or if it should aim to change the existing system in order to fit the "right" goal. As mentioned in the recommendations above, I believe that having a common goal is key to achieving effective cooperation. Therefore, if fundamental aspects of a country's industry are incompatible with a new system of renewable energy, governments should aim to make internal changes rather than work around the existing system. Nevertheless, in order to make an energy transition feasible, a strategy should aim to make the best use of what is already there.

Lastly, the recommendations should be regarded as suggestions to improve a government's current energy strategy. On their own, they are not sufficient in order to make an energy transition but they are also not necessary in the sense that a country is able to make an energy transition without, for example, cooperating with other countries. However, following

the recommendation will make the process both more effective and feasible for those countries who are having a hard time making the transition. This is supported by the case study of Germany, where many of the recommendations can already be found back in German energy policy documents. Because Germany has been one of the most successful countries in making an energy transition, confidence in recommendations increases.

In conclusion, despite the inability to recommend one specific strategy that enables countries to make a shift towards renewable energy, the recommendation above can guide governments in designing the best-fitting strategy for their country. Ultimately, these aim to deal with some of the major challenges that energy policy-makers face, such as dealing with the international, strategic, and cognitive dimensions, a wide temporal horizon and uncertainty, technical-scientific content, and high interdependence with other sectors. Hopefully, policy-makers can overcome the conflicting political considerations and fulfill the environmental objective of making a shift towards the use and production of renewable energy sources.

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