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Institute of Political Science

The Influence of China’s Energy Transition on its Rise in the International System

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Brasília and Duisburg

2022

The Influence of China’s Energy Transition on its Rise in the International System

Doctoral Dissertation presented to the Institute of International Relations of the University of Brasilia and the Institute of Political Science of the University of Duisburg-Essen (Cotutelle/Joint PhD).

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Approved without restrictions on August 30, 2022.

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To my grandfather “Vô Carlos” (in memoriam) with all my love and gratitude.

A kiss on the tip of the nose.

Para o Vô Carlos, com todo meu amor e gratidão.

Um beijo, na ponta do nariz.

Acknowledgements

Almost five years ago, when I began the journey that led to this dissertation, I could never have imagined that the years ahead would be so challenging and rewarding at the same time. The journey was hard. It involved a lot of self-doubting, a pandemic, several frustrations, loneliness, and even mourning. Doing a PhD was much more than writing this dissertation. It was the longest and deepest journey of personal and professional growth that I have ever embarked on. I could have never made it without the amazing people that have crossed my path along the way, and here I would like to thank them with all my heart.

I would like to begin with my supervisors, Professor Eduardo Viola and Professor Nele Noesselt for the careful guidance and patience over the last years. Thank you for all the opportunities, feedback, and advice. I am also grateful for your support of the cotutelle, and here I extend my gratitude to all of those somehow involved. The cotutelle required a lot of coordination between two different cultures, bureaucracies, sets of expectations, regulations, and rules. I know that every single person involved in the process from both sides had to make some adjustment, shorten some deadline, or do some extra work at some point along the way. I am deeply grateful for that. I would like to specifically thank Professor Ana Flávia Barros and Professor Nicolai Dose, who, at different stages, helped us navigate the bureaucracies from both sides. Thank you also to the other two members of my Committee, Professor Niels Soendergaard and Professor Hannes Mosler, for agreeing to participate.

I extend my thanks to all the Professors of the Institute of International Relations at the University of Brasilia for their valuable lectures and seminars at the beginning of the PhD. I especially thank Professor Cristina Inoue for supervising my teaching assistantship, composing the Committee for my “qualification exam” (qualificação), and for keep providing me with assistance in my academic life.

On the foundation of the process that led me to this day are my parents Carlos and Luciane, who have provided me with a life of love and support. This dissertation only exists because you chose to put me (and my siblings) first. Every sacrifice you have made for me so that I could have the best education available and so that I could follow my dreams can be read between the lines of the following pages. Thank you for helping me fly and for the loving "nest" to which I can always return. Thank you also to my sister Marina and my brother Leonardo for the support and company, for the example of determination, for always cheering for me, and for making sure I never feel alone. My gratitude also to my sister-in-law Rudinara for the sister she has become to me over the past years.

My grandparents also deserve my deepest gratitude. You have been a fundamental part of this journey, showing me your strength and taking such good care of me. Loosing my grandpa was the hardest thing I have ever experienced, but it also brought me closer to all of those who came before me and whose strength I have inherited. This dissertation is as much about them as it is about China's energy transition. It is about honoring all of those that came before me and whose struggle allowed me to have a better life and be able to make choices not available to them. It's about tender souls and strong minds whose examples have inspired me.

But the journey I chose more often than not has pushed me far from my family, and I have been so lucky to find family and friends around the world. First, I would like to thank those that were so important at the beginning of this process. The years in Brasilia have a special place in my heart. Thank you especially to Vinícius Mendes, Tiago Tasca, and Elciane Rocha for your friendship. My gratitude also to Anna Lúcia Koebe, whose support throughout those years still makes me feel that I have family in Brasília.

I left Brasília feeling like I was leaving a piece of me behind. When I moved to Duisburg I never expected that in the middle of a pandemic, in a city I didn't know, and so far from my family and friends I would find so many friends for life. Thank you Camila Sánchez, Silvia Flores, Mona Mostafa, Ana Laura Zuanazzi, Prashanti Poudyal, and Naa Dedei Okine for your friendship and for making me feel that I had a community to belong. My especial thanks to Cami. From the desperate trips to the Ausländerbehörde and from carrying by bags to the airport in the middle of the night to the many moments of happiness and celebration, you were really there for me in all situations. Thank you also Gláucia Murta Guimarães for the company and the talks, Michael Nies for the company in all the bike rides, Miquel Slvadó-Gracia for the very long walks and talks that showed me another side of Duisburg and helped me navigate the stressing moments. Thank you Alexander Solty for supporting me in so many ways, for making me laugh about the cultural differences between our countries and especially for remaining present in my life even with all the distance.

I also thank “my German family”, Familie Stasch, who has opened Germany’s doors for me over a decade ago. Thank you for still referring to me as your “Brazilian daughter” after fourteen years. The experience I had living with you in 2008 left profound marks in me and in the kind of person I became.

Going back to Germany in 2019 gave me a “second German family”, and I will be forever grateful for how I was welcomed by Familie Schleper. Anne opened her house to me in a moment when everybody else was closing theirs. She made sure I had a home to run to whenever I needed anything close to a family. Anne was family, and without her, the challenging times in Germany would have been much darker.

I also thank my life-long friends, who have supported me and kept their friendship after so much time and often-long distances: Alexandre San Martim Portes, Marina Willrich, Maíra Rodrigues, Thayse Furtado, Maria Eduarda Ferrer, and Sarah Kessler. Thank you also Barbara Pilz, Carolina Nascimento, Gustavo Bodenmüller, and Tatiana Goulart for the reunions in Europe that made me feel at home.

I also thank the 25 experts that agreed to provide me with an interview. Thank you for trusting me and for sharing with me your valuable time and knowledge.

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) - Finance Code 001. The cotutelle period in Germany was financed by CAPES through the CAPES/DAAD 2018/2019 Joint call (Edital 22/2018).

Abstract

This dissertation focuses on the intersection of two defining issues of contemporary international relations: an ongoing global energy transition and the rise of China. As energy has historically been a strategic source of state power, the research aims to connect these two processes by investigating how China's energy transition toward low-carbon sources influences its position in the international system. This 21st century energy transition is a complex and multifaceted process, connected to broader climate-related goals and therefore it involves notions of purpose, urgency, and responsibility. This plurality of elements and the fact that it is still an ongoing process bring theoretical and methodological challenges that have resulted in little progress in the study of the current energy transition within the discipline of International Relations. Therefore, the study adopts an exploratory approach and proposes an eclectic theoretical framework that departures away from assumptions commonly used in energy studies in the fossil fuels era toward approaches that take into account the specificities of the 21st century energy transition. This framework is mainly constructed by eclectically revisiting and pragmatically combining strands of some IR theories, such as international political economy, geopolitics and energy security studies, global energy governance, and soft power. In order to operationalize the research question, the study places three mediating variables between China's energy transition (independent variable) and the country's position in the international system (dependent variable): technology, energy security, and image in global climate governance. The empirical analysis of each variable helps to explain how the current transition influences China's power dynamics in the international system.

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Introduction

Energy is a paramount element of modern and contemporary societies and an intrinsic aspect of our basic way of life. Moreover, energy is a strategic source of state power. The relevance and centrality of energy resources was emphasized by the oil embargo crisis during the 1970s. From that point onwards, many governments began to see disruptions of energy as a possible threat to national security and therefore passible of being responded by military means. Numerous events involving energy disruption have followed since, including the current European energy crisis.

Since the Industrial Revolution, the basis of the world's energy matrix has been mostly composed of fossil fuels, but throughout history two main transitions from one major source to another have occurred: from wood to coal and then from coal to oil and gas, even though coal has kept a relevant share. Once more an energy transition is taking place, this time centered on low-carbon sources. As energy and state power have had a strong interconnection throughout history, it is interesting to notice the existence of a parallel phenomenon to the energy transition. The international system is increasingly decentralized with more powers rising and augmenting their power capabilities. The rise of China and its role in the 21st century energy transition intersects both of these phenomena, and the country presents an interesting case in which to observe how the transition transforms so-far known relations between energy and power in international relations.

This dissertation therefore focuses on the intersection of two defining issues of contemporary international relations: an ongoing global energy transition and the rise of China. The study connects those two processes by addressing the following research question: How does China's energy transition toward low-carbon sources influence its position in the international system? In this context, the study is not focused on China's intentions or on whether China cares for the climate crisis or if it is simply trying to profit from the benefits of the transition. The research is rather concerned with the consequences of China's energy transition to its relation with the world. Moreover, the research puzzle does not imply that the energy transition *causes* China's rise or that energy is the single factor influencing China's power internationally. On the contrary, China's rise has many other drivers that are equally or more important than this topic[1]. The research rather attempts to make a contribution to the understanding of how China's energy transition entails power in certain dimensions of international relations, considering that energy, in its multiple forms, has historically been tied to power dynamics in the international system.

This 21st century energy transition is a complex and multifaceted process tied to broader climate-related goals and therefore it entails notions of purpose, urgency, and responsibility. Moreover, it is still an ongoing process whose results can only be partially assessed as the transition evolves, though certainly the speed of the transition doesn't match the speed of global warming. These features combined pose some methodological and theoretical challenges. This has resulted in the fact that, while progress has been made in and outside of the Social Sciences, the efforts within the IR discipline to include the transition into its scope are still incipient. Therefore, considering the current stage of research on the topic, this study adopts an exploratory approach. It presents a mixed-methods case study, anchored in theoretical eclecticism and methodological pragmatism. It focuses on one example (China) of a broader phenomenon (the relation between the low-carbon energy transition and power in international relations). Moreover, even though the dissertation does not ignore subnational dynamics, it focuses on the national and international levels of analysis, which intersect one another and are the most appropriate arenas where the research variables can be observed.

The study therefore aims to contribute to the efforts to understand how the 21st century energy transition affects the power dynamics involving energy and international relations. It proposes a departure away from the tradition lenses that have been used by energy studies to assess the political implications of the fossil fuels energy paradigm toward an eclectic theoretical framework able to address the specificities of the current transition.

Even though this is an exploratory research and therefore it does not aim to test any predefined hypothesis, the underlying assumption is that the effects of the

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[1] Such as: giant population, a great demographic bonus that is exhausting in the 2020's, a modern state, a high GDP growth rate, the efficient allocation of resources based on a combination of limited economic freedom with strong national and subnational planning, massive use of fossil fuels, authoritarian regime capable to exercise efficient social control by the ruling Party, US tolerance – until recently – regarding Chinese unfair economic practices, huge expansion of the defense budget and modernization of the military machine, and the recent promotion of technologies of the fourth industrial revolution.

energy transition go beyond the field of energy per se and impact certain dimensions of international power. This differentiates the present study from a significant body of literature that has focused on how the transition occurs, or the need to achieve it and how. In order to operationalize the research question, the study places three mediating variables between China's energy transition (independent variable) and the country's position in the international system (dependent variable): technology, energy security, and image in global climate governance.

In terms of chronological limits, the research will encompass events from 2005 to April 2022. The initial year marks the approval of China's Renewable Energy Law, followed by the 11th Five Year Plan in 2006, which marked the inclusion of environmental concerns into the scope of these documents. The final limit refers to the date of the last interview conducted for this research[2].

This dissertation is structured in two main pillars divided in six chapters besides this introduction and a conclusion. The first part is composed of the three first chapters and provides the conceptual, theoretical, and methodological frameworks of the research. Chapter 1 defines the scope of what this research calls the 21st century energy transition, its meaning, and how it differs from previous transitions. It evidences the complex and multifaceted character of the current transition as well as the purpose and urgency it involves. It also provides an account of the current status of the energy transition both globally and in China. Chapter 2 takes this definition into account and proposes an eclectic theoretical framework for the dissertation that eclectically highlights and pragmatically combines strands of some IR theories, especially international political economy (IPE), geopolitics and energy security studies, global energy governance, and soft power. Finally, Chapter 3 defines this research as an exploratory and descriptive mixed-methods research anchored in pragmatism. It also delineates the research design as a case study focusing on China and operationalizes the research.

The second part encompasses the last three chapters, which comprise the empirical portion of the work, each focusing on one mediating variable. Chapter 4 focuses on technology. It first looks into the policy framework related to the development of low-carbon technologies in China and then maps and examines the

[2] The energy transition is an ongoing process, so it makes sense that the research advances as much as possible in terms of the time frame.

main technologies of the 21st century energy transition. Chapter 5 is dedicated to energy security. It traces the evolution of China's energy security and the changes the concept has suffered. Then it contrasts the present geopolitical context with the emerging one brought about by the current energy transition and discusses the energy security implications of this shift. Finally, Chapter 6 analyses China's image in global climate governance. It first assesses China's evolving participation in this sphere of international relations and how these changes are entangled with domestic policies and then addresses China's image shifts in this field and the centrality of the energy transition in this process.

Chapter 1: The 21st Century Energy Transition

The 21st century energy transition is a still ongoing process and, as such, its meaning and scope are also evolving. Besides, it encompasses the contradictions derived from the coexistence between the emerging new energy paradigm and the one that is being replaced. In this context, even though it might share some commonalities with previous energy transitions, the current transition has its own specificities. Among them, the most important and defining one, and which differentiates it from past transitions is an inherent sense of urgency since the decarbonization of the energy system is a paramount part of the efforts to tackle climate change.

Moreover, it is broader in scope than past transitions, since it not only involves the emergence of a new resource, but also gains in energy efficiency, the development of storage and transmission solutions, and the electrification of the transport sector. Furthermore, the unfolding of the energy transition encompasses changes in the entire energy system, which create new geopolitical and economic dynamics between producers and consumers. Additionally, though the main characteristics of the energy transition are widely applied, each country has its own conception of the energy transition, which therefore has some features that are country-specific.

This chapter will explore those issues as well as assess the current stage of the energy transition. It is thus both conceptual and contextual. The chapter begins by defining the key concepts of this research, especially what the 21st century energy transition is and what it is composed of. Then, the second part depicts the current status of this process both globally and in China.

1.1. Conceptual Framework of the 21st Century Energy Transition

Generally understood, energy transition refers to “the change in the composition (structure) of primary energy supply, the gradual shift from a specific pattern of energy provision to a new state of an energy system” (Smil 2010, vii). Araújo (2014, 1) adopts a more cross-cutting definition of energy transition as “a shift in the nature or pattern of how energy is utilized within a system. This definition recognizes the change associated with fuel type, access, sourcing, delivery, reliability, or end use as well as with the overall orientation of the system". The transition, therefore, is not only the result of resource substitution, but also of technical innovation (Smil 2010). Besides, it can happen at any level, from the local to the global ones (Smil 2010, Araújo 2014).

The concept of system is equally important to fully comprehend the transition. Here, an energy system can be characterized as having mainly three components: natural energy sources, their conversions, and specific uses of the energy flows (Smil 2010). More broadly, it is "a constellation of energy inputs and outputs, involving suppliers, distributors, and end users along with institutions of regulation, conversion and trade" (Araújo 2014, 1).

Kern and Markard (2016, 298), on the other hand, adopt a more localized definition of energy transition as being "[…] a long-term, multidimensional and fundamental transformation of the energy sector in a specific techno-institutional context (e.g. country). It includes and affects a broad range of technologies, organizational and institutional structures". Nevertheless, these different national or regional transitions might impact each other, in the sense that "[t]hey are interconnected, among others, by international knowledge flows, collaboration, value chains, trade, technology transfer and even ideas or visions (Kern and Makard 2016, 300).

According to Smil (2010), the pace of energy transitions is closely related to the size of the countries in which they take place. In larger economies, especially in those with high per capita demand and with infrastructures dependent upon an established fuel, substitution of energy systems is slower. Additionally, the progress of energy transitions requires scientific advances, such as technical innovations, as well as organizational actions and economic, political, and strategic circumstances (Smil 2010).

The concept of energy transition can be applied to many contexts, sources, sectors, and to different scales. Germany's *Energiewende*, Denmark's focus on wind energy, and even China's increasing use of natural gas in detriment of coal could be considered energy transitions. Nevertheless, this dissertation will adopt, on the one hand, a broader meaning of energy transition, by considering the global scale. Thus, even when analyzing China's energy transition (a national scale), this will be connected to the broader, international level. On the other hand, it also adopts a more strict understanding of the concept, in the sense that it considers energy transition as being a transition toward *clean* energy. Such definition of what the research calls "the 21st century energy transition" is in accordance to IRENA's (2019) conceptualization of the energy transition as "a pathway toward transformation of the global energy sector from fossil-based to zero-carbon by the second half of this century".

At the global level, there have been two major energy transitions – from wood to coal and then to oil and gas. Besides, in different historical periods, and mainly during wars and oil shocks, there have been worldwide incentives to change the energy system. Nevertheless, several pressures contribute to the sense of urgency in the case of the current transition, such as those related to sustainability, access, security and reliability: "What differs today is arguably a heightened awareness relating to the scope of energy challenges, their cross-border impacts, and efforts (depending on the challenge) that may be needed" (Araújo 2014, 2).

In this context, Brown (2015) identifies three main concerns driving the present transition: climate change, health consequences derived from air pollution, and the desire for local control over energy production and security. We could add to these drivers also the acceleration of disruptive technologies. Besides, population growth, increasing urbanization and globalization are three important energy-related mega-trends that must be considered (Araújo 2014). It is, thus, a "*purposive transition* towards sustainability", driven not simply by a set of technological breakthroughs to produce better and cheaper energy, like in former transitions (Kern and Markard 2016, 291-292; 299).

In fact, two main aspects can be highlighted as very particular of the current energy transition in opposition to the past ones. The first is that it is part of a broader process of deep decarbonization, within the context of climate change mitigation efforts. Currently 73.2% of global CO_2 emissions come from the energy sector, including electricity, heat, and transport (Ritchie and Roser 2020). The relation between energy and climate change is therefore paramount, since achieving decarbonization requires thus a transformation in the entire energy system.

In the case of China, energy transition and decarbonization are even more evidently intertwined for two reasons. First, China is the world's largest consumer of energy and has been the largest contributor for global energy consumption growth for the last 17 years – the country accounted for 33.6% of such growth in 2017 and for 23.2% of global energy consumption that same year (BP 2018a). Second, the country is the largest polluter in the world, with fossil sources still accounting for 87% of primary energy consumption – 62% of which being coal (BP 2018).

Deep decarbonization, "a profound and structural transformation of how we produce and use energy" (Basso 2018, p. 19), demands "structural changes in current modes of production, consumption patterns and lifestyles" (Basso 2018, 55). This can be achieved by a twofold process of "increasing energy conservation and efficiency and steering energy systems and energy end-use away from fossil fuels and towards low carbon energy sources" (Basso 2018, 19). Therefore, in order to meet current energy challenges, the present energy transition involves a systemic transformation – that is, a shift in production, transmission, and consumption – from a high to a low carbon energy system. Moreover, it encompasses all societal levels, from individuals to the global economy (Cherp, Jewell, and Goldthau 2011, 76).

The second particularity is that the current transition not only encompasses the advancement of a new source – in this case low carbon energy – but also energy efficiency and conservation, energy storage, technological innovations and the expansion of electric vehicles[3]. It is thus more complex and plural than former transitions. Besides, even though the majority of the literature assesses the energy transition as being the result of the increasing participation of renewables in the mix, low carbon energy refers to both renewables and nuclear energy. This broad conception is not consensually adopted, as some authors argue that the current

[3] Some authors also consider the advance of geoengineering, especially Carbon Capture and Storage (CCS) as part of the transition. Though this technology helps to avoid climate change, it does not represent a change in the energy system, and therefore is excluded from the definition adopted in this dissertation. Recently, green hydrogen has also entered the energy transition lexicon. However, it is excluded from our concept since it is still incipient. Currently over 95% of the world's hydrogen is produced using fossil fuels (Kane and Gil 2022). In China, green hydrogen only accounts for about 1% of production, even though the country aims to become a leader in green hydrogen technology (Brown and Grünberg 2022). Moreover, only recently countries have begun to adopt hydrogen strategies. The EU released its strategy in 2020 while China has released its Medium and Long-term Plan for Hydrogen Energy Industry Development (2021-2035) in the beginning of 2022. Even though current developments indicate that hydrogen will play an important role in the transition, it has specific geopolitical dimensions that have just begun to be explored (IRENA 2022a). For those reasons, green hydrogen is not included in the scope of the dissertation at this point.

transition is a shift away from both fossil and nuclear fuels and thus limit their scope to renewables[4]. Others are even stricter and consider the transition as a shift toward solar and wind energy[5]. This dissertation considers nuclear energy as part of the transition, since it is technically considered a low-carbon source and as, despite rising public dismay globally, it has been increasing its consumption rate, especially in non-OECD countries like China.

An even broader conception could also include the increase in use of natural gas in substitution for oil and coal since natural gas produces less carbon emissions than the other two. Nevertheless, this shift could lead to a carbon lock-in, a process of path-dependence in which the investments would continue to be directed to fossil fuels technologies instead of to low-carbon ones. Therefore, even though one key aspect defining energy transitions is the coexistence of both the declining and the emerging energy paradigms, this dissertation will focus on clean, low-carbon energy as previously defined: renewables and nuclear.

This study adopts IRENA's definition of renewables, which encompass bioenergy, hydropower, geothermal, solar, wind, and ocean energy. Renewables could be further divided into two groups: a mainstream one, composed by hydropower, wind energy, solar energy, biomass energy, biofuels and geothermal energy, and an emerging one, which includes technologies like marine energy, concentrated solar photovoltaics, enhanced geothermal energy, cellulosic ethanol and artificial photosynthesis (Hussain, Arif, and Aslam 2017). Many of the so-called mainstream technologies are already affordable and in operation, while the developing ones indicate the potential of technology breakthroughs in the sector. Table 1 summarizes the main characteristics of renewable energy in comparison to fossil fuels'. Perhaps one of the main features of the energy transition is that it will likely result in a much more decentralized system, with many households both supplying and consuming energy from the grid.

In addition to renewables, nuclear energy is a low-carbon alternative that, unlike renewables, does not suffer from the problem of intermittency. Public acceptance of nuclear energy was impacted after the Fukushima accident in 2011 (IEA and NEA 2015), and, as consequence of that event, countries like Germany

[4] Such as in Kern and Markard (2016, 299).
[5] Such as in Brown (2015).

decided to phase-out its nuclear power by 2022 while Switzerland set the same goal for 2034. Nevertheless, nuclear deployment has been increasing in some countries, especially in China, which is leading new reactor construction, India, and the United Arab Emirates (OECD 2018).

Table 1: Comparison between the Main Characteristics of Fossil and Renewable Energy

Fossil Energy	**Renewable Energy**
Finite and depleting resources	Abundant and intermittent resources
Geographically concentrated reserves	Resources are not geographically concentrated
Oligopolistic markets dominated by net-exporters	More competitive markets
Dependence on overseas reserves	Make-or-buy decision. More countries can produce a larger share of their energy needs, lessening import-dependence.
Clear division between net-importing and net-exporting countries	This division is blurred as countries are seen as "prosumers"[6]
Price volatility due to political instability	Market prices probably more volatile due to intermittency
The revenues from the extraction process generally do not stay within the community	Potential to reduce energy poverty, foster local development and empower local communities
CO_2 emissions have global environmental impacts	Localization of environmental impacts (hydropower plants and stench of biogas digesters, for example)
Raw material globally transported in solid, liquid or gaseous state in pipelines, tanks, rail or road (risks related to infrastructure bottlenecks)	Distribution mostly electric (risks related to long-distance losses and grids usually restricted to countries or regions and not the globe)
Allows for efficient storage in depots and strategic reserves	Usually costly to store and requires on the spot emergency response (accidents can easily cascade from one part of the grid to the other)
Focus on continuity of commodity supply	Focus on continuity of service supply
Production and refinement in centralized facilities near oil and gas fields or in facilities near demand centers	Decentralized generation
Vantage related to the possession of the resources	Vantage related to the possession of technology
	Requires rare earths minerals for clean tech equipment production

Source: Author's own elaboration based on Scholten (2018) Goldthau, Keim, and Westphal (2018), and O'Sullivan, Overland, and Sandalow (2017).

Nuclear energy equally presents specific characteristics with geopolitical consequences, especially because it encompasses risks related to nuclear accidents,

[6] It is worth noting though that some countries have more favorable conditions to produce renewable energy than others, such as solar radiation and wind speed.

proliferation, and waste management. Moreover, such risks are hardly local, as the lack of safety in one state can affect entire regions (De Blasio and Nephew 2017). Still, it would be difficult to accomplish climate change mitigation without nuclear energy in the current scenario. Even in Germany, an advanced economy where the energy transition advances relatively fast, the energy security crisis that has followed the invasion of Ukraine forced the government to reactivate coal-fired power plants to meet a gap in supply that could have been met with nuclear at least partially, had the country not phased it out. An energy transition without nuclear could be even harder for emerging economies with a large energy demand.

As previously defined, the contemporary energy transition is marked not only by the advancement of low carbon energy but also by other factors equally important, such as energy efficiency and conservation. Even though both concepts are related, they have different definitions. "Energy conservation is any behavior that results in the use of less energy" while energy efficiency is "using technology that requires less energy to perform the same function" (EIA 2018). The International Energy Agency (IEA 2017) calls energy efficiency "the first fuel", a resource that all countries possess and which is key for a cost-effective energy transition. Energy storage, transmission technologies, and the increase in use of electric vehicles are also important facets of the 21st century energy transition.

Another dimension of the energy transition is that the increase in the use of clean energy technologies, especially for renewable energy production, involves the intensive use of several minerals, such as rare earths[7], lithium, cobalt, tellurium, tin, indium, hafnium, gallium, silver, cadmium, selenium, nickel, molybdenum, magnesium, tungsten, and platinum. For instance, lithium ion batteries help manage the intermittency of solar and wind power and are also used in electric vehicles, while indium and cobalt are used in solar panels and batteries (O'sullivan, Overland, and Sandalow 2017). Tellurium, tin, indium, hafnium and gallium are used in photovoltaic cells; silver, cadmium, and selenium are employed in solar technology; the rare earths dysprosium and neodymium are used to produce the magnates for the electric generators present in wind turbines; nickel and molybdenum are used for wind power

[7] The following elements are considered rare earths: lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), lutetium (Lu), scandium (Sc), and yttrium (Y).

technology; lithium and tungsten are used in electric vehicles' batteries, and cobalt and magnesium for bio-energy technology (De Ridder 2013).

This first section has defined the key concepts most relevant to this dissertation and has presented the complexity of the 21st century clean energy transition, which is both a purposive transition, in the sense that it is part of a wider process of decarbonization, and a much more plural transition than previous ones. In addition, the next section will investigate the current stage of this process globally.

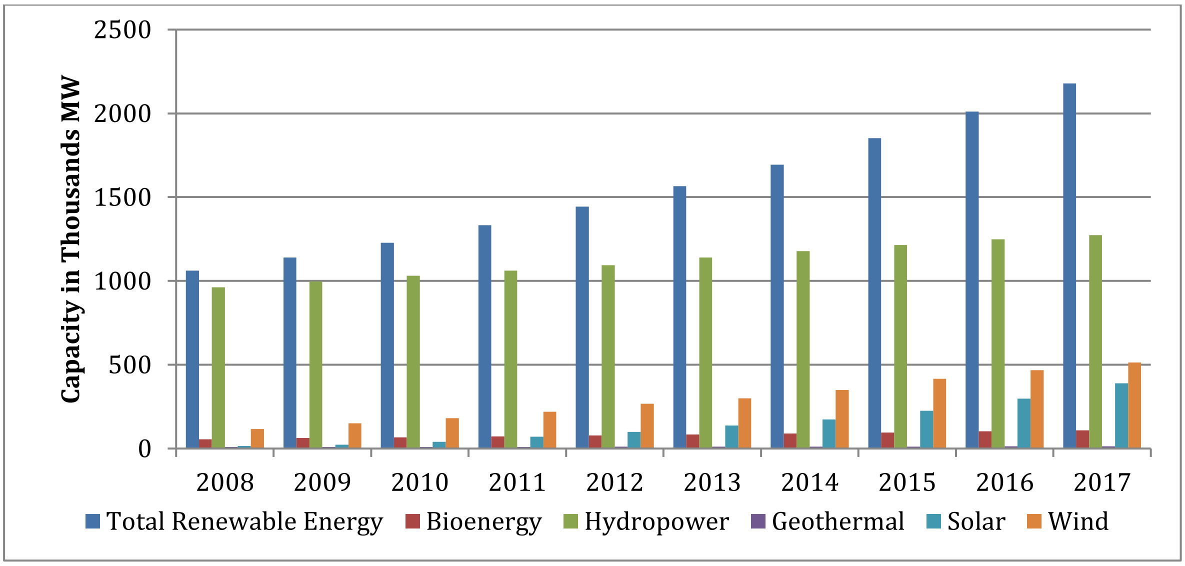
1.2. The Status of the 21st Energy Transition Globally and in China

One of the main characteristics of energy transitions is that they are highly uncertain, as they encompass not only past and present conjuncture but also future ones. Through their course, they may be affected by multiple factors, including new discoveries, the advancement of disruptive technologies, and new political and economic scenarios. Considering that, this section will assess the current status of the energy transition and the main forecasting scenarios both globally and in China, using data from various sources.

In roughly ten years, the increase in renewable energy capacity and production worldwide has been significant, as illustrated in Figures 1 and 2 respectively. In terms of its share in the energy matrix, renewables accounted for 13.7% of the world's Total Primary Energy Supply (TPES) in 2016 – of which 9.5% were biofuels and waste, 2.5% hydro, and 1.6% other renewables. Nevertheless, the highest average annual growth rate of world renewables supply from 1990 to 2016 came from solar PV (37.3%) and from wind (23.6%). The growth rate for renewables in general within this timeframe was 2%, and therefore higher than the growth rate of world TPES, which was 1.7% (IEA 2018). According to the technological law of exponential growth (Moore's Law), solar could be close to the moment in which its growth will dramatically increase its share of the global energy matrix. However, it is difficult to forecast how economic vested interest and socio-political opposition might slow the technological trend down.

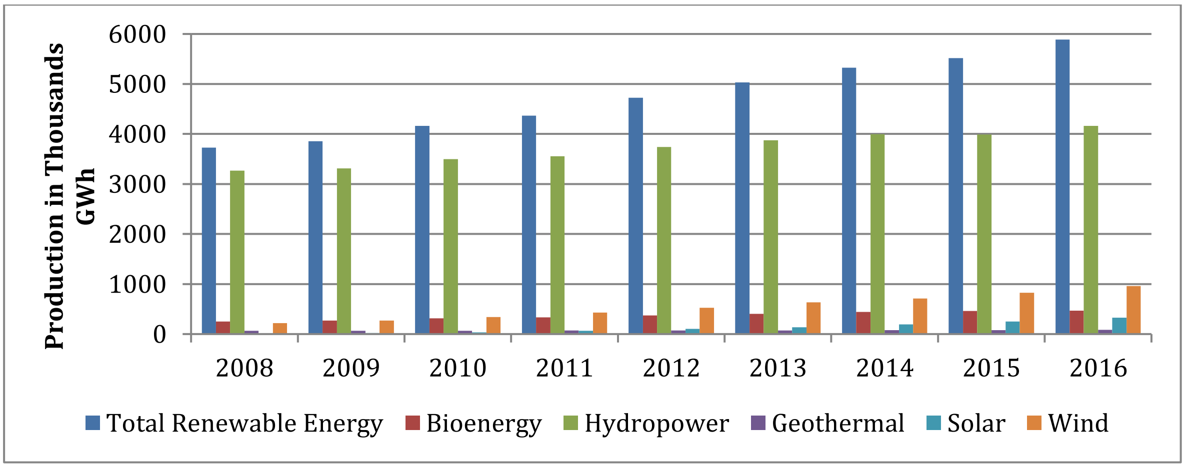
Globally, renewables have been mainly used in the residential, commercial, and public services sectors – 43.1% of 2016 world sectorial consumption of renewables – followed by electricity plants (33.6%) and industry (10.1%). Besides, renewables were responsible for 23.8% of world electricity production that same year – of which 16.3% was produced by hydropower, 5.5% by solar, wind, geothermal, and tide, and 2% by biofuels and waste (IEA 2018).

Figure 1: World Renewable Energy Capacity



Source: Own elaboration based on IRENA (2018).

Figure 2: World Renewable Energy Production



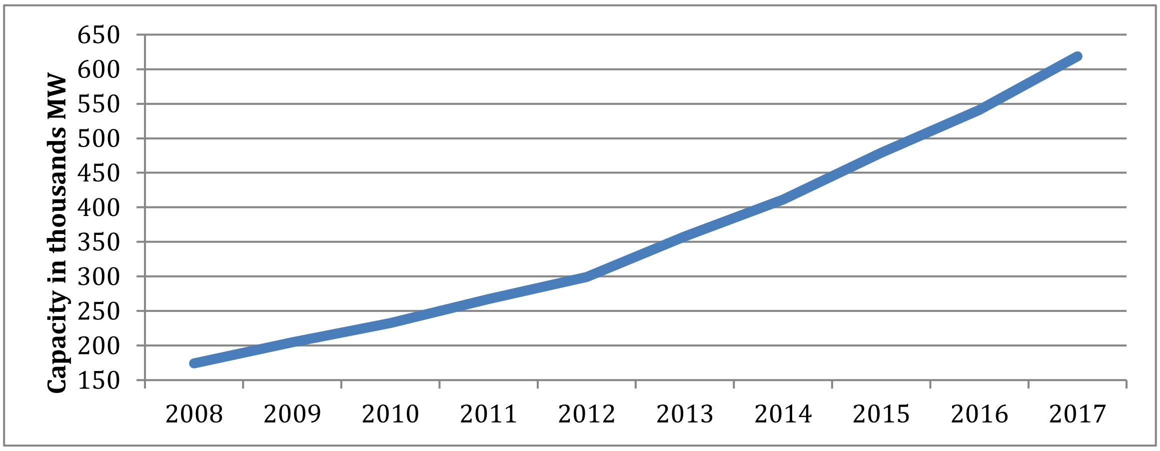
Source: Own elaboration based on IRENA (2018).

Even though renewables have been growing significantly throughout past years, they have a still diminished participation in the world's energy matrix. O'Sullivan, Overland, and Sandalow (2017) observe that while all forecast scenarios see increase in renewable energy, none predict a revolution in the use of renewable energy – none anticipate that the consumption of renewable energy will surpass that of any fossil fuels in the next several decades. Nevertheless, they also notice that forecasts have historically underestimated the increase of renewables, especially wind and solar, which had to be adjusted upwards over the last years. Moreover, even minor changes in the mix could result in significant geopolitical outcomes (O'sullivan, Overland, and Sandalow 2017).

The fall in the costs related to renewables has been strongly responsible for the advancement of this kind of energy and is expected to continue playing a key role in its increase. IRENA (2018a) identifies three main cost reduction drivers: (i) technology improvements, (ii) competitive procurement (given the globalization of the renewable power market), and (iii) a large base of experienced, internationally active project developers, which constantly seek new markets globally. According to the Renewable Energy Policy Network for the 21st Century (REN21 2018), 2017 was marked by several developments that impacted the use of renewables, such as the record low bids for solar and wind power in tenders, rising digitalization, more attention to electrification of transport, areas willing to become coal-free, new policies and partnerships on carbon pricing, and new governmental initiatives and goals. In this context, solar PV and wind power are already competitive with new fossil fuel capacity and almost competitive with existing fossil fuel and nuclear generation. They join other renewable energy technologies, such as hydropower, bioenergy, and geothermal power and heat, as cost-competitive sources (REN21 2018).

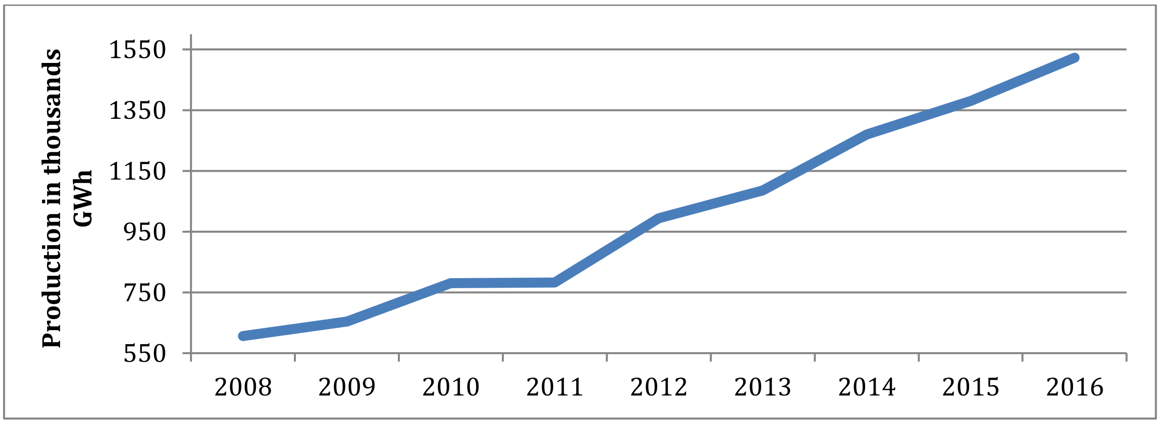
The deployment of renewables in China has played a significant role in this process. In the last decade, there was significant and constant growth in renewable energy capacity and production in China, as shown in Figures 3 and 4 respectively. In 2015 China became the world's top generator of solar energy, ahead of the US and Germany, and its CO_2 emissions declined by 0.1% for the first time since 1998 (BP 2016). In 2017, China's consumption of renewables grew by 31% – solar by 76%, biomass by 25%, wind by 21% and hydro by 0.5%. The country accounted for 36% of global renewables consumption growth and for 21.9% of the global total consumption (BP 2018a).

Figure 3: China's Renewable Energy Capacity



Source: Own elaboration based on IRENA (2018).

Figure 4: China's Renewable Energy Production



Source: Own elaboration based on IRENA (2018).

Even though the share of this kind of energy source in the Chinese matrix is still little – 12% (BP 2018) – the current path of investments indicates its potential. According to BP (2018), renewables will be responsible for 26% of primary energy consumption in 2040 and IEA (2017) shows that, by that same year, installed low-carbon capacity will make up 60% of total capacity. When considering power generation alone, the use of coal in electricity production currently accounts for two-thirds of its power mix but is expected to fall to less than 40% in 2040 as a result of the diversification of the energy matrix (IEA 2017). Besides, by 2040, solar PV will become the cheapest source of electricity generation in China (IEA 2017).

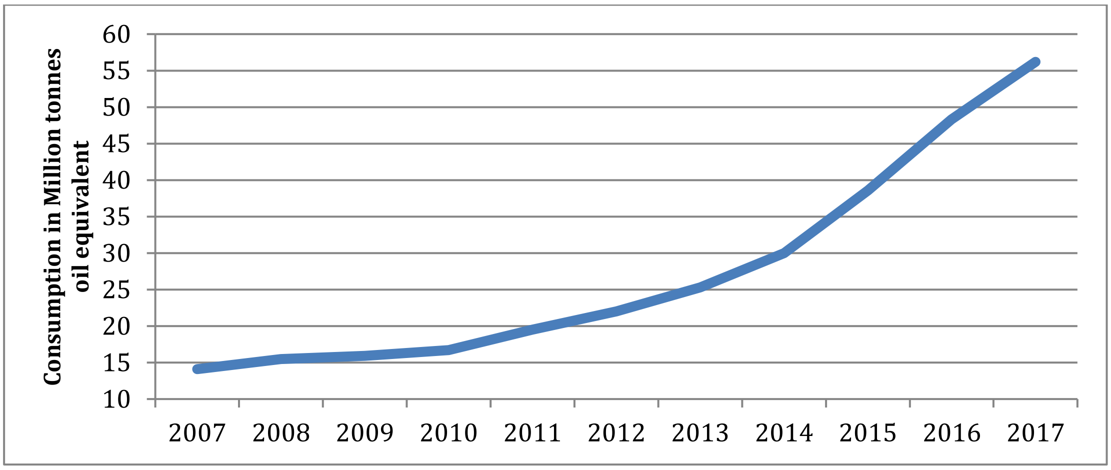
In terms of investments, China is already the world leader in domestic investment in renewables and associated low-emissions-energy sector (IEEFA 2017). In 2015 Beijing invested US$ 102.9 billion in renewable energy excluding large hydro, up 17% year over year, which represents well over a third of the global total (Frankfurt School of Finance and Management 2016). According to the same source, the US invested US$ 44.1 billion, up 19%, which makes Washington a distant second.

China also has five of the world's six largest solar-module manufacturing firms and five of the ten top wind-turbine manufacturing firms, including Goldwin, the largest globally. From 2015 onwards, Chinese companies have outpaced European, Japanese and North American ones in renewable energy deals, with important acquisition such as Jupiá and Ilha Solteira power plants in Brazil, Pacific Hydro of Australia, the purchase of a Dutch solar cell factory from Solland Solar, the German EEW, and the acquisition of a majority stake in the Australian PV distributor One Stop Warehouse (IEEFA 2017).

In addition to renewables, nuclear energy has also played a key role in energy decarbonization. The rise in world nuclear consumption in the last few years has been driven by non-OECD countries, for which 2017 growth rate for this kind of energy was 6.1%, against a negative rate of -0.5% for OECD countries. Considering the entire decade from 2006 to 2016, nuclear consumption growth rates for both groups were 4.1% and -1.8% respectively. Nevertheless, the share of world nuclear consumption is still higher in OECD (74.2%) in comparison to non-OECD (25.8%). Total world consumption presented a negative growth rate of -0.7% in the decade from 2006 to 2016 and a positive one of 1.1% in 2017 (BP 2018).

China is leading new nuclear reactor construction (OECD 2018). This kind of energy represents 2% of China's energy matrix, but is expected to rise to 8% by 2040 (BP 2018). The country currently accounts for 9.4% of world nuclear consumption and the growth rate of this energy source in China in 2017 was 16.7%, much above the world growth rate of only 1.1%. Considering the entire decade from 2006 to 2016, nuclear consumption growth rate in China was 14.5%, while the world presented a negative rate of -0,7% (BP 2018b). Figure 5 below illustrates the advancement of this source in China.

Figure 5: China's Nuclear Energy Consumption



Source: Own elaboration based on BP (2018b).

Besides the progress of low-carbon energy, efficiency has also advanced. Between 2000 and 2016, energy efficiency improved 13% globally. Considering the energy demand growth in this period, final energy use in 2016 would have been 12% higher without this improvement in efficiency (IEA 2017a). Between 2000 and 2015, energy intensity improved by 33% in China, above the world rate, and in 2016 it fell by 5.2%, while global energy intensity fell by 1.8%. Besides, the country had a growth rate of investments in energy efficiency of 24% in 2016, which is the world's strongest rate (IEA 2017a).

The increasing number of electric cars sales is also indicative of an important change within the clean energy transition. According to the International Energy Agency (IEA 2018a), in 2017, a record number of over one million units were sold in the world, which represents a growth of 54% compared to the previous year. Norway has the highest sales share for electric cars – 39% of new car sales in the country in 2017 – but China was responsible, in that same year, for more than half of global sales of electric cars, which had a market share of 2.2% in the country, also in 2017. Two-wheelers and buses are also developing quickly, with the vast majority of sales also happening in China (IEA 2018a). In 2017, electrical vehicles avoided emissions of 29.4 million tonns of CO_2, of which 81% corresponds to China (IEA 2018a). By 2040, more than half of new cars will be electric globally. The figure for China and Europe will be around 70% and in the US, under 60% of new cars (Bullard 2019). Besides, IEA (2017) projects that by 2040 one in four cars on the road will be electric in China.

Another Chinese advantage regarding renewables is the country's rare earths' industry. Even though technological breakthroughs, cost reductions, and recycling should counterbalance the geopolitical relevance of rare earths, they are still vital for low carbon energy production. China currently sits on 40% of global rare earth reserves and produces nearly 90% of global supply, being the major supplier for all countries (Wübbeke 2015). As these minerals are not rare in the sense that there are not enough of them on the planet, but because their supply depends on the profitability for extraction with available technology and market conditions, factors such as lower wages and more flexible environmental and health legislation made it cheaper for states to buy rare earths from China in the market than maintaining mining capacity at home[8] (De Ridder 2013). In the early 2000s China transitioned from exporting more than 80% of its domestic production to promoting the domestic consumption for the production of semi-finished applications. Therefore, as domestic consumption increasingly competes with foreign industries for supply, China prioritizes the former. Consequently, the conservation measures that decreased extraction mostly affected the exports (Wübbeke 2015).

Even with such pace of progress regarding clean energy, China's energy transition still faces several challenges. Emissions from energy use in the country grew by 1.6% in 2017 (BP 2018a). In that same year, China's gas consumption rose by 15% and its coal consumption grew by 0.5% (BP 2018a). Also, at the same time that it is projected to double the share of renewables in its energy matrix by 2040, China will also double the use of natural gas (BP 2018, IEA 2017). This is an indication of the limitations of the transition pace if compared with the constraints of the remaining global carbon budget. However, China's progress so far has had a great impact not only in the country but also in the worldwide reduction of renewable technology costs. Also, as shown in this section, projections from several sources point to the intensification of the clean energy transition in the country in the next

[8] Until 1991, the United States was the largest producer (Wübbeke 2015, 21).

decades, which will deepen the global impact of China's energy transition. China is, thus, a key actor for the advancement of the 21st century energy transition.

1.3. Conclusion

This chapter has conceptualized the 21st century energy transition as a broad, ongoing process of change in the entire energy system driven by the urgency related to the need to tackle climate change. It has also defined its scope as not only encompassing both renewables (solar, wind, hydro, bio, geothermal, and ocean energy) and nuclear energy, but also energy efficiency, energy storage and transmission solutions, and the electrification of the transport sector.

As an ongoing process, the energy transition is therefore not complete, which results in contradictions inherent to the coexistence between the low-carbon and the fossil fuels paradigms. As the second part of the chapter has shown, there are still severe limitations to the pace of the energy transition both globally and in China. However, the data indicates the advances so far and the tendency toward a low-carbon energy mix.

The definition of the current energy transition has evidenced that in this emerging low-carbon energy paradigm what matters is not necessarily the possession of the resources per se, but the technology needed to transform them into electricity. This change results in new geopolitical and economic dynamics between producers and consumers with direct consequences at the international level. This chapter has provided the conceptual and contextual basis from which a theoretical framework that addresses those emerging patterns can be built, which will be the purpose of the next chapter.

Chapter 2: Theoretical Framework

Energy studies have flourished mainly since the 1970's oil shocks, which draw the attention of the IR community – both scholars and policymakers – to the risks involving energy shortages and its political, economic, security, and environmental consequences. By then, oil and coal[9] were already established as the major energy source, and low-carbon energy had a minor share of the mix[10], with renewables still far from reaching a commercial scale. Only in the 21st century a transition toward clean energy has started to seem reachable and feasible. Precisely because it is still an ongoing process, this energy transition has only recently become an object of study in IR, which results in a challenging lack of traditional theoretical tools to evaluate the issue.

This is not to say that the discipline has not included energy into its ontological scope. On the contrary, there is a significant literature that explores the political, economic, security, institutional, and geopolitical dimensions of energy. Nevertheless, this particular energy transition, which this dissertation refers to as the 21st century energy transition, is different both from past transitions and the current energy paradigm. Moreover, even though the relation between energy and power in IR has been addressed since the early beginnings of the discipline, how this relation unfolds changes across time. While this variation has to do with the type of resources composing the world's energy mix and the way those resources are deployed, it also has to do with the power configurations of the international system in that specific moment.

Considering the above context, this chapter aims to build a theoretical framework that is able to address the complexity of the energy transition and its emerging connections with power in IR. It thus proceeds in two steps: the first section will depart from the specificities of the 21st century energy transition to address its consequences for theory. The second section then builds on those considerations to construct an eclectic theoretical framework.

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[9] Oil was much more traded internationally than coal.
[10] Except for hydropower in some countries.

2.1. Theoretical Considerations on the 21st Century Energy Transition

Differently from more traditional topics in IR, energy, and especially the current energy transition, is also studied in technical disciplines such as geography and technology studies, as well as in other social sciences' subfields and in economics. The plurality of approaches from different fields allows for a deeper understanding of the transition's different facets. Nevertheless, such multidisciplinary character has, generally, addressed the issue in two separate ways: technically and, only recently, socio-politically. This has for some time resulted in a disconnection between the technical features of the emerging clean energies and their political implications. Additionally, as noticed by O'Sullivan, Overland, and Sandalow (2017), the focus of studies has been on how to achieve a low carbon transition rather than on the consequences of a successful transition for world politics and the power of states.

Kern and Markard (2016) identify five central characteristics of purposive energy transitions that are paramount for theory development: (i) they are multidimensional, (ii) they are highly uncertain and complex, (iii) they require public policies, (iv) they involve vested interests and conflicts over its goals, and (v) they are highly context dependent. Moreover, as conceptualized in the previous chapter, the current energy transition is a complex and multifaceted process. It encompasses large-scale deployment of renewable energy, which is different from fossil fuels not only in its carbon emissions but also in the way it is produced, stored, and transmitted, and the technologies required for all these steps are significantly more mineral-intensive. Moreover, since the energy transition is part of broader efforts to tackle climate change, the urgency inherent to it requires leadership, technology innovation, and international cooperation coordination.

These features have two major consequences for theory. First, they challenge the explanation power of traditional IR theories that have often been used in the field of energy studies. The classical "power as resources" interpretation, in which power is envisioned as an entity (Bially Mattern 2008), comprises the idea that power can be measured by the resources and capabilities owned by a state. In the fossil fuel era, this understanding has resonated with the idea that the mere possession of resources would provide a country with power.

However, in a world dominated by renewables, this understanding no longer applies. The mere possession of the resources, such as sun or wind, does not automatically provide a state with power. It is necessary to transform the resource into electricity, to store the power generated in batteries, and to transmit it through often-long distances. Therefore, power does not derive from the resources in and of themselves, but from the ability of states to transform them, and that requires technology. The energy transition thus shifts the focus of the source of power from the resources to the technology that transforms them.

In this context, realist accounts that have often depicted energy politics as a zero-sum geopolitical game in a world of finite resources (Klare 2009, Klare 2012), in which one's gain is the other's loss, are no longer suitable to explain how the energy transition will influence power in international relations. The logic behind this tradition portrays a situation that could often lead to resource wars (Klare 2002, Klare 2007), which is hardly applicable to the emerging reality brought about by the energy transition[11].

Similarly, relational interpretations of power, classically depicted by the idea that "A has power over B to the extent that he can get B to do something that B would not otherwise do" (Dahl 1957, 202-203), have also been present in several works in the energy field and equally require an update. These works have focused on issues such as energy interdependence, the "oil weapon", popular after the 1973 oil embargo, and broader accounts on energy as a weapon such as those on the Russian-EU gas relation. Nevertheless, there are significant limits to the application of these approaches to a low-carbon energy paradigm. Even though some authors have pointed to the fact that the energy transition would still involve conflicts over critical minerals needed to produce low-carbon energy technologies, their features and the dynamics involved in their exploration do not result in the same geopolitical patterns as in the fossil fuels era (Overland 2019).

Likewise, liberal institutionalist interpretations that have centered on the international oil regime could hardly explain a world in which the major resources are

[11]The transition still involves the overlap between clean energy resources and fossil fuels. Therefore, this kind of approach still explains much of the current energy-related events, such as the European gas crisis resulted from the invasion of Ukraine. However, as the energy transition advances, the explanatory power of such approaches diminishes. Hence, even though both paradigms still overlap and intersect, those theories need revision when applied to the way the advance of the energy transition affects power dynamics in international relations.

no longer commodities traded in the global market. And even a broader focus on the energy regime complex is still mainly centered in oil (Colgan, Keohane, and Van de Graaf 2012). Other concepts such as resource nationalism (Mares 2010, Wilson 2015) or the resource curse (Ross 2012) have also limited explanation power. Therefore, the energy transition results in new dynamics that require new theoretical thinking.

However, a significant part of the effort to theorize the energy transition has been advanced outside of the discipline of IR. For instance, innovation systems theory helps to explain how innovation is not only fostered by firms and entrepreneurs, but occurs within a whole system, in which technologies, actors and institutions co-determine one another and require a conjoint analysis (Twomey and Gaziulusoy 2014). It can thus explain the technological change to low carbon energy and enables an in-depth analysis of interdependencies and comparisons across cases (Araújo 2014). Likewise, techno-economic paradigms explain how technological revolutions not only involve the creation of new products, services, systems and industries, but also impact almost the whole economy. They have effects on cost structure and conditions of production and distribution throughout the system (Twomey and Gaziulusoy 2014). In the case of low carbon energy, a new paradigm leads to the upgrading and modernization of current industries to synchronize with newer ones (Araújo 2014).

Equally effective accounts can be found in socio-technical multi-level perspectives, a middle range theory (Geels 2010) that encompasses three levels, whose interplay explains transitions (Kern and Markard 2016). The regime level refers to the practices and routines, the dominant rules and technology that guarantee the stability and that reinforce the prevailing social-technical systems. Niches are the micro level in which there is space for experimentation and radical innovation (Twomey and Gaziulusoy 2014). The landscape is composed by external factors and developments (Kern and Markard 2016). The multi-level perspective posits that transitions occur when external pressures (landscape) destabilize a predominant regime thus enabling breakthroughs in niches. By this approach, disruptive technologies progress in tandem with changes in markets, regulations, infrastructure, practices, industrial networks, culture, and scientific understanding (Araújo 2014). The concept of system here encompasses the notion that its elements interact and together provide society with particular services, such as energy supply (Kern and

Markard 2016). While technical innovation systems focuses on the prospects and dynamics of a specific innovation and is concerned with the successful diffusion of a specific technology or product, the social-technical multi-level perspective focuses on the prospects and dynamics of broader transition processes and a broader variety of innovation and is concerned with successful transformative societal processes (Twomey and Gaziulusoy 2014).

In addition to those, other approaches such as path dependence (or lock-in) and path creation explain the inertia that shapes action. Path dependence refers to how inertia of previous choices constrains future alternatives due to self-reinforcing limits. This pattern is important to understand the complexity and pace of energy transitions, since a new energy technology may not be adopted even if it is better or economically viable (Araújo 2014). On the other hand, path creation focuses on the agency of entrepreneurs, which are also essential in fostering the energy transition. Further approaches include learning, which relates to knowledge-based improvement and can be seen in experience curves, economies of scale in installed or investment cost curves and in ideas about adaptiveness, openness, and innovative capacities (Araújo 2014).

Although these approaches provide valuable insights about the dynamics involved in the energy transition, they are more focused in the process per se and thus do little to explain how the energy transition affects international relations. Despite recent efforts to bring a concept of energy as a socio-technical system to the study of global energy politics (Van de Graaf and Sovacool 2020), there are still significant gaps in the IR discipline when it comes to theorizing the current energy transition.

The second consequence brought about by the complex and multifaceted character of the energy transition is that it does not fit into one single theory. In fact, it is not possible to understand the global politics of energy in a complete way from a single scientific discipline (Van de Graaf and Sovacool 2020), let alone a single theory. Opting for one specific theoretical approach would distort the consequences of the energy transition for international relations. For instance, a realist interpretation could provide insights into how the transition could affect security patterns or how it could weaponize green technology or critical minerals, while a liberal approach could focus on the economic interdependence of the countries involved in the production of these technologies, and a constructivist framing could shed light on questions over climate responsibility or leadership. However, individually, these approaches would only provide very partial answers to a complex and multifaceted question. Certainly a thorough analysis is neither possible nor desired, but focusing on one single aspect would be contradictory to the exploratory proposal of this dissertation[12].

Therefore, instead of engaging in grand theory debates, this research adopts an eclectic theoretical framework. This kind of approach consists of navigating through the many theoretical paradigms without restricting the analysis to a specific lens. This framing allows for a deeper understanding of the different parts composing the whole, which is particularly relevant for understanding the energy transition in its entirety, considering its complexity. According to Katzenstein and Sil (2008), eclectic scholarship aims on exploring an issue in original, creative ways and it contributes to both a deeper understanding of it and to the theoretical progress in the field. With this approach,

> features of analyses in theories initially embedded in separate research traditions can be separated from their respective foundations, translated meaningfully, and recombined as part of an original permutation of concepts, methods, analytics, and empirics (Katzenstein and Sil 2008, 110-111).

It is important to notice though that analytic eclecticism does not mean that anything goes or that established research traditions should be neglected. It is neither a theoretical synthesis nor an attempt of building a unified theory. It rather means self-consciously engaging with research traditions “in pursuit of empirical and conceptual connections that recognize the complexity of international life in ways that no single research tradition can” (Katzenstein and Sil 2008, 118). The result is a pragmatic perspective, in the sense that it selects “what kinds of knowledge are worth pursuing, in what manner, and with what aims” (Katzenstein and Sil 2008, 113).

In an effort to value eclecticism in the field, Lake (2013) seeks to identify mid-level theories that have flourished in the interstices of the Great Debates and which form a much more progressive and eclectic approach to IR. This theoretical choice changes the emphasis of the “paradigm wars” that focus less on explaining

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[12] The methodological framework is presented in Chapter 3.

world politics than on the best set of assumptions on the nature of humans and states (Lake 2013).

Mid-level theory focuses on parts rather than the whole and thus bridges and frequently violates the boundaries between the levels of analysis (Lake 2013). It does not defend a specific set of assumptions, but instead builds theories to deal with specific issues of world politics. It is an eclectic way of theorizing precisely because it mixes assumptions, issue areas, units, and interests:

> [...] mid-level theories are not judged by their fit with pre-existing paradigms, nor limited to particular methodologies. Rather, they are best measured by their empirical power and ability to generate new propositions that are themselves empirically confirmed (Lake 2013, 577).

This approach thus fosters the field's progress much more than the traditional Great Debates between IR grand theories (Lake 2013). Also Barnett and Duvall (2005), even though they do not make any explicit reference to eclecticism when building their power taxonomy, state that:

> Scholars can and should draw from various conceptualizations of power that are associated with other theoretical schools. We believe that such poaching and cross-fertilization is healthy, needed, and might, in a small way, help scholars move away from perpetual rivalry in disciplinary "ism" wars and toward dialogue across theoretical perspectives (Barnett and Duvall 2005, 45).

The theoretical framework that should be built to assess the connections between the 21st century energy transition and power in international relations is therefore one that takes the particularities of this process into account in a novel and multifaceted manner. Such framework cannot simply assume that the same patterns of the fossil fuel era apply to the low-carbon paradigm and must therefore update traditional theoretical approaches used in energy studies. Moreover, theoretical assessments that combine specific strands of different approaches will contribute to a more complete understanding of the energy transition, as it is still an ongoing process.

2.2. An Eclectic Theoretical Framework

As seen in the previous section, some approaches from transition studies, such as innovation systems theory, techno-economic paradigms, socio-technical multi-level perspectives, and path dependence (lock-in) and path creation help explain technological changes that foster transition. Nevertheless, they offer limited insight on the influence of this process on international relations. In this context, Kern and Markard (2016) offer a valuable effort in trying to combine both transition studies and international political economy. As previously defined in chapter one, the 21st century energy transition is a purposive one, which means that politics, actors' interests, and policy conditions are essential to understand the process, even though they have been surprisingly neglected in initial literature. Additionally, transitions are fostered by the interplay between economic and political aspects and involve underlying processes, such as technology development and value chains, which are international in nature (Kern and Markard 2016).

The authors identify four reflections from IPE that can contribute to transitions studies. First, the relevance of politics and the strong influence of established industry actors (multinational companies, associations, international NGOs and international organizations) that advocate their interests in national and international policy systems through international networks. Second, the idea that there are diverging national interests, which means common goals and strategies at the international level are hard to achieve and that national policymakers should consider relative gains in relation to competitors. Third, there is an interplay of local, national, and international political developments. And, finally, the distributional consequences of the transitions. On the other hand, transition studies focus on ongoing changes (in contrast with IPE's focus on mostly stable situations) and highlight the importance of institutional structures and the co-development of institutional, organizational and technological changes – which adds the technological dimension to IPE's focus on the former two aspects (Kern and Markard 2016).

In fact, technology is a key component of energy transitions and it is especially important to the current transition. In an ever more energy interdependent world, it is increasingly difficult for states to control and design *their* energy systems, as few states can rely on their own resources. Cherp, Jewell, and Goldthau (2011) extend this argument to the present transition, as many countries will not have the conditions to obtain and use technologies like carbon capture and storage, nuclear energy, smart grids and renewable energy facilities. Considering that, the authors identify three characteristics of the emerging energy scenario: increasing systemic interdependencies, externalities beyond borders and decreasing regulatory capacity of individual states.

Drezner (2019) follows the same line of thought. Even though he does not address the energy field specifically and rather focuses on nuclear weapons and the Internet, the author assesses the consequences of technological change in international relations. He makes two relevant points that can be extended to the energy transition as well. First, that both technological change and world politics have mutual, reciprocal effects on one another. Second, that any technological change is also a shift in terms of economic redistribution and societal disruption.

The first point implies that technology is not merely an external shock, an independent variable that impacts world politics by changing the distribution of power. This does not mean that technology does not affect politics. On the contrary, "[...]technology developments might be much faster than national (policy) developments, thus acting as supranational forces creating tensions for and across national interests" (Kern and Makard 2016). Nevertheless, Drezner's (2019) analysis shows that, because of reciprocal effects, shifts in the international system can also affect technological change. The second point is related to the fact that technological change can also lead to the creation of new winners and losers, alter actor's preferences, and lead to the strategic creation of new norms. The effects on international relations depend on the nature of the technology and the degree to which the public sector steers innovation (Drezner 2019). The idea of winners and losers is related to the fact that, as energy supply shifts to a process driven by technology and innovation and away from the extracting industry, international division of labor and the world trading system would also be affected (Goldthau, Keim, and Westphal 2018).

Besides, acknowledging that the process involves winners and losers complements the usual economic perspective, which stresses the relevance of technological change to economic growth. Such understanding leads to a rationalist view, which is complemented by neorealist accounts that technological change is a key element for great powers survival in the anarchic international system. Both theoretical views thus agree that the motivations to obtain new technologies prevail over other factors. However, this perspective ignores how international relations, as an independent variable, impact the pace of technological innovation (Drezner 2019).

Examining the ideas of economic historians, Drezner (2019) infers that multipolarity fosters more rapid innovations than unipolarity. This is because the former generates an appropriate mix of security and insecurity while the latter produces a context marked by a too secure hegemon with little incentives to invest in disruptive innovations and other states that see themselves so far from catching up with the hegemon that they also renounce to invest. Also, in a context of unipolarity, states would be more focused on guaranteeing their survival and thus would not prioritize investments on technology (Drezner 2019).

Domestic politics – explored mainly by long cycle and power-transition theorists – is also a driver of technological innovation. The logic is that states become hegemons because they create the conditions to foster technologies in leading sectors, but eventually fail to keep the rate of innovations (Drezner 2019). This is what Mokyr (1992, 504) calls the Cardwell's Law[13]. The argument therefore is that innovation can be a threat to the states interested in maintaining the status quo. Finally, prestige is also a driver of investments in technology (Drezner 2019). This variable can explain investments that might not be so valuable militarily or economically, but that generate considerable prestige (Drezner 2019).

Regardless of the ways in which international relations affect technological change, technologies are at the core of the energy transition. In fact, Goldthau, Keim, and Westphal (2018) predict that technology rents could become "the decisive driver" for societies' welfare and the success of energy systems' transformation. This focus on technology does not contradict the fact that technology has always been important to the energy sector, but the current transition is much more disruptive. This is related

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[13] Nevertheless, it is worth noting that the United States has been the hegemon for three-quarters of century and has always kept high rates for technological innovation.

to its broader purpose to decarbonize the economy and the inherent urgency related to climate goals, which puts extra pressure in the development of technologies. Moreover, while countries abundant in fossil resources and limited in technological competence can still expect significant revenues, renewables are more distributed. In this context, intellectual property rights are more important, which means that counties with strong innovation cultures and research capacity could have an advantage (O'Sullivan, Overland, and Sandalow 2017).

This particularity also affects another element of the relation between energy and international relations: the geopolitical and security-related dimension. The current transition is reinforcing a shift from traditional security policy and geographical spheres of influence to the control of the flow of goods, knowledge, capital and information (Goldthau, Keim, and Westphal 2018). It encompasses changes in at least three ways. First, a shift occurs in the value chains, as economic value is accrued at conversion stage (end-use energy and energy services) rather than from the resource itself (in the case of fossil fuels). Second, the transition creates new energy spaces (infrastructure, production chains, industrial clusters) that result from technological change (for example, local micro grids or regional super grids). Third, and contrary to current focus on individual sectors, the transition changes the focus to sector coupling by integrating electricity, heat and mobility, which reinforces the reconfiguration of energy spaces (Godthau, Keim, and Westphal 2018).

Nevertheless, the geopolitics of the current energy transition, precisely because of the specific characteristics of that process, cannot be a simple mirror of the traditional blood-for-oil, zero-sum, and resource-wars energy geopolitics used to explain the fossil fuels-dominated world. For instance, the focus on states and interstate relations also minimizes the plurality of actors involved in the transition, which has also been advanced by relevant non-state actors, such as the business sector, individuals, institutions and subnational states/provinces and cities. Besides, even when focusing on renewables, geopolitics excludes important facets of the process such as industrial leadership in clean technology and the impact of renewables in oil demand (Scholten 2018).

Indeed, the transition toward renewables is a game changer for energy relations among states and, as their share in the mix increases, so does energy geopolitics (Scholten 2018). There has been an emerging literature on the geopolitics of the energy transition (Hafner and Tagliapietra 2020, Goldthau, Keim, and Westphal 2018), and especially on the geopolitics of renewable energy (O'Sullivan, Overland, and Sandalow 2017, Scholten 2018, Eisen 2011, Criekemans 2011, Scholten and Bosman 2013, Overland 2019, Vakulchuka, Overland, and Scholten 2020). O'Sullivan depicted the magnitude of the geopolitical impacts of the current energy transition in an interview:

> The movement away from fossil fuels to a more sustainable energy mix will bring major geopolitical changes. Think of how significant it will be when the world moves not just to a different energy mix, but to a whole different energy system. Patterns of trade will change; economic relationships will be transformed; old alliances will lose some of their *raison d'etre*; and new partnerships will emerge (Nyquist 2019).

The changes in the energy system will thus have direct impact on geopolitics. For instance, the supply chain from critical materials such as rare earths whose production is concentrated in a few countries[14] could foster competition. In this context, some authors have applied the often-used zero-sum geopolitical reasoning of the fossil fuels era to explain how the energy transition will enhance competition for those resources. De Ridder (2013), for instance, argues that the importance of these minerals to the advance of renewables would change the relative power position of states within the international system. According to Scholten (2018), US, Germany and China are examples of countries that are already competing for industrial leadership in renewables technologies and that examine accessing rare earths as potential bottleneck and liability.

Indeed, rare earths have significant economic value, as they are not only used in the renewable energy industry, but also for medical drugs and equipment, smartphones, in the military and even in oil refineries. Considering the relevance of these minerals, China's recent threat to cut off the supply of these minerals in the midst of the trade war with the United States has raised the concern that Beijing could use its leverage as a geopolitical weapon (Johnson and Groll 2019). Nevertheless, Overland (2019) points to the high probability of technological improvements and cost reductions and the fact that the materials intensity of several minerals used in clean energy technology has actually been reduced in the recent years. Increasing

[14] An assessment on the critical minerals supply chain is provided in Chapter 5.

recycling rates and a move toward a closed cycle tend to also contribute to diminish potential geopolitical tensions resulting from critical minerals demand (Goldthau, Keim and Westphal 2018).

Another often-cited aspect of this emerging geopolitics is a renewed resource curse. This dimension could affect both the petro-states that currently benefit from high rents from oil and gas and countries that produce significant amount of renewable energy, which could be trapped in the curse. Nevertheless, developing renewables is very different from fossil fuels and thus countries exporting renewable energy could present more diversified economies and therefore a renewable energy resource curse would be unlikely (O'sullivan, Overland, and Sandalow 2017). The resource curse could also affect countries with large mineral reserves. However, geological reserves are not absolutes, as they vary over time and demand for minerals is also affected by the dominant technologies. Innovations in engineering can replace materials within a technology and entire technologies can also be substituted due to scarcity or alternatives created by innovation (O'sullivan, Overland, and Sandalow 2017). Moreover, exporting renewable energy demands more long-term maintenance of infrastructure, creates more local jobs and generates more stable revenues than fossils have produced (Overland 2019).

There could also be geopolitical consequences derived from the electrification of the energy system, such as a potential use of electricity disruption as a geopolitical weapon. Electric grids increase cross-border electricity trade, which could, on the one hand, result in geopolitical vulnerabilities for importers and, on the other, increase interdependence and thus reduce the risks of conflict. Even though electric grids might be vulnerable to cyber attacks, they could also become more resilient with more microgrids and distributed energy technologies (O'sullivan, Overland, and Sandalow 2017). Moreover, it is easier to hold or redirect oil stocked in tankers than to do the same with solar and wind power distributed by cable. Besides, such a renewable energy weapon would be more unlikely in a context marked by mutually dependent prosumer countries and even net-importer countries could opt to develop their renewables potential (Overland 2019). The grid could also face the geopolitical risk of cybersecurity, as terrorists or intelligence services of hostile countries could hack the computers controlling the grids. However, Overland (2019) argues that risks related to electricity are not new, since grids have been controlled digitally for a long time. In fact, as renewable energy will likely result in more decentralization, with several prosumer households providing electricity, the system could actually become more resilient (Overland 2019).

Besides those aspects, conflicts could also emerge from issues on technology transfer between developing and developed countries and on the reduction of oil and gas demand, which could affect fossil fuel export and consumer countries (O'sullivan, Overland, and Sandalow 2017). On the other hand, the geopolitical impact of the increasing use of renewables could also result in the reduction of conflicts. For instance, the reduction of greenhouse gas emissions could diminish the risks of conflict and instability caused by climate change and sustainable energy access could contribute to solve instability and conflict (O'sullivan, Overland, and Sandalow 2017).

Therefore, the energy transition encompasses different geopolitical aspects and, as a consequence, the tendency to replicate the argument that control over resources provides states with power in the international system must be revisited. For Overland (2019), given the characteristics of renewables, the nature of international energy relations will actually become less geopolitical, as its focus will change from locations and resources to technologies for capturing, storing and transporting the resources. Technology and intellectual property will thus be more important than controlling resources' physical location and transportation and could become the focus of international energy competition (Overland 2019). As summarized by O'Sullivan, "[...] having a technological edge, not a vast oil reserve, could become a major source of power. Trade conflict, not open war, could be the way in which that power is demonstrated" (Nyquist 2019). This understanding thus challenges traditional energy geopolitics, which needs to take into account the particularities of the current energy transition.

Furthermore, this emerging geopolitical context not only creates new energy security dynamics between states, but can also shed new light to the concept of energy security per se. Since the securitization of energy during the 1970s oil crises the concept has suffered extensions and context-specific adaptations. Although its classic definition as "the uninterrupted availability of energy sources at an affordable price" (IEA 2019) is still the mostly used conception, energy security also encompasses security of demand from the producers' perspective and a variety of issues including justice and climate change. In addition, “energy security is not just about countering the wide variety of threats; it is also about the relations among nations, how they interact with each other, and how energy impacts their overall national security” (Yergin 2012, 266). Therefore, as the energy transition progresses, the concept might have to be further adjusted. For instance, clean energy technologies will likely be at the center of the concept. On the one hand, the security of supply perspective could be more concerned on accessing affordable low-carbon technologies while on the other, the security of demand perspective will probably be more focused on securing market share for the producers of green technologies.

I have so far discussed the international political economy of the energy transition, the mutual implications between technological change and international relations, and the geopolitical and security consequences of this multifaceted process, but how do we govern such complexity? Global governance faces the same problem of geopolitics and security approaches, in the sense that the theoretical implications of the particularities of the current energy transition have not yet been fully explored. In this regard, Cherp, Jewell and Goldthau (2011) expose the reductionism in the assumption that global governance is a patchwork of autonomous institutions and organizations and that energy challenges are well defined, fixed, and unconnected problems. They thus propose a shift in focus for global governance studies, from who governs or should govern the transition to what should be governed and how. This leads to an interesting combination of systems, complexity, and transitions.

Differently from the current situation, in which one single fuel dominates the energy system, it is unlikely that one technology or fuel will dominate the future energy system, which means that multiple coexisting technologies will have to be governed jointly in a context of increasing interdependence between national energy systems (Cherp, Jewell, and Goldthau 2011). Moreover, such interconnectedness not only occurs within and between energy systems, but also between energy and non-energy sectors – industry, transport, land use, agriculture, water management and urbanization, for example – which adds to the complexity of the energy transition (Cherp, Jewell, and Goldthau 2011).

Energy systems are complex systems, which are characterized as such because of their interconnectedness (large quantity of interacting elements), unpredictability (future behavior cannot be reliably predicted based on its past), nonlinearity (minor changes can lead to disproportionate major consequences), path dependence, openness (boundaries not clearly defined), and adaptability and resilience (can adapt to external consequences and preserve their patterns even when suffering external pressures and shocks) (Cherp, Jewell, and Goldthau 2011). Based on that, Cherp, Jewell and Goldthau (2011) argue that current energy challenges and the shifts required to solve them (the sustainable energy transitions) are increasing and changing such complexity, which deeply impacts global energy governance.

To deal with these changes, Cherp, Jewell, and Goldthau (2011) suggest a balance between exploitation – related to "hard" coordination mechanisms associated with choice, implementation and execution needed to drive large-scale transitions – and exploration – related to flexibility, diversity and innovation required to deal with uncertainty and change. This equilibrium could be achieved through polycentric and multiscale arrangements. This is connected to an important conclusion of the authors, that the problem of current energy governance is not its complexity but rather the fact that it has been unable to keep up with the changes in the energy challenges. This is important because it indicates the need to think of new ways of approaching the energy transition instead of simply adapting past theoretical frameworks that were able to assess the fossil era but cannot simply be applied to the emerging new reality.

However, while energy governance is a central piece in the efforts to theorize the energy transition within IR, focusing exclusively on it might miss a broader connection between energy and power brought about by the transition. As defined in Chapter 1, one feature that differentiates this transition from past ones is the fact that it is linked to the necessity and urgency to decarbonize the economy and tackle climate change. As shown before, this element fosters technology innovations, but it is also tied to another dimension of power, which is that related to responsibility and leadership, and those elements must be observed beyond energy governance, but within the broader architecture of global climate governance. Besides, this dimension of power influences a country's image internationally.

In this context, the interaction between the norms of great power responsibility and climate responsibility matters, as states that wish to be recognized as great powers must fulfill the criterion of responsibility, which has historically constituted the ideological basis of the "great power club" (Kopra 2019). Moreover, for a big country highly reliant on fossil fuels, completing the energy transition will involve an emphasized notion of sacrifice,[15] which affects a state's image as a responsible actor more than if it were a developed small state already abundant in renewable resources and with access to technology.

Furthermore, regardless of the reasons for adopting climate actions, which might be altruistic or not, countries could still frame them as initiatives motivated by the notion of responsibility. As Nye similarly puts it, "in an information age, communications strategies become more important, and outcomes are shaped not merely by whose army wins but also by whose story wins" (Nye 2011, 19). In this sense, this discussion is also related to the notion of soft power, "the ability to affect others through the co-optive means of framing the agenda, persuading, and eliciting positive attraction in order to obtain preferred outcomes" (Nye 2011, 20-21). This kind of power is associated with intangible resources, such as institutions, ideas, values, legitimacy, and credibility. Nevertheless, attraction depends on the perceiver, which means that whether a certain resource produces hard or soft power depends on the subject's perceptions. Thus, differently from hard power, whether the outcomes of soft power are successful or not, is more in the control of the target (Nye 2011).

Therefore, regardless of the motivations for forwarding an energy transition, such as technology development, energy security, economic benefits, or green jobs, the decarbonization of the energy system could positively impact the image of countries that succeed in that effort by reinforcing the idea of them being responsible actors. In other words, "a strong narrative is a source of power" (Nye 2018), and the energy transition could be a strong narrative that affects power by improving a country's image, which in turn could ameliorate its credibility in global climate governance.

2.3. Conclusion

While Chapter 1 has delineated the main features of the 21st century energy transition, this chapter has explored how those characteristics affect theoretical assessments on the issue. On the one hand, they require an update of the traditional approaches often applied to energy studies. In this regard, while significant theoretical

[15] For a detailed discussion on the different meanings of responsibility, see Kopra (2019).

progress has been made, it is mostly located outside of the IR discipline. Therefore, a theoretical framework that aims to assess the relation between the current energy transition and power in international relations must avoid the simple replication of the same approaches used for fossil fuels as well as the assumption that the same patterns will necessarily emerge. On the other hand, given that the energy transition is complex and multifaceted, analyzing it from the perspective of a single theory would misrepresent the understanding of how it influences power dynamics in the international system. Moreover, since energy is a multidisciplinary subject, restricting its analysis to one theory would be very limiting.

Therefore, this chapter has used strands of IPE and technology change, geopolitics and energy security studies, global energy governance, and soft power to assess how the 21st century energy transition influences power in international relations. Blending those theories in an eclectic manner allows for a much broader understanding of the multiple variables of this complex process. The strands of these approaches, eclectically highlighted and pragmatically combined in this chapter, form the theoretical approach of this research and help to delimit the dissertation's variables and its operationalization, which will be the focus of the next chapter.

Chapter 3: Methodological Framework

Chapters 1 and 2 have defined the energy transition and constructed an eclectic theoretical framework that takes into account the complexity of the phenomenon. Considering such conceptual and theoretical bases, the aim of this chapter is to construct the methodological framework of this dissertation. This process involves three steps.

In the first part, the chapter starts by defining the study as an exploratory and descriptive mixed-methods research anchored in pragmatism. It then moves to the second part, where the research design is defined as a case study focusing on China. Finally, the last section operationalizes the research and thus defines its main data and methods. Some reflection on the limitations of the research is also included in this part.

3.1. Definitions and Philosophical Assumptions

As shown in chapters 1 and 2, the 21st century energy transition is an ongoing complex and multifaceted process that still lacks understanding in IR. In other words, it is an emerging field of research, which therefore requires an exploratory study. This dissertation thus focuses on the twofold goal of exploring and describing the phenomenon in order to provide an understanding about it. Though the value of this kind of research is often underappreciated, King, Keohane, and Verba (1994) disagree with those that belittle description: “Even if explanation—connecting causes and effects—is the ultimate goal, description has a central role in all explanation, and it is fundamentally important in and of itself” (King, Keohane, and Verba 1994, 122). In addition, this research mixes qualitative and quantitative data, which more accurately places it in the mixed-methods category (Bazeley, 2012).

Moreover, this study adopts pragmatism as its research paradigm. This interpretive framework allows for the combination of a plurality of data and methods, which helps to answer the proposed question considering the multiple dimensions of the energy transition. Pragmatism is also in accordance with the exploratory character of the research, and it equally matches the theoretical eclecticism adopted in this dissertation as justified in the previous chapter.

Pragmatism stands in the middle of two opposite sides of the ontological spectrum, that is, positivism and relativism, and therefore reality is understood as what is useful and what works (Creswell and Poth 2018, Kaushik and Walsh 2019). In this paradigm, the focus is on the research consequences and questions rather than on the methods (Creswell and Poth 2018, Kaushik and Walsh 2019), which does not mean the negligence of methods but rather an openness toward a plurality of them with the aim of answering the research question appropriately. Epistemologically, thus, the researcher comprehends reality through the use of many tools that reflect both deductive (objective) and inductive (subjective) evidence and, methodologically, data collection and analysis involve both qualitative and quantitative approaches (Creswell and Poth 2018). Finally, in terms of axiological assumptions, I recognize that as a non-Chinese person researching on China, this study might carry my own values and biases. However, I have tried my best to consciously distance myself from those and to get a balanced dataset and an objective analysis.

3.2. Research Design

This dissertation uses case study as its methodology, as it focuses on one example of a broader phenomenon (Gerring 2004). In this case, the example is China and the wider phenomenon is the relation between the low-carbon energy transition and power in international relations in the 21st century. This choice for the case study methodology is based on the fact that this approach is instrumental to the goal of this dissertation, which is to seek a deep understanding of a case. Moreover, it is a single unit case study, as it does not compare cases, but rather focuses on the particularity of the Chinese case. Equally, it does not aim on generalization, although it does contribute to wider assessments on how low-carbon energy transitions might influence other dimensions of power in international relations, especially for emerging economies.

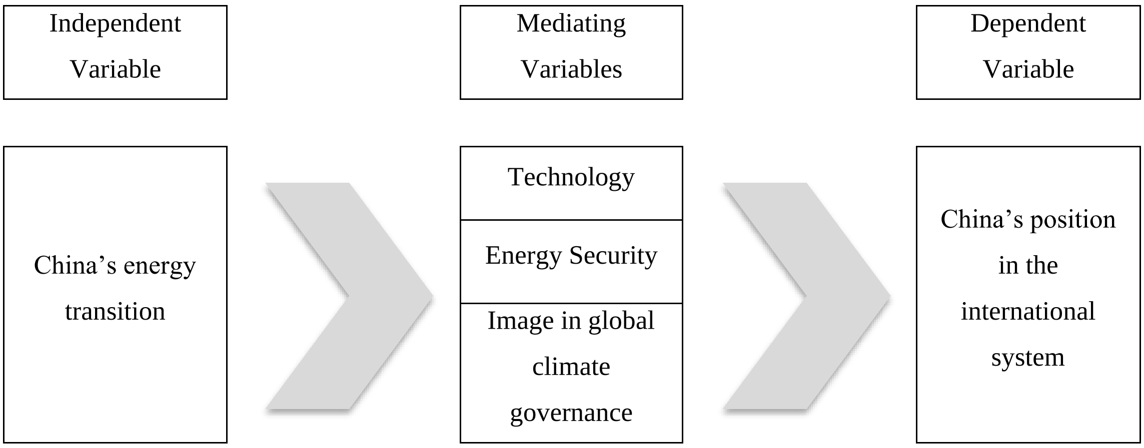
Following Gerring’s typology of case studies, this is a case study of type I, that is, with no spatial variation (since it focuses on a single unit, which is China) and with temporal variation (which is before and after the start of the energy transition process) (Gerring, 2004). The focus on a single unit is justifiable in the case of China because of the particularities of this case, which make it unique. First, as discussed in the first chapter, what this dissertation calls the 21st century energy transition is a rather context-specific process, which varies alongside countries and even provinces, cities, and neighborhoods. Thus, deeply exploring each country's case of energy transition is a relevant contribution to the understanding of a complex phenomenon. Second, China holds important world's superlatives: it is the world's second largest economy, the largest emitter of greenhouse gases, the largest consumer of energy, and the largest responsible for energy consumption growth globally. This means both that its energy policy has a significant impact worldwide and that it is not possible to mitigate climate change without it. Third, due to China's unique political regime and, consequently, its ability to plan for the long term, its energy transition process is tied to other, wider frameworks, concepts, and policies, such as the ecological civilization and the Made in China 2025, which also reinforces the particularity of the Chinese case. Fourth, China's case highlights the issue from a strategic perspective, which encompasses other factors not limited to environmental concerns and more closely connected to China's rise in an increasingly changing world order. Finally, though there are plenty of studies on China's energy transition and on China's power in international relations, the manner in which the former influences the latter is still underexplored. A comprehensive account bridging these two variables is thus both relevant and necessary.

3.3. Operationalization of the Research

Considering, on the one hand, both the conceptual and theoretical frameworks constructed in chapters 1 and 2 and, on the other, the aim of this dissertation to assess how China's energy transition toward low-carbon sources (independent variable) influences its position in the international system (dependent variable), this study will analyze three dimensions of the relation between the energy transition and power in international relations for the Chinese case: technology, energy security, and image. In other words, these three dimensions help to explain how the energy transition in

China influences its state power and position in the international system. Moreover, each of these dimensions will be treated as mediating variables that stand between the independent and dependent variables, as illustrated below.

Figure 6: Independent, Mediating, and Dependent Variables



Source: Author's own elaboration.

In order to assess variation (before and after the start of the transition process) and, thus, the relation between the variables, the research uses official documents, speeches, interviews and energy data. The qualitative materials are analyzed with the method of qualitative content analysis while the quantitative data is assessed through descriptive statistics. Table 2 summarizes the proposed operationalization. In terms of the dissertation's structure, each variable will be the subject of one empirical chapter.

All the data was collected online. For energy statistics, the majority of the data was gathered from the databases of the IEA, IRENA, and EIA. Keeping multiple sources was a deliberate choice, aimed to ensure reliability. Quantitative data mainly included renewables installed capacity, renewable energy patents, data on manufacturing of low-carbon technology, nuclear energy production and installed capacity, data on UHV lines, energy storage capacity, China's energy imports, and data on critical minerals production and refining.

Table 2: Data and Analysis

Mediating Variables	Before initiating the energy transition	After initiating the energy transition	Supporting Data	Data analysis procedures
Technology	Late comer in the technologies of the fossil fuel era	Central role in technological innovation The first mover advantage	Data on installed capacity, patents, standards, and internationalization of key technologies of the energy transition Official related documents and policy papers Interviews	Descriptive statistics and Content Analysis
Energy Security	Large energy importer Dependent on geographical straits, pipelines, and maritime routes	As the energy transition progresses, less dependency on imported resources and more self-reliance Less impacted by geopolitics related to resources transportation Better positioned in the critical minerals supply chain than in the fossil fuels'	Statistical data on the evolution of China's energy mix and the share of imported energy Identification of main transportation routes Data on critical minerals Interviews	
Image in global climate governance	World's largest polluter, suffering from health diseases and deaths due to pollution Seen as a challenger of global climate governance	Able to use the energy transition to improve its legitimacy in global climate governance The energy transition can support the narrative of being a responsible power China can advance its own concepts in global climate governance It can play a more active rather than passive role	China's participation in global climate negotiations and accession to climate treaties Official climate pledges in international forums Official documents and domestic plans Interviews	

Source: Author's own elaboration.

Qualitative primary data included the 11th, 12th, 13th, and 14th Five Year Plans, the Renewable Energy Law, the National Medium and Long-Term Plan for the Development of Science and Technology (2006–2020), Made in China 2025, China's Standardization Law, China's National Standardization Development Outline, the Medium and Long-Term Development Plan for Renewable Energy in China, China's NDC and other climate-related announcements in international forums, the Kyoto Protocol, the Paris Agreement, and the Glasgow Climate Pact, the Guidance on

Promoting Green Belt and Road, the Belt and Road Ecological and Environmental Cooperation Plan, and the Vision and Actions on Energy Cooperation in Jointly Building Silk Road Economic Belt and 21st-Century Maritime Silk Road, the US-China Joint Announcement on Climate Change, the US–China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s, news, literature, and semi-structured expert interviews.

Due to the impossibility to go to the field caused by the Covid-19 pandemic, all interviews had to be conducted online. I have applied twice for a research period in China, hoping that the country would eventually open again, but as that did not happen, and considering the deadline to finish this research, I had to build my own online fieldwork environment. This was challenging for many reasons. First, people tend to be more distrustful in the online environment. Second, as tensions between China and the West increase, so does cautious to participate in a research affiliated with Western institutions. Third, while climate had been a relatively open space in China in the past compared to other issues, this has been changing rapidly, with journalists and experts working on climate reporting rising and significant restrictions[16].

Indeed, it has become increasingly challenging to conduct research on China. The limitations brought about by the Covid-19 pandemic and by the deepening of the country's authoritarian regime have impacted access to data, and this has certainly been the case in this dissertation as well[17]. However, it is precisely for those same reasons that studying China is even more important nowadays. As summarized by Professor Daniel K. Gardner during an interview,

> there are so many questions that we can't answer when it comes to China because of this distance and also because of some lack of transparency that we don't necessarily have in our own countries. So it makes it a little difficult sometimes to observe with the precision we might like but it shouldn't stop us from doing that research. We just have to acknowledge that we are sort of prisoners of the data that are out there and that we have to make the best of that (Interview 14).

[16] As recently reported by Climate Home News: https://www.climatechangenews.com/2022/07/15/as-xi-jinping-seeks-more-power-the-worlds-window-into-chinas-climate-action-narrows/

[17] As an example of these limitations, I received no response after contacting GEIDCO, which is supposed to be an internationally oriented organization, through its official information email address.

Amidst those limitations, I conducted 25 semi-structured online expert interviews[18] that have taken between 30 to 80 minutes each. The initial selection of experts was further expanded using the snowball sampling technique, that is, by asking the interviewees to indicate other experts that could contribute to the research. Several of the same names were suggested by multiple experts, which indicates the relevance of the sample and the recognized expertise of the interviewees. Experts were selected based on their experience either working with or researching on China's energy transition and overall energy and climate policies, regardless of their nationality or country of residency. The online environment has allowed for the inclusion of experts working from a wide variety of locations. Although this research is concerned about the international implications of China's energy transition, the study tried to establish a balance between Chinese and non-Chinese experts, and between those working in China and overseas.

The table below provides the details of the interviewees. All experts were given the option to remain anonymous or not. Moreover, all of them received a file with the parts of the dissertation that make reference to them or their quotes. They then had another opportunity to change their previously chosen option. The way they are presented here was also specifically approved by them and reflects their positions and organizations at the time of the interview. As a standard, the country is indicated as the location, except when that would enable the identification of those experts that have wished to remain anonymous.

Table 3: List of Interviews

Code	Interviewee	Position and Organization	Date of the Interview	Location
Interview 01	Dr. Tatiana Prazeres	Senior Fellow at the University of International Business and Economics in Beijing	September 16, 2021	China
Interview 02	-	GIZ Office China	October 20, 2021	China
Interview 03	Huw Slater	Lead Climate Specialist at ICF China	November 23, 2021	China
Interview 04	-	Independent consultant	November 25, 2021	Europe
Interview 05	Lauri Myllyvirta	Lead Analyst at the Centre for Research on Energy and Clean Air	November 29, 2021	Finland
Interview	-	Fudan Scholar at Fudan University	December 9, 2021	China

[18] I have, however, contacted 72 experts. The gap between the number of invitations sent and the people that agreed to talk further illustrates the challenges mentioned above.

06				
Interview 07	-	Global Energy Monitor	January 13, 2022	Europe
Interview 08	Michael Standaert	China Correspondent for Bloomberg Industry Group and freelance journalist	January 18, 2022	China
Interview 09	-	Global Energy Monitor	January 21, 2022	US
Interview 10	David Fishman	Senior Manager at The Lantau Group	January 27, 2022	China
Interview 11	Ang Zhao	Co-Director & Co-founder at the Rock Environment and Energy Institute	February 9, 2022	China
Interview 12	Dr. Michal Meidan	Director of the China Energy Programme at the Oxford Institute for Energy Studies	February 10, 2022	UK
Interview 13	Erik Solheim	Vice-chair of the China Council for International Cooperation on Environment and Development, Senior Advisor at the World Resources Institute, President of the Belt and Road Green Development Institute, and former Executive Director of the UN Environment Program	February 14, 2022	Norway
Interview 14	Professor Daniel K. Gardner	Dwight W. Morrow Professor Emeritus of History at Smith College	February 15, 2022	US
Interview 15	Dr. Shuwei Zhang	Researcher at Draworld Environment Research Center	February 16, 2022	Germany
Interview 16	Dr. Muyi Yang	Senior Asian Electricity Policy Analyst at Ember	February 16, 2022	Australia
Interview 17	Wanliang Liang	China Director at the Global Wind Energy Council	February 21, 2022	China
Interview 18	-	Senior Lecturer at the University of Dundee	February 22, 2022	UK
Interview 19	Dr. Erica Downs	Senior Research Scholar at the Center on Global Energy Policy at Columbia University’s School of International and Public Affairs	February 28, 2022	US
Interview 20	Dr. Junyan Liu	Climate and energy project leader for Greenpeace East Asia’s Beijing office	February 28, 2022	China
Interview 21	Dr. Sanna Kopra	Senior Researcher in the Northern Institute for Environmental and Minority Law of the Arctic Centre at University of Lapland	March 7, 2022	Finland
Interview 22	Yiyan Cao	Senior Research Analyst at a global information company	March 10, 2022	China
Interview 23	-	Anonymous working for a global environmental organization and advisor to CCICED	March 23, 2022	China
Interview 24	-	Assistant Professor at the University of California, San Diego	April 13, 2022	US
Interview 25	-	Assistant Professor at Stony Brook University	April 14, 2022	US

Source: Author’s own elaboration.

All interviews were recorded and transcribed. The interviews have normally started with a question on the experts’ general assessment of the current status of the energy transition in China, before the interview moved on to more specific questions about the mediating variables. This course allowed for participants to highlight the key aspects of the energy transition according to their views, without the influence of questions about specific features. Generally, the answers converged to the association with the dimensions previously identified. The interviews play an important role in the dissertation and serve mainly to confirm and bring new insights to the research.

3.4. Conclusion

This chapter has constructed the methodological framework of the dissertation. It has defined the research as an exploratory, mixed methods study, anchored in methodological pragmatism, which allows for a combination of several materials and methods. This delineation is in accordance with the conceptual framework that has defined the 21st century energy transition in Chapter 1 and the theoretical eclecticism adopted in Chapter 2.

The Covid-19 pandemic has brought several challenges and imposed multiple limitations to the research. The online availability of multiple data and the construction of a representative "virtual fieldwork environment" have counterbalanced those restrictions. Moreover, the research has taken advantage of the online setting by inviting experts from various countries and continents.

This chapter is the third and last structural pillar of the dissertation, following the previous chapters and their respective conceptual and theoretical frameworks. The next chapters compose the empirical part of the research. Each mediating variable operationalized here will thus be the subject of one individual chapter.

Chapter 4: The Technology Advantage

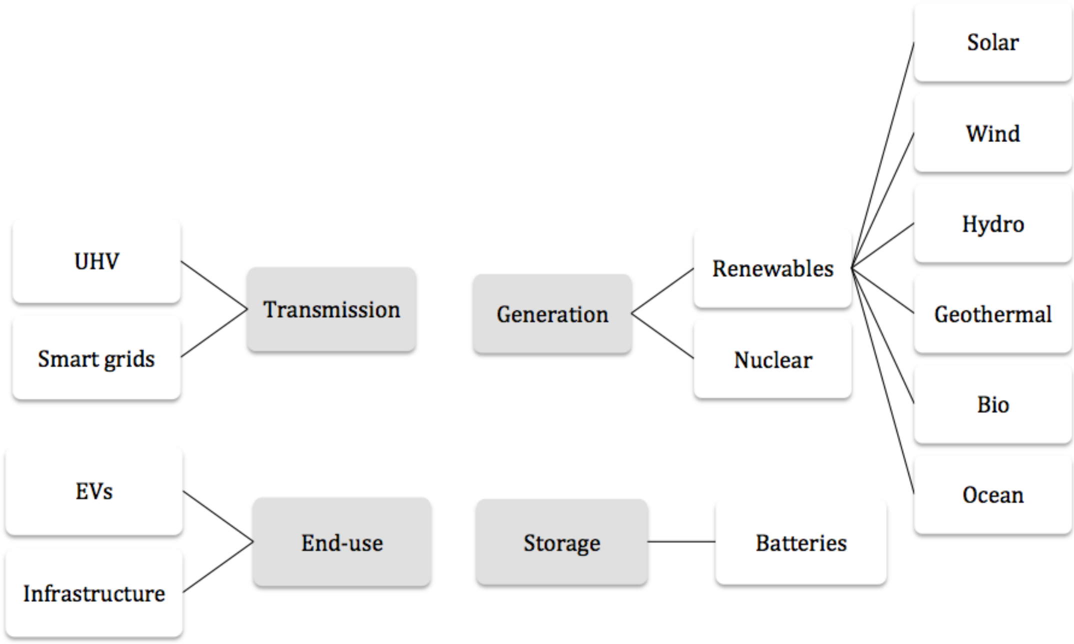
One of the main features of the current energy transition is that it is highly technology-driven. This observation does not imply that previous transitions did not require or stimulated technology innovations. Indeed, the oil and gas sectors have fostered important technological breakthroughs over the last century. From the oil industry innovations since the early decades of the 1900s (see Yergin 1991) to the innovation capacity of the oil and gas industries in the present day (see Drahos 2021), the fossil fuel sector has fostered important technological advances. Nevertheless, the current energy transition cannot be detached from the *necessity* to reach carbon neutrality and mitigate the effects of climate change. This broader contextualization adds certain urgency to the development and scaling up of related disruptive technologies.

While some of these technologies have gained impressive economies of scale in the past years, others still lack economic viability, and we can go as far as to argue that some technologies are yet to be developed if the world is to reach its carbon neutrality goals fast enough. IEA's (2021, 184) roadmap to achieve net-zero emissions by 2050 predicts that almost 50% of the CO_2 emissions reductions in that year will come from technologies that are still under development today. This context of pressure elevates the importance of and the scale needed to address technology gaps in the current energy transition in comparison with previous ones.

Additionally, technological innovations are required in multiple sectors and involve not only the transformation of the resources into actual energy, but also its storage and transmission – put differently, it involves the electrification of the entire economy. The figure below illustrates the main technologies involved across these different sectors and areas[19].

[19] This map does not intend to be an all-encompassing, exhaustive list of the technologies related to the energy transition, but rather an illustration of the main technologies across key sectors.

Figure 7: Technology Map of the 21st Century Energy Transition



Source: Author's own elaboration.

This chapter aims to assess technology as a mediating variable that helps to explain the relation between China's energy transition and its international power. To that end, it first depicts the broader policy framework for the development of clean energy technologies in China. Secondly, it maps the main technologies of the 21st century energy transition and examines their development in the country. Though China's leadership in these technologies is often associated with its huge installed capacity, I also examine other variables such as patents, international market share, and standards.

4.1. From Made in China 2025 to China Standards 2035

While China has for long been known as the world's factory, the Chinese government has worked to change the country's role in global value chains. This transformation has been heavily fostered by innovation, which the government places at the center of China's development philosophy and defines as "the primary driving force for development" in its 13th FYP (Central Committee of the Communist Party of China 2016). Even though this change has been attributed to recent initiatives, such as

Made in China 2025, the transformation has older roots. Almost a decade before the launch of that initiative, the 2006 Renewable Energy Law had already pushed for technological innovation. Its article 12 establishes that scientific and technological research in renewable resources should be a priority in broader science and technology and high-tech industrial development.

That same year China's National Medium and Long-Term Plan for the Development of Science and Technology (2006–2020) (State Council 2006) has set the goal of constructing "a National Innovation System with Chinese Characteristics", a government-led system that would allow for the market to play its role in allocating resources while multiple innovation players would interact. At that time, the government had turned the building of "an innovation-oriented country" into "a major strategic choice for China's future development", signaling the path that the country should adopt in the next fifteen years, with indigenous innovation at its core.

Interestingly, the 2006 plan associates excessive energy consumption and the related environmental consequences thereof with the structure of the country's economy, and energy is one of the main priorities set by the document. Amongst the development paths for this area are acquiring indigenous technology development capacity in nuclear energy, attempting breakthroughs in renewable energy, and prioritizing large-volume, long-distance, and efficient power transmission and distribution technologies. In other words, the plan shows the energy-environment nexus, on the one hand, as part of the problem of the country's lagging economic structure and, on the other, as part of the solution to building an innovation-driven China. The plan was later complemented in 2010, when the government identified the seven strategic emerging industries that it understood as key to drive China into becoming an advanced, internationally competitive economy. Amongst those industries were energy efficient and environmental technologies, new energy, and new-energy vehicles.

Broader in scope than the 2006 National Medium and Long-Term Plan for the Development of Science and Technology, Made in China 2025 has set the country's industrial strategy and consolidated the idea that building an internationally competitive manufacturing sector is "the only way China can enhance its strength, protect state security and become a world power" (State Council 2015). Although the initiative is a plan for the decade from 2015 to 2025, it aims to support China's long-term goal of leading global manufacturing before 2049, and is set to lay the foundation for the Chinese Dream of the great rejuvenation of the Chinese nation.

Made in China 2025 aspires to achieve 70% of self-sufficient supply of key materials by 2025. This strong localization goal aims to support significant qualitative changes in the country's industry: from Made in China to Created in China, from China Speed to China Quality, and from Chinese products to Chinese brands. It is an innovation-driven development strategy that prioritizes quality and is guided by green development – green production is one of the policy's nine strategic tasks and it aims to reach advanced international levels of green development of the manufacturing sector and establish a green manufacturing system by 2025.

Even though Made in China 2025 is a comprehensive manufacturing strategy, here again, energy is central. Amongst the ten strategic industries prioritized by the initiative, two directly concern the energy transition: (i) Energy saving and new energy vehicles and (ii) Electrical equipment. The first comprises the continuing development of EVs and fuel cell vehicles, the improvement of core technologies, the establishment of a complete industrial and innovation system from key components to complete vehicles, and integrate energy savings and new energy vehicles with advanced international levels. The second includes promoting the development of new energy and renewable energy equipment, advanced energy storage, and smart grid power transmission.

What these policy documents show is that for long the Chinese government has understood the development of new energy technologies not only as a means to tackle its climate challenges but also as a way to gain economic leverage through an increasingly relevant industrial sector. The US tariffs on wind turbine and solar panel related products from China have been an attempt to relocate the manufacturing of these technologies to the domestic industry and show the underling strategic advantages of the renewable energy industry for future economic advantages.

In addition to manufacturing, the Chinese government has also been advancing its policy on standards setting. This is an important dimension of technological power because established standards shape the rules that influence technology use and indirectly privilege certain companies. In that sense, China Standards 2035 complements Made in China 2025 in that, while the latter aimed at the development of Chinese manufacturing of key technologies, the former is about governing their use.

When it comes to international standard setting, China is a latecomer, but its dominance over key emerging technologies presents an opportunity for China to expand its leverage also in this area. In other words, while it would be difficult for China to try and change established standards, its rise as a manufacturing power in strategic sectors of the latest industrial revolution facilitates both domestic standards setting and the internationalization of Chinese standards. According to the Standardization Administration of the PRC (SAC), in an article titled “Chinese Wisdom in the Development of the IEC”, green technologies are amongst those key sectors:

> In the traditional industrial fields, international standards are mainly developed by developed countries such as the U.S., Germany and Japan; while in the emerging industrial fields such as highspeed (sic) railway, nuclear power, UHV and clean energy, China has established relatively complete standards systems with relevant standardization work on a par with developed countries (SAC 2021).

China has been enhancing its participation in international standards organizations such as the International Standards Organization (ISO), the International Electrochemical Commission (IEC), and the International Telecommunications Union’s Telecommunication Standardization Sector (ITU-T) (Teleanu 2021). China has also been successful in exporting its technical standards to its allies through the BRI and other infrastructure projects (Rühlig 2020; Gargeyas 2021).

This international engagement is backed by China’s Standardization Law, which was revised in 2017. Among the changes from the 1988 original law is the weight of international activities. While the original law only mentions that “The State shall encourage the active adoption of international standards” (SAC 1988), the revised version stresses a much broader form of international engagement, including the development of international standards:

> The State shall promote participation in international standardization activities, engagement in international cooperation and exchanges on standardization, participation in the development of international standards, adoption of international standards in the Chinese context, and harmonization of Chinese and foreign standards. The State shall encourage enterprises, social organizations, educational institutions, research institutes and other organizations to participate in international standardization activities (SAC 2017).

China formally began to frame its standardization strategy at the beginning of this century in the context of its entrance to the WTO (Wang, Wang, and Hill 2010). Indeed, the 2006 National Medium and Long-Term Plan for the Development of Science and Technology had already mentioned the development of technology standards as a goal of S&T programs and the need for China to actively participate in international standards development and to make China’s technological standards international standards (State Council 2006).

Nevertheless, the debate over China’s standards policy and the potential geopolitical and geoeconomic consequences thereof gained international traction more recently, amid the preparation of China Standards 2035, a blueprint for the country’s standardization strategy and which resulted in the release of China’s National Standardization Development Outline (NSDO) in 2021. This document details the country’s approach toward standards development, and two of its features are particularly relevant for this research: its focus on green development and its international reach.

A substantive part of the NSDO (State Council 2021) is dedicated to “improve assurance for green development standardization”, which includes the development and improvement of standards for carbon peaking and carbon neutrality by upgrading energy conservation standards and improving standards for renewable energy, the optimization of ecological protection standards, the development of standards for the green exploration of energy resources, and the enhancement of green production and green consumption standards.

The NSDO also highlights internationalization throughout its text. The document asserts the need for China to improve the level of internationalization of its standards and sets the goal of changing from a domestically-driven model of standardization to a system that mutually promotes domestic and international interests by 2025. China wants to expand international cooperation on standardization and to "actively participate in international standardization activities". By 2035 it wants to achieve a more robust system of "advanced, reasonable, and internationally compatible standards."

> As a member of the UN and the ISO, China will promote the formulation of international standards in areas such as climate change, sustainable cities and communities, clean water and sanitation, animal and plant health, green finance, digital fields, etc., and will share its experience in standardization to actively participate in international standardization activities [...] and will contribute to the achievement of the UN Sustainable Development Goals. China will also support developing countries in enhancing their capacity to use standardization to achieve sustainable development (State Council 2021).

These two components combined, the emphasis on climate-related goals and the focus on China's international role in setting standards, indicate the continuation of China's strategy to place the clean energy industry at the center of its development policy and use it as a means of international leverage. This path began with policies centered on fostering indigenous manufacturing in key technologies of the future and has reached a new level in the field of standards setting. This could further enhance China's first-mover advantage, this time not only in terms of market share, but also in setting the rules of future technology use and increasing its weight in the governing bodies that design those rules.

This trajectory of technological development shows that China's path from becoming a leading manufacturing power to developing indigenous technologies and to internationalizing Chinese standards has green technologies at its core. While China might not be seen as a leader in terms of climate governance and responsibility since it is also the world's largest polluter[20], this does not seem to be contradictory when it comes to technology. It is rather an opportune field for China to be a leader. The policy and strategy documents that the Chinese government released since the beginning of the 21st century regarding technology signal that understanding.

> I think a lot of people has the impression that china is just where you assemble iPhones but it's not when it comes to renewable energy. This is one of the most strategic areas that the government is promoting as the

[20] This dimension will be the focus of Chapter 6.

> country is moving up the global value chain, becoming a manufacturing power not just a factory (Interview 4).

At the international level, the urgency to tackle climate change and to complete the energy transition equally fosters the opportunity for China to position itself as a key supplier of green technologies. “Whoever has clean technology will have the power in the future. [...] the new power resource will be clean technologies. It is and will increasingly be a new power resource” (Interview 6). In other words, “there is a discourse on green technologies and China wants to be ahead. [...] As the entire world makes this transition, China intends to position itself well in this new economy” (Interview 01).

Therefore, while China is not competitive in an oil-dominated era it is leading the technologies of the energy transition so far, even though it is still distant from most developed and some developing countries in terms of the proportion of low-carbon energy in the energy mix. This frontrunner position gives China significant advantages from dominating market share to governing standards.

> I think that when China’s oil companies entered the global oil market there really was a sense that they were late to the party, [...] whereas I feel like now there really is a sense among Chinese companies that they are not late to the party, that all of a sudden countries and companies around the world [are] eager to go out and to develop, or master, to continue to bring down the cost of the technologies that the world needs for the energy transition, and there is a sense that they can go out there and if they are not already competitive, if they are not yet world leaders, that they have a chance of becoming world leaders (Interview 19).

This reasoning is not limited to the oil industry. It also applies to other conventional technologies, where China is not much competitive. Against this backdrop, green technologies are a different story, “it is the first time that China feels that [it] can compete under the same starting line, if not have a first mover advantage” (Interview 25).

While this section has underlined the connection between China’s technology policy and green development through the analysis of key documents that conform China’s policy framework for the development of green energy technologies, the following part of this chapter looks at those technologies in depth. Whereas the government's position indicates the understanding of the development of green technologies as an opportunity to lead, the next section does not take leadership for granted. It rather examines the status of selected key technologies in China and thus investigates the terms of this potential leadership.

4.2. China and the Technologies of the 21st Century Energy Transition

China has played an uncontested role in scaling renewable energy generation technologies and making them economically feasible in a global scale. Though innovation is often associated with the development of essentially new technologies, experts agree that taking existing technologies, scaling them up, and significantly reducing their costs is a kind of innovation (Interview 5, Interview 12, Interview 24, Interview 25), and in the field of renewables this has been China's main success.

> China's innovation can take many forms. Innovation isn't necessarily the result of basic R&D where you come up with a new material. But innovation can also include manufacturing and process innovations and other ways of take an existing technology and dramatically reduce the cost of scaling it. And I think that's a form of innovation and I think china has excelled in that and that's the reason why it has become such a dominant green player (Interview 24).

Indeed, while the policies mentioned in the previous section clearly indicate the Chinese government's attempt to make China technologically independent, the leading position that China holds today in industries such as wind and solar is the result of what Nahm (2021) calls collaborative advantage, the "process through which firms insert themselves into globalized production systems", and which allows firms to specialize within a global division of labor and "to repurpose existing institutions for application in new industries." In the specific case of solar and wind industries, while in the US and Germany the focus has been on invention and customization respectively, China has focused on innovative manufacturing, that is, R&D for the commercialization and scaling of those technologies (Nahm 2021).

Solar is perhaps the most striking case of China's green technological dominance. Chinese companies began to develop their manufacturing capacity to meet an increasing demand from Europe, especially from Germany. At that stage, transfer of intellectual property and experts from German companies to China helped the nascent industry (Malcomson 2020). Domestically, it was also China's interest to increase the share of renewables, and the government offered significant subsidies to the solar industry.

Today, China has the world's largest solar installed capacity, with over 250 GW at the end of 2020 (IRENA 2022). Considering that China has added 54.88 GW of solar power in 2021, that number is now over 300 GW, and the country expects to add yet another 75 to 90 GW in 2022 (Reuters 2022). Given that the world solar installed capacity is around 709 GW (IRENA 2022), China already had over one third of global installed capacity for solar power by the end of 2020. The US comes next, with about 75 GW of solar power installed capacity (IRENA 2022), which makes it a distant second in the global ranking.

China is also the main supplier of solar PV component, accounting for about 70% of the world's solar panels, and for an even higher percentage of solar PV cells yearly (Adler 2022). In 2021, the four largest panel providers were Chinese companies – Longi, Trina Solar, JA Solar, and JinkoSolar respectively (Shaw and Hall 2022). This position in the global market shows that, in addition to leading in terms of installed capacity, China is also a leader in terms of manufacturing solar power technologies.

The role China has performed in terms of scaling up the production of these materials has been a paramount contribution to the energy transition not only in China but also globally. Nevertheless, data on patents indicate there is also innovation beyond large-scale deployment. The cumulative number of solar patents (encompassing PV-thermal hybrid, solar photovoltaic, and solar thermal) in China in 2021 was about 47% of the world's total (IRENA 2022). "For solar PV industry, Chinese companies are now leading in both production and innovation. So, in the solar industry, China is really dominating" (Interview 17).

China also plays a relevant, though different, role in wind energy. Wind accounts for about 30% of renewable energy installed capacity, which is an even greater share than solar (IRENA 2022). China also has the world's largest installed capacity, with 281.99 GW in 2020 (Our World in Data 2022), which accounts for about 30% of the world total. China also accounts for the largest increases in installed capacity globally. In 2020, it was responsible for 56% of the world's new wind power capacity (GWEC 2021). In 2020, over 400 wind energy companies signed the Beijing Declaration on Wind Energy, an initiative that pledges to achieve 3,000 GW of cumulative capacity by 2060 (GWEC 2020).

In terms of manufacturing, Chinese companies have a significant market share. In GWEC's 2020 Global Wind Turbine Supplier Ranking, the Chinese companies Goldwind and Envision were ranked 3rd and 4th respectively (GWEC 2021a). Nevertheless, according to one industry expert (Interview 17), China's role in wind is less internationalized, with Chinese companies not as active in overseas market yet. He argues that this is because China's own domestic market is big enough for those companies.

A Wood Mackenzie report also indicates that. It shows that most of the new installed capacity by Chinese firms was at the domestic market, with their participation in global markets still low. The report attributes this to an increase in onshore activity in the country, in anticipation of the phasing out of subsidies in 2020 (Barla 2021).

Nevertheless, according to an expert, this is changing, as China's companies start to change their strategies and aim for a larger share of the international market due to an increase in the quality of their products at a competitive price: "in wind power, Chinese companies, in the past decade, have been kind of learning and chasing the leading international companies, and at this moment we cannot say Chinese companies are leading, but I think they are very close to the top companies" (Interview 17).

He is referring to Vestas (Denmark), Siemens Gamesa (Germany), and GE Wind (US), the three main international wind turbine producers, which, in terms of technology, innovation, and experience, are still ahead, according to him. This gap, however, is getting smaller, which has reflected especially in emerging markets, where Chinese products are very competitive (Interview 17). Considering these recent changes, he thinks that "in a close future Chinese companies may be able to get projects in mature wind markets in Europe".

China also accounts for about 40% of the world's cumulative patents of wind energy technology in 2021. In terms of net additions, in 2019 China accounted for around 72% of the world additions that year (8,311 out of 11,527). Only five years earlier, in 2014, this share was much lower, with China accounting for around 32% of new additions (3,378 out of 10,543) (IRENA 2022). These numbers indicate, like in solar, that China's innovative role has not kept restricted to large-scale manufacturing.

Hydro is another central pillar to the energy transition in terms of power generation, as it represents the largest share of renewable energy power capacity, both in the world and in China. In 2020 this kind of energy (including pumped storage) represented 40% of China's renewable installed capacity (IRENA 2022) and according to the International Hydropower Association, China's hydro installed capacity accounts for around 28% of the world total (IHA 2021). Moreover, China has around 43% of the world's total cumulative hydropower patents and has been responsible for the majority of net additions over the last years – the country accounted for about 68% of global net additions in 2019 (IRENA 2022).

Geothermal energy currently accounts for only a small share of the world's total renewable energy installed capacity (0.5%) (IRENA 2022) and for an even smaller share in China[21]. The country's installed capacity in 2018 was around 25 MW only – for comparison, the US has the largest installed capacity, with 2,444 MW that same year (IRENA 2022). While it is true that not all the countries can develop this kind of energy since it requires specific natural conditions and resource availability, this is not the case in China. The current stage of development of geothermal power there is "inconsistent with the country's vast geothermal resources, and its determination to pursue renewable energy as a way to reduce greenhouse-gas emissions for climate change mitigation" (Huang 2012). The situation is different in district heating, which is still heavily fueled by coal. China has implemented plans to clean this sector by adding renewable heat sources, especially biothermal and geothermal (Keating 2021). This is nevertheless a still incipient effort. Surprisingly, though, China accounts for around 45% of the world's geothermal patents (own calculation based on data from IRENA 2022).

[21] The share of geothermal energy in China is so small that it is not specified at IRENA's (2022) database.

When it comes to bioenergy, China has the largest installed capacity in the world, with around 18 GW, which represents around 15% of the world's installed capacity. This kind of energy only accounts for 2% of the country's renewable installed capacity, but its share in the world's renewable energy installed capacity is also relatively small (around 4%). In terms of technological innovation, China has around 34% of the world's cumulative bioenergy patents (IRENA 2022).

With less than 5 MW of installed capacity, marine energy does not play a significant role in China's energy transition but again it is worth noting the relative minor relevance of this kind of energy globally. In France and Korea, which have the largest installed capacity, marine energy only accounts for 0.4% and 1% of renewables installed capacity respectively. All things considered, the country still ranks 6th in terms of world installed capacity and accounts for around 33% of ocean energy patents (IRENA 2022).

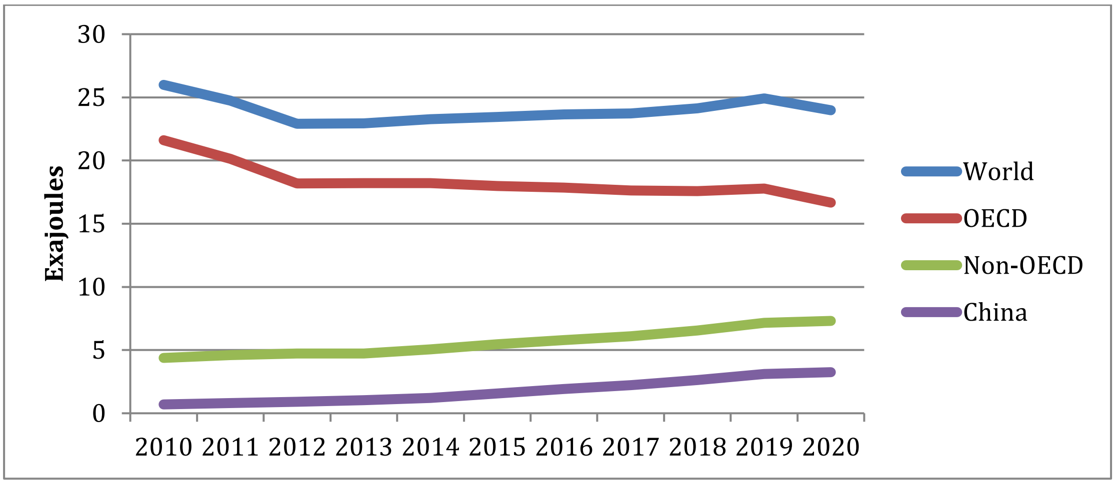
Among renewable energy, solar, wind, and hydro play a major role in helping to position China's technological leadership. Nevertheless, nuclear is also part of China's energy transition and contrary to renewables it can be constructed near the places with higher demand, which is an advantage. Even though only 4.6% of China's current electricity generation comes from nuclear, this share accounts for a production of 348 TWh, which is the equivalent to 12.5% of the world total. This makes China the third largest nuclear electricity producer and the third largest nuclear installed capacity of the world, only behind the US and France (IEA 2021a).

More important though is the potential of future expansion of nuclear energy in China, based on the country's current expansion. While the tendency among the OECD countries is to diminish or even stop the use of nuclear[22], China has been increasing its consumption. As the figure below shows, the country represents a significant share of non-OECD countries' nuclear consumption. From 2009 to 2019, China's annual growth rate of nuclear consumption was 16.7%, while the world had a negative rate of -0.2. In 2020, while China alone presented a growth rate of 4.3%, the world's was -4.1% (BP 2021), and as the table below shows, China's annual growth rates are significantly higher then that of the non-OCED counties. China has thus

[22] However, the emergence of a new generation of advanced small nuclear reactors will likely affect this, especially in the context of the current energy crisis brought about by the invasion of Ukraine.

been able to continue developing nuclear technology while many countries have stopped altogether.

Figure 8: Nuclear Energy Consumption



Source: Own elaboration based on BP 2021.

Table 4: Annual Growth Rates of Nuclear Energy Consumption

	2009-2019	2020
World	-0.2%	-4.1%
OECD	-1.8%	-6.5%
Non-OECD	5.6%	2%
China	16.7%	4.3%

Source: Own elaboration based on BP 2021.

China currently has 53 operable nuclear reactors and 19 under construction and continues to lead new nuclear build (World Nuclear Association 2022). The country also plans to build at least 150 new reactors in the next 15 years, which is more than the rest of the world has built in the last 35 years (Murtaugh and Chia 2021). The technology has come from France, Canada, Russia, and the US. Of special importance for China was the US-developed AP1000 (from Westinghouse), which involved major technology transfer and became the basis of technology development in China. This led to the local development of CAP1400, a reactor with Chinese intellectual property rights that was the basis of a policy of exporting nuclear technology (World Nuclear Association 2022). Under development since 2008, the CAP1400 was completed in 2020. By that year, 1,052 patents and 6,513 intellectual property applications connected with this third-generation nuclear technology had been registered (Xie 2020).

In January 2021, China achieved a significant advance in its nuclear technology development when it put its independent third-generation reactor design Hualong One, to which China has exclusive intellectual property rights (CNNC 2022), into commercial operation. China put its second Hualong One power generator into commercial use in March 2022. This domestically-developed Chinese technology has over 700 patents, 120 software copyrights, and 411 core components, all of which were designed and manufactured domestically (Guo 2022). According to China National Nuclear Corporation, Hualong One, which is qualified to export, "has lifted China's nuclear power technology to a globally leading position and become a strategic tool for the government to promote nuclear power technologies abroad" (CNNC 2022). The building of their own nuclear reactor is something China is very proud of (Interview 14).

Most experts interviewed for this research on this issue think nuclear will play an important but not a central role in China's energy transition in comparison with renewables (Interviews 2, 3, 10, 17, and 23). Reasons for that include the fact that while the cost of renewables has come down very quickly, the cost of nuclear has not changed significantly (Interview 3), as it remains an expensive investment (Interview 17, Interview 23). There are also safety concerns (Interview 3, Interview 17), and the long time it takes to build a new plant (Interview 2, Interview 17). Still, such a marginal role would account for a significant share. Some of these experts indicate that the future share of nuclear could reach between 10% and 25%, which would still be very relevant for China's energy transition. Similarly, an IEA (2021b) roadmap shows that nuclear primary energy demand would reach 15% in 2060, which would mean almost quintupling it between 2020 and 2060. So the tendency is that nuclear development in China increases. Besides, nuclear is more resilient than renewables in the sense that it does not have the same intermittency and curtailment problems – it can be installed directly at the industrialized Eastern provinces.

Both the size of nuclear projects and the decades-long time it takes to develop them indicate the low probability that China will export a significant amount of nuclear power plants worldwide (Interview 17, Interview 2). Nevertheless, the country's latest nuclear technology has been framed as playing "a principal role in accelerating China's nuclear power ‘going global’ strategy and promoting international production cooperation” (CNNC 2022a). Hualong One’s first overseas unit is already operating in Pakistan, and an agreement to build a power station with this technology in Argentina was signed in the beginning of 2022 (Global Times 2022, Ng 2022). Additionally, the UK has approved the Hualong One design that could be used at a planned nuclear plant in Essex. If political controversy over Chinese participation in Britain’s nuclear sector (see The Economist 2022 and Cahill 2022) is overcome, and the project is completed, this will be an important milestone for Chinese nuclear technology, as it would be deployed by a developed country.

This constellation of clean energy generation technologies is impressive but not enough to foster the 21st century energy transition. Though deploying renewable energy is a major part of the effort to decarbonize the economy, its use also presents problems that require technological solutions. Two of the main challenges in this area are curtailment and intermittency. Renewables are usually generated far from the big urban centers where energy is mostly needed, which often results in energy loss in transmission. There is also a mismatch between peak power generation during the day and peak demand during the evening and a varying seasonal output. Developing solutions in transmission and storage is thus paramount to complete the energy transition. And in these fields too China is making important contributions.

In the field of transmission, China has been promoting ultra-high-voltage transmission (UHV) lines, which are able to avoid energy losses while transmitting power through long distances. In September 2015, President Xi signalized the importance for China to foster those lines when he introduced the idea of creating a Global Energy Interconnection (GEI), at the UN Sustainable Development Summit, and in March 2016 the Global Energy Interconnection Development and Cooperation Organization (GEIDCO) was created. GEI has three components (smart grid, UHV, and clean energy), and it is particularly interesting that the main backbone of the initiative is UHV, considering China’s central role in further developing and implementing this technology. A report by the Paulson Institute prepared by the staff of the Center for Energy, Environmental, and Economic Systems Analysis at the Argonne National Laboratory, and published before Xi’s proposal at the UN shows China’s efforts to set standards to UHV technology both at home and internationally. According to the report, “the potential internationalization of China’s domestic UHV standards will almost certainly affect the global market share for both Chinese manufacturers and dominant multinational companies" (Paulson Institute 2015, 1).

The momentum for Chinese UHV technologies to become global standards, and thus gain a larger share of the global market, was due to the fact that China was the only country implementing it on a large scale and because there was not yet a prevailing international UHV standard. In fact, at that point, China had already made some progress in that direction by establishing the joint development of a UHV project in Brazil and by promoting three of its UHV standards as international ones at the Institute of Electrical and Electronics Engineers (Paulson Institute 2015).

Even though other multinational companies had already developed UHV technology, especially Siemens (Germany) and ABB (Sweden/Switzerland), State Grid Corporation of China (SGCC) was the first one to use it in a large scale. In fact, in the beginning of the 21st century, there were no UHV lines (AC or DC) in commercial operation, and no integrated system of UHV AC and UHV DC existed in the world (Xu 2019). Since then, SGCC became a global leader in long-distance, high-voltage transmission technologies:

> Its UHV transmission lines, based largely on its own design and on Chinese-made equipment, span longer distances, operate at higher voltage, and experience lower power loss than any competitor has achieved. These advances provide China with an infrastructure framework that has long-term lock-in effects on future development. In so doing, SGCC has built a global brand and helped some Chinese electric equipment manufacturers to move from import dependence to a new status as globally competitive exporters. By mastering the UHV technologies and accumulating experience in constructing and operating UHV infrastructure, SGCC has become a major global player in this demanding field (Xu 2019, 253).

This change in China's position from technology dependence to leadership indicates that, also in the transmission sector, China is not just replicating foreign technology, but actually promoting innovation. According to the Paulson Institute's (2015) report, this could facilitate the internationalization of Chinese UHV standards, and challenge other countries and multinational companies not only in terms of market share, but also technologically.

As of January 2021, China had over 40,000 km of UHV lines (Fishman 2021). Globally, the Belo Monte UHVDC project in Brazil is the SGCC's showcase for the overseas deployment of its UHV expertise – 48% of SGCC's overseas assets are located in Brazil (Cariello 2021). The project is displayed at GEIDCO's website to illustrate the benefits of this technology: "UHV technology is a symbol of China's innovation which will promote grid upgrade across the world" (GEIDCO 2022). Besides Brazil, SGCC has also invested in transmission lines (not necessarily UHV) in the Philipines, Portugal, Australia, Italy, Greece, Oman, and Chile. Additionally, the company's projects have already crossed borders, as it has built ten transnational transmission lines with China's neighboring countries and cross-border projects such as the Mindanao-Visayas Interconnection Project between China and the Philipines and the Ethiopia-Kenya DC Power Transmission Project (SGCC 2022).

GEIDCO aims to strengthen domestic interconnection by 2035, intracontinental interconnection by 2050, and intercontinental interconnection by 2070, which would entail nine horizontal and nine vertical channels linking the world (GEIDCO 2022). Nevertheless, it is not likely that China's knowhow in UHV lines will be enough to overcome geopolitical challenges and advance towards the goal of developing a global grid. According to one energy technology expert, "technology is not a barrier, it's about how different countries or different continents can really work together to implement such a strategy" (Interview 25). Nonetheless, considering the slow progress to date on integrating power grids and markets between provinces in China and for the grid to absorb renewables within the country (Interview 23), some experts still point toward technical, institutional, and political challenges to the idea of building a global energy interconnection. Finally, another challenge is the economics of the project, considering the trend of declining costs in storage: "I don't think making ginormous UHVDC grids crossing the globe is ever going to be more cost effective than having more strategic local storage solutions to deal with some of those issues like long duration storage" (Interview 24).

Still even assuming that China will not be able to implement GEI, its technology leverage in UHV lines, through large-scale deployment and standards setting, is relevant per se. It presents a connectivity solution for the geographical mismatch between production and consumption of renewables and the derived problem of curtailment. It is especially important for large countries and for cross-border energy transmission. Moreover, even though there is also a tendency to move toward a more distributed and localized transmission system centered on microgrids, those are not contradictory trends:

> that grand grid can help if we move toward a renewable-dominated energy system but at the same time we can for sure use microgrids to provide the resilience that such a grid might need in the face of disasters or other challenges. I think we need both but each has its own challenges for sure (Interview 25).

In the storage sector, China is also significantly increasing its capacity. In 2020, China's operational energy storage project capacity totaled 35.6 GW, which accounts for 18.6% of the world's total capacity, with a growth of 9.8% in relation to the previous year. Pumped hydro accounts for the major part of installed capacity (89.3%), but electrochemical energy storage (9.2% of installed capacity, 88.8% of which is composed of lithium-ion batteries) has presented an impressive growth of 91.2% from 2019 to 2020. In fact, China accounted for 33% of the world's new installed electrochemical energy storage project capacity in 2020 (CNESA 2021). Besides, the National Energy Administration and the National Development and Reform Commission have recently released a proposal to reach 30 GW of energy storage capacity from non-pumped hydro energy storage by 2025 (Jenkins and Wilkinson 2021), about ten times the current capacity of a little over 3 GW (CNESA 2021). China has also been investing a lot in the next generation, cutting edge batteries. That includes investments in scaling up compressed air storage, thermo storage, and flywheels (Interview 10).

Advances in such a scale will bring down costs further and allow for Chinese companies to gain more market share. For instance, according to China Energy Storage Alliance (CNESA 2021), technological progress was responsible for reaching the cost inflection point of batteries that led Chinese companies to expand towards the overseas market because of their superior safety. Additionally, as with UHV, the storage sector is also important for China's broader standard-setting goals. In 2018, the government authorized CNESA to implement an association standards pilot program, and nine association standards have been released so far since then (CNESA 2021).

From power generation to transmission and storage, China has made significant progress in the key technologies of the 21st century energy transition and has consolidated a global leading position in these industries. The progress of such developments shows an evolving path in the way China unfolds innovation. In renewables, it started with the manufacturing and deployment of generation technologies in large scale, which can be seen in the country's enormous installed capacity. In transmission, the unprecedented scale of China's UHV use is also illustrative. This process of scaling up resulted in substantial cost reductions with worldwide impact on renewables use. It then included significant incremental innovations as shown by the large share of Chinese patents in every renewable energy technology. In nuclear, the successful completion of a Chinese reactor design is also an example of this stage of innovation. Finally, China started to make some progress also in setting international standards for these technologies.

> Once China has some dominance in the market and it has some power to set up standards, that's the goal of the technology development. They have a saying [in China] that the first tier of company set up standards, the second tier of company does the manufacturing, and the third tier of company provides the supply. That is in general the mindset [it] is trying to set up, move up [the] ladder of innovation and set up standards (Interview 25).

In addition to the technologies mentioned in this chapter, China has become increasingly relevant in the EVs sector, with currently 99% of all the electric busses in the world running in Chinese roads (Interview 13). Moreover, there are other promising developments still in initial stages in China right now that indicate the country's continuing wish to advance its green technology industries. For instance, China will start to test an experimental nuclear reactor fuelled by thorium, which could produce safe and cheap nuclear energy and generate less radioactive waste at the same time. China is not the first country to test this element, but it is the first to have a chance to commercialize the technology. Thorium is a waste product of China's rare earth mining industry and would thus be an alternative to imported uranium. This will be the first molten-salt reactor operating since the US shut theirs down in 1969, and it will be the first one fuelled by thorium (Mallapaty 2021). China has also been successfully experimenting on fusion based on the experimental advanced superconducting tokamak (EAST), popularly known as China's "artificial sun" (Xie 2022, Zhang and Zhao 2022). Other examples include China's lead in floating solar (Nelson 2019), the construction of floating nuclear power plants (Chen 2021), and increasing investments in tidal (Frangoul 2020), geothermal energy (Robbins 2020), and offshore wind power (Interview 3).

> Every potential avenue for technology they're throwing money in to see if they can figure out a great solution. That's pretty much the case in every technical area that touches on China's energy transition. If there is need for R&D, for progress to solve a certain problem in the grid or energy system then there's a bucket of state money to research (Interview 10).

4.3. Preliminary Results and Conclusion

This chapter has assessed the role of technology as a mediating variable between the current clean energy transition and power in international relations in the case of China. To that end, that is, in order to assess whether China's position in the technology dimension helps to explain how the energy transition influences China's international power, I have taken two steps. The first was to examine the country's official policies toward technology and the green industry, and the second was to assess the key technologies of the energy transition and evaluate China's role in their development.

In the first step, the analysis of those policies combined with opinions from selected experts has shown that green technologies have been strategic in China's technology policy and the reasons for that are twofold. First, the urgency pressing countries all over the world to tackle climate change creates an opportunity for those holding the technology solutions to achieve decarbonization as fast as possible. Second, while China is a latecomer in many industries, it finds a different, more opportune context when it comes to those clean energy technologies. Moreover, this section also found that technology innovation in this field in China has taken multiple forms. It started with the scale up of technologies developed outside of China, which resulted in tremendous cost decline and allowed for the large-scale deployment of renewables not only in China but worldwide. It then involved the goal to develop indigenous technology and transform the country's industry from Made in China to Created in China. Finally, it has also encompassed the aim to set international standards. Though these types of innovations form a kind of technology ladder, the government policies toward each type are not necessarily chronologically organized and also overlap across time.

In the second step, the analysis of installed capacity, patents, standards, and internationalization of key technologies of the energy transition has demonstrated China's global leading position in the field. This empirical account has found that China either dominates or co-shares an important position in the majority of the technologies assessed. As for those technologies for which this leadership does not apply, their usage is also incipient globally – such as in the case of geothermal and ocean energy. Nevertheless, even for those sectors China is either expanding its capacity or researching incremental solutions. The country also accounts for significant shares of clean energy technologies patents and is proposing and trying to implement connectivity solutions using UHV transmission lines in a global and unprecedented scale. China is also actively aiming to set international standards in these technologies and has been particularly successful in the transmission sector. The assessment of such indicators for those technologies has again showed how China's technological leadership in this particular field has evolved over the years: from enhancing its clean energy capacity and fostering economies of scale that have impacted the entire global market to fostering innovation, setting standards, and planning global-scale projects.

When it comes to the technologies of the 21st century energy transition, China is not simply the world's factory. It rather has a leading role in the technology dimension of the energy transition, and there is a clear connection between this role and Beijing's political goals regarding its position in the international system. The connection between technology as a mediating variable and the energy transition, on the one hand, and the way it affects China's position internationally, on the other, is, therefore, a strong one and a central part of the theoretical mechanism of this dissertation.

Chapter 5: Toward New Energy Security Dynamics

Energy security is a major concern for any nation, and in China it has been one of the government's top priorities. This chapter aims to assess how the energy transition impacts China's energy security, and how, in turn, post-transition energy security could impact China's position internationally. The chapter thus analyzes how the energy security works as a mediating variable and the role it plays in the overall theoretical mechanism of the dissertation.

This chapter proceeds in three steps that are divided in three main parts and a concluding section. The first part traces the evolution of China's energy security and the changes the concept has undergone over the years. The second depicts the current energy security implications of China's present energy situation, which includes not only energy dependence on imports, but also geopolitical risks along maritime and overland transportation routes and pipelines. Finally, the third part assesses future security implications of China's energy transition, which lead to a more self-sufficient and energy secure context even though new risks and dependencies emerge.

5.1. The Evolution of China's Energy Security

The centrality of energy security as a strategic asset for a nation's development is an uncontested fact that holds true for every country, even though its meaning and weight changes across time and geographical space. In China, the situation is not different. As the country faces several challenges not only in supply but also in its own economic development, the concern about energy security has been at the government's top priorities. During the 2021 energy crisis, several official declarations have highlighted the vital importance of assuring energy security in China. However, those statements have also raised a broader discussion among researchers and policy analysts on what energy security in China actually means amid the country's recent climate targets and energy transition. In addition to the 2021 power shortage, increasing international tensions have also resulted in policies aiming to achieve self-reliance, which is not limited to but includes the energy sector.

This is not the first time that China seeks to increase its self-reliance. When put in historical perspective, this feeling has accompanied China for a much longer time and is the result of several episodes of energy scarcity and international isolation:

> [...] it's a regime after a long-time war, the II World War, civil war, the Korean war, so the whole country is in a very poor situation, everything needs to [be] rebuilt, recover from the war. But then there was no source, no energy sources, no support from the outside world except from the Soviet Union [...]. But then in the 1960s China broke up with the Soviets, so it [was] isolated from both sides. So it's really an isolated country, no allies, no support. So this history has a very deep memory on this country [China], the country has a very impressive memory of this history. There was a slogan at that time, we have to reach the self-[dependency], be self-sufficient. This is the background of all this energy transition, energy development in general. So the energy insecurity is the general feeling, it's a mark in their genes, they always feel insecure. And not only [in] the energy [sector], [but also in] many other things like technology. So they always try to produce everything by themselves. And this is a cultural thing [...].so self-dependency, self-sufficiency are the two keywords to understand the feeling and also the regime always has the feeling that the outside world is hostile to them. Even if they show some friendship it might be fake and not last long. So they always prepare that someday this will be gone and [China] will be on [its own] again. If you understand this background [...], all the policies and reactions, it will be reasonable, you understand in a different way (Interview 7).

This perception of being insecure remained in more recent years. In the decade between 1994 and 2004, there was a growing sense of insecurity in the country, as China had become a net oil importer, and the dependence on imported oil was increasing (Interview 19). This feeling was further reinforced by the worldwide general perception at that time that the world was running out of its limited resources. As the energy scenario changed, especially with the shale revolution in the US and the discovery of the pre-salt oil reserves in Brazil, discussions also shifted their focus from peak oil to energy abundance (O'Sullivan 2017, Yergin 2020, Interview 19). However, although in a different context, the feeling of insecurity still remains and is encouraged by the current state of affairs in international relations. For instance, the trade war raised the concern that the Trump administration could make it difficult for China to get critical inputs for its economy, which included the energy sector and the related technologies (Interview 19). The US's tough policy toward China continued with the Biden administration, and now the war in Ukraine further complicates the geopolitical scenario.

This historical context based on external factors affecting China's reliance on foreign resources is one of the dimensions of how China understands and deals with energy security. The other dimension is composed of its domestic priorities. In China, the government's legitimacy does not derive from the popular vote but rather from its accomplishments, that is, from its capacity to deliver results (Interview 01). It is sustained by a growing economy and the distribution of income (Interview 06). This conception of legitimacy therefore entails stability and economic growth: "the real concern is about the economy, and the economy is always about stability" (Interview 14)[23].

> [...] [T]he first priority is the regime's stability. So often when you talk about China's international role or their domestic policy toward the energy or other things, the keyword is stability, they really want to stay in power forever. If you understand this essential thing you can understand anything. So, for the stability they need legitimacy to stay stable (Interview 07).

This legitimacy-stability-and-economic growth tripod that characterizes energy security from a domestic perspective explains the share that coal has had in the country's mix. Not only has coal lasted so long to keep the economic growth but it will also probably continue central despite China's climate pledges (Interview 08). Nevertheless, the emphasis on the economy does not mean that the environment will necessarily be sacrificed for the economy, because the energy transition could also be a driver for economic growth[24]:

> I think if it's a tradeoff between economic growth in momentum versus environmental protection, economic growth wins out when there is a concern about economic growth but they are also mutual beneficial elements, which I think is one of the big drivers of the energy transition or of the 30-60 [goals] is that there is an industrial angle, so to the extent that environmental protection, sustainability can create new industries and can become a motor of economic activity then they are mutually reinforcing but to the extent that the energy transition means less coal in the energy mix in a time when the Chinese economy is still growing rapidly and it still needs reliable sources of energy, then coal is not going to be phased out as quickly as one would expect (Interview 12).

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[23] This is not to say that only stability and economic growth provide the government with legitimacy, but these are the main elements for the energy security sphere. For instance, another major driver of regime's legitimacy is the deep, massive, and constant operation of the propaganda machine emphasizing the benefits of the loyalty to the Communist Party, which has been strengthened during Xi's ruling.

[24] As was explored in Chapter 4.

Considering the high priority of stability, one way in which climate fits this discussion is through pollution. The tipping point of this problem was the so-called 2012 "airpocalypse" in Beijing. The heavy smog that covered China's capital that year raised popular dissatisfaction to the point that the regime felt the instability and successfully tried to reduce the pollution and clear the air (Interview 07). Just a few years before that, the air quality was just as bad, but the local Chinese would refer to the pollution as fog even though it was smog (Interview 08), so there has been an increasing environmental awareness, even though still highly focused on pollution and not on broader climate change concerns at that point. So, "[the energy transition] has been important as far as reducing visible pollution [...], so it's important for the Party when it creates kind of social pushback [...], when it causes a social instability issue (Interview 08). "The deep reason and the main interest [for the energy transition] is the stability" (Interview 07).

This context points to a specific understanding of energy security in China that is not limited to the often-used security of supply concept but one that also encompasses broader social, political, and economic components. It also highlights that the energy transition is not always a part of the energy security but that sometimes they actually compete with one another: "[...] it would be the foundation of China to develop its economic system, to keep social stability. So when there is a conflict [between energy security and the environment], you would see energy security is a priority" (Interview 22).

The meaning of energy security and the idea that it would most likely be a government priority over the energy transition was highlighted by the 2021 energy crisis. Experts point to several reasons for that crisis. Mainly, it was related to coal power generators curtailing output due to the high price of coal and not the lack of coal per se (Interview 03), though other factors include the fact that China had imported less coal from Australia and that the government had forced small-scale coal mines to shut down (Interview 17). In turn, this turbulence in the existing system could not be resolved with available clean alternatives since, for instance, China had less wind than normally at that time (Interview 16, Interview 17). These events have exposed the country's vulnerabilities and the limits of an accelerated energy transition:

> recently China is saying that we need to establish before breaking. That means that China will progress its energy transition in a timely and orderly manner. So it will try to promote the development of clean technology or clean resources first to a point that it can replace fossil fuels in meeting energy electricity or energy demand in all circumstances (Interview 16).

At that occasion, China’s vice-premier Han Zheng, who oversees the power sector, told state-owned energy companies that they should secure supplies at all costs, which led the country’s coal producers to pledge to increase output (Hume and Sanderson 2021). President Xi also made declarations that indicated a potential shift in China’s short-term climate policies. For instance, he stated that climate policies could not impact “normal people” and that, in the near-term, the country would prioritize jobs over the environment (Gatten 2022). These declarations from government representatives are directly linked to the backbone of China’s energy security tripod (legitimacy, stability, and economic growth). They also resonate some popular perception that emerged during the 2021 energy crisis that the power shortage happened because of environmental protection and China’s climate goals (Bloomberg News 2021), even though the crisis was much more related to coal and electricity prices:

> Some people might say [that] as renewable energy increases we are getting more power blackouts and it is because they are renewables and therefore we have to maintain our coal power capacity. In reality part of the reason why the providers there were unprofitable is because there are too many of them [...] and collectively they become less profitable when the coal price is high (Interview 03).

However, Xi also stressed the need to “stick to the overall planning and ensure energy security, industrial supply chain security and food security at the same time as cutting carbon emissions” and that “economic development and the green transition should be “mutually reinforcing” (Gatten 2022). Those declarations do indicate the importance that the government attributes to achieving decarbonization as well as energy security, but they also imply that the government treats these two processes as different, and to some extent even as opposing, pathways that need to be reconciled. This potential contradiction is evident in Xi’s recent speeches after the 2021 power shortage and amid a slower economic growth. For instance, he has affirmed that "the gradual withdrawal of traditional energy must be based on the safe and reliable replacement by new energy" (Gatten 2022) while at the same time stating that China needs to guarantee enough coal and the steady growth in oil and gas output (Boomberg News 2022).

From the exclusive perspective of the energy sector, that is, excluding notions of great power responsibilities[25] and the urgency in achieving net zero[26], many experts agree that assuring energy security is not only part of the energy transition but also a paramount condition for it (Interview 25). And this notion does not apply exclusively to China, but to every other country:

> No country [...] is going to achieve climate targets at the expanse of degrading quality of power supply, energy security and power reliability. It makes no sense politically, it makes no sense from a social-welfare perspective. So if they are facing severe shortages and in the short term the only way to alleviate those in their minds is to dig up more coal then they are going to do that (Interview 24).

The invasion of Ukraine has highlighted this point, as the response to the energy crisis that unfolded has been primarily met with fossil fuels. Europe, where fracking is prohibited in many countries due to its high emissions, has increased its LNG imports from the US, and Germany is reopening coal mines, while the US has negotiated sanctions with Iran and Venezuela in exchange from those countries increasing their oil production in an attempt to keep prices under control. However, in normal circumstances, some countries do sacrifice more than others. For instance, when Germany decided to increase the proportion of intermittent renewable energy over stable sources, its energy security decreased. Moreover, EU emissions trading system has been an important effort for decarbonization. Following this logic, many of those experts make a distinction between short and long term energy policies.

> I think for Li and for Xi and probably for other leaders around the world the immediate is the most important. In winter in china the most important thing is to make sure that people have the energy that they need to stay

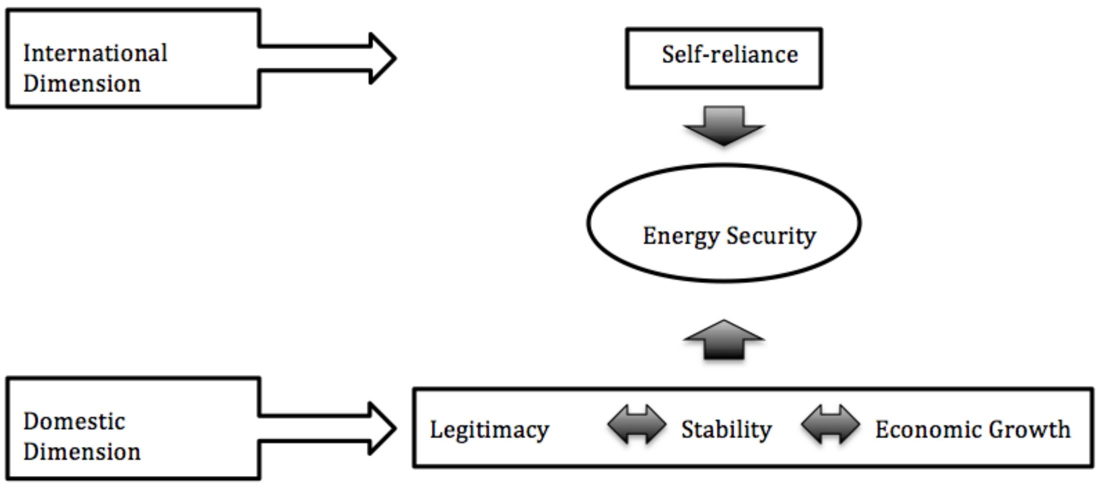
[25] An element discussed in Chapter 2.
[26] As was discussed in Chapter 1.

> warm and to have their lights on so right now that is more important than carbon peaking by 2030 and carbon neutrality by 2060 (Interview 19).

In this sense, while short-term measures could result in an increase in coal deployment, the direction of long-term policies toward climate goals and the energy transition should not be affected (Interview 03, Interview 12, Interview 18, Interview 23, Interview 24, Interview 25). Put differently, it is unlikely that China will reverse its climate goals, even if it increases the use of coal in the short term – as Germany is unlikely to do that as well, even as it resorts to coal during this crisis. However, this does not change the fact that these short-term energy policies affect long-term climate policy in terms of speed, consistency, and constancy.

The concept of energy security in the Chinese context therefore entails two dimensions, that is, self-reliance and independence from foreign supplies, on the one hand, and legitimacy, stability, and economic growth from a domestic perspective, on the other. The figure below illustrates that structure.

Figure 9: China's Conception of Energy Security



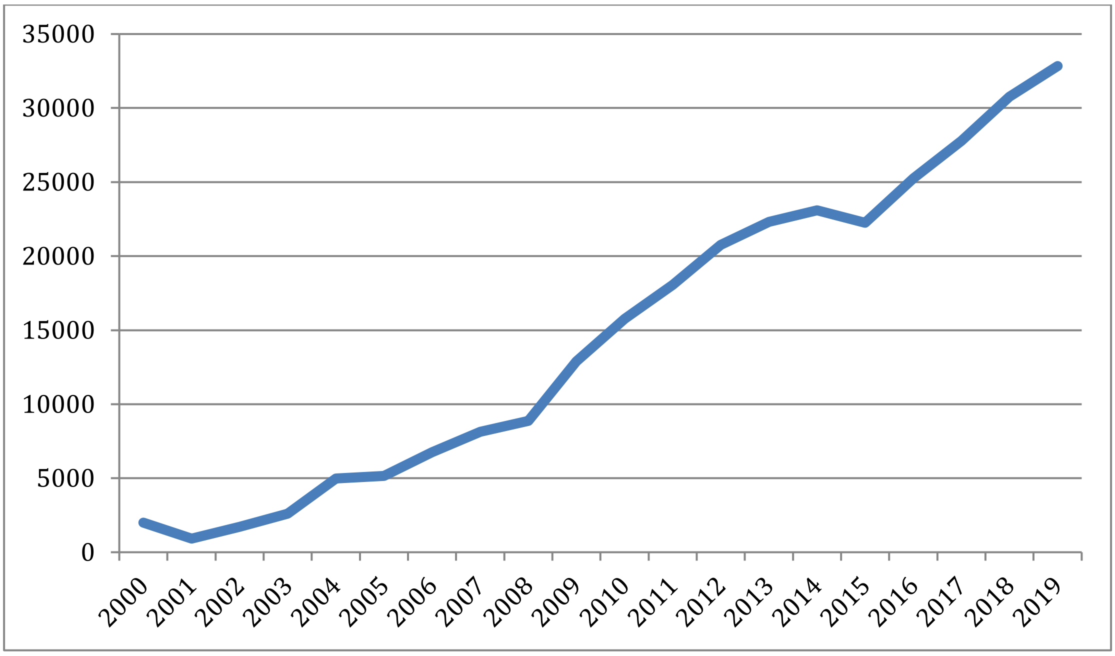
Source: Own elaboration.

This conceptualization also helps to explain China's large-scale deployment of coal upon which the country has built its economic development over the past decades. In this context, coal has been "the anchor of energy" due to its low price and domestic availability (Interview 07). Put differently, in China, self-reliance is usually understood to mean coal (Interview 23), and when faced with power shortages and energy security concerns, the emphasis will be on domestic energy supply, which essentially implies deploying coal (Interview 25). As one expert explains, “in terms of the energy situation there is a saying to describe it and this is a very popular and common and adopted even by the high ranking policy makers which is: China’s energy situation is rich on coal, short on oil and lack of gas” (Interview 07). To further understand this dependence on coal and the insecurities that have derived from foreign dependence on oil and gas, the next section explores the current energy scenario in China and the geopolitical dynamics that have characterized it.

5.2. Current Energy Scenario: Foreign Dependence and Geopolitical Constraints

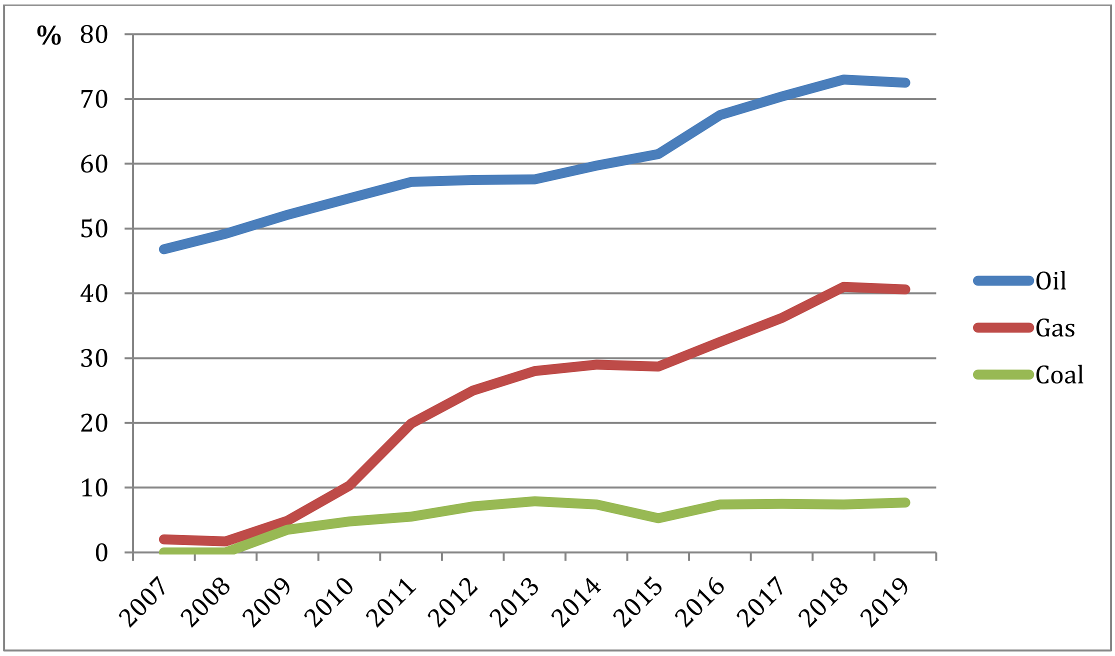
Over the last decades, China’s fast economic growth and large population have impacted China’s increasing energy needs. Since 2006 it has been the world’s largest energy producer, but since 2009 the country has also been the world’s largest energy consumer. As the two graphics below show, China’s net imports have increased sixteen times since the beginning of the century and six times since the enactment of the Renewable Energy Law and the beginning of the 11th FYP period. Moreover, this increase was mainly driven by China’s heavy reliance on fossil fuels and its dependence on oil and gas imports.

Figure 10: China's Net Energy Imports in the 21st Century by year in TJ



Source: Own elaboration based on data from IEA 2022

Figure 11: The Evolution of China's Dependency of Fossil Fuels Imports



Source: Own elaboration based on IEA 2020.

In 2019, China accounted for two-thirds of incremental global oil consumption (EIA 2020) and imported over 70% of its oil (IEA 2020). This resource accounts for 20% of China's total primary energy consumption, and there is an increasing gap between the country's production and consumption. In 2019, China's petroleum consumption was almost three times higher than its production, which means a gap equivalent to 9.6 million barrels per day (EIA 2020). In 2017, China became the world's leading oil importer (Reale et al. 2020). Though China has been trying to diversify its oil suppliers, it still relies heavily on Middle Eastern countries and especially on Saudi Arabia. The region accounted for 44% of China's oil imports in 2019, and the country alone was responsible for 16% of the total imports (EIA 2020). Russia is also a key partner and has alone supplied 15% of the country's total oil imports that year. The table below shows the evolving composition of China's foreign dependence in oil.

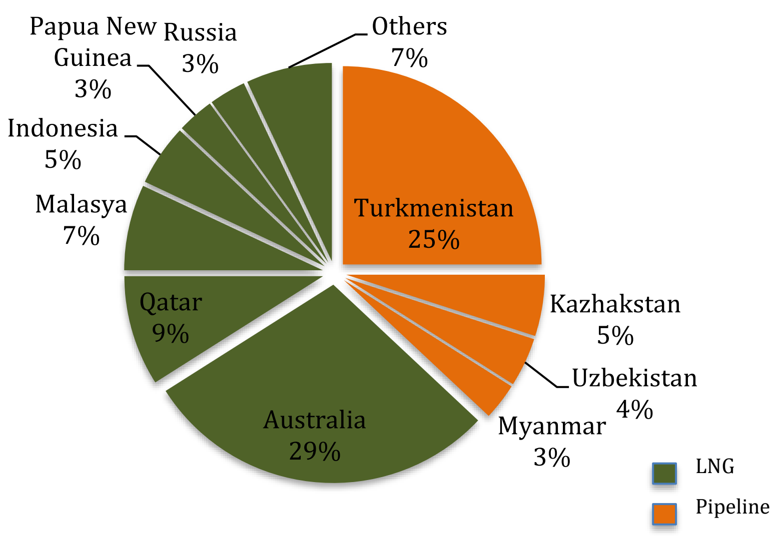
Table 5: China's Crude Oil Imports by Source

2010		2014		2019	
Saudi Arabia	19%	Saudi Arabia	16%	Saudi Arabia	16%
Angola	16%	Angola	13%	Russia	15%
Iran	9%	Russia	11%	Iraq	10%
Oman	7%	Oman	10%	Angola	9%
Russia	6%	Iraq	9%	Brazil	8%
Sudan	5%	Iran	9%	Oman	7%
Iraq	8%	Venezuela	4%	Kuwait	4%
Kuwait	4%	UAE	4%	UAE	3%
Kazakhstan	4%	Kuwait	3%	Iran	3%
Brazil	3%	Colombia	3%	Colombia	3%
Libya	3%	Congo	2%	Congo	2%
Other	19%	Brazil	2%	Libya	2%
		South Sudan	2%	Venezuela	2%
		Kazakhstan	2%	Other	15%
		Other	9%		

Source: Own elaboration and calculation based on EIA 2011, EIA 2015, and EIA 2020.

Natural gas, which is often seen as a transition fuel, has also increased its participation in China's energy mix. In this case too there exists a gap between domestic production and consumption that has been met with imports. This gap has started in 2006, when China began to import LNG, and in 2010 the country started to import pipeline natural gas from Central Asia. As of 2019, this mismatch between domestic production and consumption was the equivalent of 4.6 Tcf, with China being the world's largest gas importer (EIA 2020). At that same year, China imported over 40% of its natural gas (IEA 2020). As the graphic below shows, 62% of those imports were met with LNG while pipeline gas accounted for the remaining 38%. Foreign reliance on gas was highly concentrated on Turkmenistan and Australia, which combined were responsible for over the half of China's total gas imports.

Figure 12: China's Natural Gas Imports by Country (2019)



Own elaboration based on EIA 2020.

Since 2019, three major changes have affected the above mosaic. The first is that in December that year China began to import natural gas from Russia through the Power of Siberia pipeline. The imports were the product of a deal signed by the two countries in 2014 that established the supply of around 1.3 Tcf of natural gas per year for a period of thirty years (EIA 2020). As of 2021, Russia is China's third largest supplier of natural gas and accounts for 10% of China's total imports, providing both liquefied (4%) and pipeline (6%) gas (EIA 2022). Moreover, that same year, China's natural gas imports from Russia increased around 50% year on year (S&P Global 2022). During Putin's visit to the Beijing Winter Olympics in early 2022, the two countries agreed to a new 30-year deal that will begin in two to three years, and according to which Russia will provide China with additional gas from a new pipeline that will link China's Far East region with northeast China (Chen 2022). In the recent years, Russia has thus significantly increased in importance in China's natural gas overseas dependence.

The second change is that the US became China's second largest supplier of LNG, which was included in the products for which the Chinese government issued tariff waivers amid an agreement to de-escalate the trade war in early 2020 (Tsafos 2021). As of 2021, the US accounted for 7% of the country's total natural gas imports (own calculation based on EIA 2022).

The third factor that has affected China's gas imports, and related to the former, is the rising political tensions with Australia, its major natural gas supplier. Those frictions between the two countries have affected negotiations involving gas projects in 2020 (Paul and Needham 2020), and Chinese state media has stressed that Australia would lose in its energy trade with China, as Beijing guarantees long-term LNG supplies from the US (Global Times 2021). But, despite those tensions, in 2021 Australia still accounted for one quarter of China's total natural gas imports (own calculation based on EIA 2022).

The situation is different when it comes to coal. Though China's coal imports are the largest in the world (EIA 2020), the country still produces most of the coal it consumes. Imports accounted for around 8% in 2019 (IEA 2020), and most of it has come from Indonesia (46%) and Australia (26%), as illustrated below.

Table 6: China's coal imports by origin

Indonesia	46%
Australia	26%
Mongolia	12%
Russia	11%
Other	5%

Source: Own elaboration based on IEA 2020

As with gas, current political tensions with Australia have also impacted coal supply from that country. After Canberra raised support for an international investigation on the origins of the Coronavirus and China's handling of it, Beijing blocked Australian coal imports in late 2020 and turned to Indonesia, Russia, South Africa, and other countries to fill the gap (Pande and Mohanty 2021; Tan 2020; Bagshaw 2020).

The data on imports of fossil fuels show how dependent China is on foreign supply of oil and gas. Though China has attempted to diversify its imports, and, to some extent, succeeded in it, the country still relies mainly on Middle Eastern oil and on Australian, Russian, and Central Asian gas. China is much more self-reliant on coal, but its imports are also concentrated in a few suppliers, with Indonesia and Australia accounting for over 70% of China's coal imports. Because of the share that fossil fuels occupy in primary energy consumption, 86% as of 2019 (EIA 2020), the high dependence on imports, 25.8% of those resources, is a major energy security vulnerability for China. Considering each resource individually, foreign reliance is higher for oil and gas, while coal, which holds the largest share of the mix, is fundamentally met by domestic supply, as summarized in the table below.

Table 7: China's Dependency on Fossil Fuels Imports (as of 2019)

	Share of Primary Energy Consumption	Import Dependency
Oil	20%	72.5%
Gas	8%	40.6%
Coal	58%	7.7%
Total Fossil Fuels	86%	25.8%

Source: Own compilation and calculation based on EIA 2020 and IEA 2020.

In addition to the risks deriving from the external dependence on those resources per se, there is also logistics-related geopolitics that adds to the energy security equation. In other words, energy dependency means reliance not only on foreign resources, but also on shipping routes and pipelines, which could involve additional countries, other than those exporting the resources.

In the case of China, this logistics is an important part of the country's energy security concerns. Most of China's supply of oil and LNG passes through the Malacca Strait and the South China Sea. That strait is a chokepoint that could be blocked in case of conflict, which would prevent oil shipments to China. This insecurity was even called "the Malacca dilemma" by former president Hu Jintao. Indeed, disruption of overseas supplies could come from multiple sources, from piracy to, and mainly, a US-led naval blockade. Moreover, the South China Sea has increasingly become a hub of tensions not only between China and Southeast Asian countries but also between the former and the US. As the economic and diplomatic means are progressively complemented by military buildup, disputes over sovereignty and rights of exploration of the Sea's natural resources could potentially escalate and thus disrupt the enormous flow of energy supply that navigates through the area.

Moreover, 44% of China's oil imports comes from the Middle East, which is a region dominated by the US military presence. Indeed, Washington's foothold in the region was motivated to a significant extent by the country's energy security needs. More recently, even as the US becomes more self-reliant in oil after the shale revolution and as the country has tried to pivot to Asia, the region still matters for the stability of global oil markets and other US interests.

Oil and gas are also transported to China overland through pipelines, and Beijing has sought to increase this type of supply. This kind of trade avoids US-controlled maritime routes, contested zones, and straights but also faces other types of risks, such as long distance transportation, and the political situation both in the exporting and the transiting countries. Pipelines also require significant investments in infrastructure, which creates certain dependencies. Therefore, contrary to oil transported by tankers and LNG, it is much more difficult for the importer to turn to other supplier in case of disruption in any point of the pipeline.

Especially for gas, Central Asia has become a central piece of China's energy geopolitics. Its importance goes beyond energy, as the region has been a key component of China's BRI strategy – for instance the New Silk Road was first announced by Xi Jinping in Kazakhstan. At the same time, the region has historically been the setting of great powers geopolitics, also known as the "(New) Great Game". For the US, the region gained more relevance after September 11, 2001, when Washington increased its military presence there, although it has declined in recent years because of the focus on the Indo-Pacific. Moreover, the region is part of what Russia considers its "near abroad," tied to Moscow by historical links. Other tensions might involve increasing Sinophobia in the region, political instability in Central Asian countries, and terrorism.

Another important overland route is The Power of Siberia. This pipeline suits both countries' interests as China and Russia enhance their "friendship with no limits." Especially recently, as Europe started to diminish its dependence on Russian gas after the invasion of Ukraine, Moscow is forced to look eastwards, which suits China's gas needs. Ceteris paribus, bilateral energy ties tend to increase and work in a complementary way, with China's security of supply and Russia's security of demand meeting one another.

The table below summarizes the main routes of transportation of China's current imports of fossil fuels.

Table 8: China's Overseas Supply of Fossil Fuels

	Dependence on imports[27]	Main foreign suppliers		Main routes of transportation
Oil	72.5%	Middle Eastern countries	44%	Malacca Strait and South China Sea
Oil	72.5%	Russia	15%	Eastern Siberia Pacific Ocean (ESPO) pipeline and tankers
Gas	40.6%	Australia	25%	South China Sea
Gas	40.6%	Central Asian countries	27%	Central Asia-China Gas Pipeline
Gas	40.6%	Russia	10%	China–Russia East-Route Natural Gas pipeline (The Power of Siberia) and tankers
Gas	40.6%	US	7%	Pacific Ocean through the Panama Canal
Coal	7.7%	Indonesia	46%	South China Sea
Coal	7.7%	Australia	26%	South China Sea

Source: Own Elaboration.

Each route, maritime or overland, entails at least some degree of geopolitical security risk. This vulnerability goes in the opposite direction of how China understands energy security – by avoiding to depend on foreign supplies, on the one hand, and by seeking legitimacy, stability, and economic growth domestically, on the other. Following the Chinese mindset according to which, as history taught them, friends might become foes, even the increasing ties with Russia, with whom China

[27] As of 2019, and according to the latest data available at IEA 2020.

has strengthened an alliance “without limits,” could pose energy security risks in the long run.

Considering those geopolitical vulnerabilities, not only has this high reliance on imported resources contributed to a feeling of insecurity in China (Interview 07) but also, for some experts, energy security is the main concern that led China to transition from fossil fuels to cleaner energy sources (Interview 09). Energy security has been very high in the agenda in China (Interview 13), and it is increasingly prioritized given the exacerbation of tensions in the systemic level. As the world becomes more fractious, with the trade war signaling that China could suddenly lose access to certain commodities, importing the energy they need to continue growing becomes an increasing concern (Interview 14). Moreover, the concern about foreign supply increases with the distance from the energy sources and other commodities.

Therefore, the examination of China’s current energy security vulnerabilities strengthen the argument that, by forwarding the energy transition, China would hold a more advantageous position internationally. The country would depend less on foreign resources and critical routes, and would be less exposed to geopolitical constraints.

5.3. Future Security Patterns

Though the energy transition does result in less dependency on foreign supplies, it still encompasses other geopolitical constraints that might lead to energy security risks. This dynamic is especially true for the mining sector since the emerging low-carbon energy paradigm is much more mineral intensive than the fossil fuel era. A World Bank report estimates that in a 2^{o}C-scenario, production of graphite, lithium, and cobalt for energy storage technologies would have to be increased by over 450% by 2050 from 2018 levels. These projections, which may be conservative, would probably be even higher in a 1.5^{o}C-scenario, in which solutions would have to be implemented faster and at a larger scale (Hund et al. 2020). For instance, an electric car requires six times more minerals than a conventional car, and an onshore wind plant demands nine times the amount of minerals of a gas-fired power plant (IEA 2022a).

China accounts for significant production shares of several minerals needed to foster the energy transition. Even in the case of the resources for which China lacks significant reserves, such as cobalt, platinum-group metals, and lithium, the country, both through state-owned enterprises and state-linked private firms, has been strategically making long-term investments in overseas projects, sometimes even at a loss (FP Analytics 2019). This strategy has resulted in China's current leading position in the supply chain of several key minerals needed to complete the energy transition, regardless of its own reserves. Moreover, Chinese companies have also been expanding their advantageous market position by procuring mines and production from other large producers and reserves, which provides China with significant leverage both economically and geopolitically (FP Analytics 2019).

As the table below shows, China produces or refines more than half of the world's cobalt, lithium, graphite, aluminum, indium, and vanadium. When it comes to rare earths, the country produces 60% and refines 90% of the world's total. The data indicates China's dominant position in the supply chain of these minerals.

Table 9: China's Position in the Supply Chain of Selected Key Minerals of the 21st Century Energy Transition

Mineral	Deployment in the Technologies of the Energy Transition	China's Position in the Supply Chain
Cobalt	Energy Storage	The Democratic Republic of Congo produces 70% of the global total, and China processes around 70% of the world's total
Copper	Wind, Solar PV, Concentrated solar, Hydro, Geothermal, Energy Storage, and Nuclear	Main producers are Chile and Peru, and China is the largest copper refining country, accounting for 40% of the total. China is also responsible for 50% of global demand for refined copper, so the country also imports refined copper products
Lithium	Energy Storage	Australia produces over 50% of the global total, and China refines nearly 60% of lithium (and over 80% for lithium hydroxide). Chinese companies such as Tianqi Lithium, have also invested in South American companies
Nickel	Wind, Solar PV, Hydro, Geothermal, Energy Storage, and Nuclear	Indonesia produces over 30%, and China refines around 35% of the global total
Rare Earths	Wind, Solar, Energy Storage, EVs	China produces 60% and refines almost 90% of the world's rare earths

Graphite	Energy Storage	China produces over 60% of the world's total
Aluminum	Wind, Solar PV, Energy Storage, Nuclear	China is the largest producer and accounts for 56.7% of the world's total
Iron	Wind and Energy Storage	China is the third largest producer of iron ore, accounting for 14.2% of the world mine production
Zinc	Wind, Solar PV, Hydro, Energy Storage, and Nuclear	China accounts for around 35% of the world mine production and is the world's largest producer
Chromium	Wind, Hydro, Geothermal, Energy Storage, and Nuclear	China does not have chromium reserves, but it accounts for over 50% of the world production of ferrochromium and stainless steel
Indium	Solar PV and Nuclear	China accounts for almost 60% of world refinery production
Lead	Wind, Solar PV, Hydro, Energy Storage, and Nuclear	China accounts for 46% of the world mine production
Manganese	Wind, Hydro, Geothermal, and Energy Storage	South Africa, Gabon, and the US are the largest producers, and China accounts for 6.5% of world mine production
Molybdenum	Wind, Solar PV, Hydro, Geothermal, and Nuclear	China accounts for 43% of world mine production
Silver	Solar PV, Concentrated solar, and Nuclear	China accounts for 14% of world mine production, and Mexico has the largest share (23%)
Titanium	Hydro, Geothermal, and Nuclear	China accounts for around 36% of world mine production and is the largest producer
Vanadium	Energy Storage and Nuclear	China accounts for around 66% of world mine production and is the largest producer
Uranium	Nuclear	Most of China's uranium for commercial use is imported. Kazakhstan is the world's largest producer and exporter. China' CGN Mining Company Ltd operates through joint ventures in Kazakhstan's mines. In Namibia, CGN controls one of the world's largest mines, and CNNC has stakes in other mines. The country has also been stockpiling uranium and plans to produce one-third of its uranium domestically, acquire one-third through foreign equity in mines and joint ventures abroad, and to buy one-third from the market

Source: Own compilation based on Hund et al. 2020, IEA 2022a, Government of Canada 2022, ICDA 2022, USGS 2022, World Nuclear Association 2021, and Hu 2021.

China specialized in the extraction and refining of these minerals because it had cheaper production conditions due to its low salaries and permissive environmental legislation. But there are important reserves outside of China that could be explored amid a more turbulent geopolitical context. Indeed, Beijing's leading position in the sector has been increasingly perceived as a vulnerability by other actors dependent on China's minerals exports. In 2010, China enforced a cut of rare earths export quotas after a Chinese captain was detained by Japan because his vessel collided with two Japanese coast guard vessels in waters controlled by Japan but claimed by China in the East China Sea. In 2012, Japan, the US, and the EU made an official complaint at the WTO and a panel was opened. Two years later, the WTO ruled in favor of the complainants, and China terminated its export quotas (WTO 2021). In 2019, the rare earths once again raised worldwide concern, as Chinese state media implied that restrictions on rare earths exports could be China's way to respond to the US trade war. A piece from the People's Daily states:

> Will rare earths become a counter weapon for China to hit back against the pressure the United States has put on for no reason at all? The answer is no mystery.. [...] Undoubtedly, the U.S. side wants to use the products made by China's exported rare earths to counter and suppress China's development. The Chinese people will never accept this! Washington has completely overestimated its ability to manipulate the global supply chain and lacks self-knowledge. The US is doomed to be met with a slap in the face after it wakes up and stops dreaming. [...] We advise the U.S. side not to underestimate the Chinese side's ability to safeguard its development rights and interests. Don't say we didn't warn you! (Wu 2019)

In this context, even as countries such as the US, where the Biden administration is pledging to secure a "Made in America Supply Chain for Critical Minerals" (The White House 2022), try to increase their self-reliance, it is nevertheless challenging for any country to completely break dependence on China. Especially for rare earths, even if a country opens a new mine or builds a processing plant, it would be difficult to have a presence along the entire value chain, and it would thus still need to send its output to be processed in China (IEA 2022a). For instance, the US has only one operating rare earths mine but no processing capability and therefore is dependent on sending its raw material to be refined in China. As a result, China has been importing more rare earths than it has exported tonnage-wise but in terms of value it has exported much more than imported due to its role as the world's refiner (Bray 2019; Scheyder 2022). Moreover, if Western countries were to increase their mining capacity, they would also have to cope with often higher environmental and labor standards, which could make the production of minerals even more expensive in those nations. Recycling and reuse could also diminish the geopolitical risks involving minerals supply. However, the World Bank predicts that even with large increases in recycling rates, mining would still be required to produce low-carbon technologies (Hund et al. 2020).

There are indeed institutional constrains that prevent China to disrupt the supply of critical minerals, and China's acquiescence of the WTO decision regarding the 2012 panel illustrates the effectiveness of those constrains. Nevertheless, as China assumes an increasingly assertive position internationally, and as relations between the country and the West deteriorate, future compliance might not be taken for granted. Moreover, in addition to its importance for the world to achieve carbon neutrality, those minerals are also present in other sectors including the military industry. This strategic dimension further increases the risk of supply disruption, especially in a scenario where current tensions escalate and countries could invoke the national security exception of the GATT 1994.

The critical minerals supply chain is therefore a key feature of the developing energy security dynamic that has emerged with the advance of the energy transition. China's position in it benefits the country economically, as it is the world's largest manufacturer of green technologies,[28] and geopolitically, as China is more self-reliant in critical minerals and faces less risks in assuring those overseas than it does importing fossil fuels. It provides favorable conditions for China to foster its energy transition while at the same time enhancing its energy security. However, these potential benefits are still lower in importance to the Chinese government relative to the use of domestically abundant coal.

Another aspect is that security can also include environmental risk. China is a high-risk country in terms of vulnerability to the effects of climate change. For instance, in 2021 the floods in Henan resulted in over 300 people killed, and the intense rainfall in Shanxi caused the inundation and destruction of 190,000 hectares of crops (Ni 2021). Therefore, fostering a clean energy transition would also help China to avoid such effects. This dimension is directly related to the way China comprehends energy security as being sustained by the three pillars of legitimacy, stability, and economic growth. Extreme weather events not only affect ordinary people's daily lives, but also bring risks to the economy, since even the minerals

[28] As was discussed in Chapter 4.

supply could be impacted in the event of excessive heat and flooding, for example (IEA 2022a).

> For sure if we move to new energy system it might in fact enhance our energy security because [it would mean] less reliance on oil or other energy imports [...]. Also because China itself faces the challenge of climate change, they see it as a real impact and actions [have] to [be] take[n] and the strategy is to electrify the energy system and try to produce the electricity domestically and move towards an EV-based or electrified transport system. So it will change the current oil and other fossil based energy system that China has a big reliance on for their supply so that will change the energy security, the economic development, and many aspects of the energy environment [and] economy system. So it's just enormous how this transition can imply to the social-economic and competitiveness and international collaboration on climate change (Interview 25).

However, as the energy transition increases China's energy security, on the one hand, it could also lead to conflicts, on the other. As China becomes a power in renewable innovations, it could also become the next battlefield for technological disputes similarly to what is happening today with 5G (Interview 04). In this case, if countries were to impose bans on imports of Chinese-made low-carbon energy technology, such as solar panels and wind turbines, for security concerns, this would also impact China economically and thus potentially affect stability.

This economic side reveals another dimension of the energy security configurations that emerge with the energy transition: the security of demand for China's green energy technologies. This aspect highlights one of the fundamental differences of the new energy paradigm in relation to past ones, which is how the relation between energy and power does not lay on the possession of the resource in itself or the control of maritime routes, straits, or pipelines, but on the technology. In other words, security of demand, in the new energy paradigm, means securing market for green energy technology and not for the electricity per se. Increasing competition in this field could equally entail opportunities and challenges in the security field. However, the energy transition is a worldwide tendency, and despite short-term challenges, it is a long-term reality. Therefore, dominating the technologies of the energy future would enhance a country's security much more than risk it.

5.4. Preliminary Results and Conclusion

This chapter has examined how energy security works as a mediating variable that explains the relation between the energy transition in China and the country's power in international relations. To achieve that goal, the chapter has proceeded in three steps. First, it put China's energy security in context and conceptualized it amid China's own understanding and needs. Second, it examined China's current energy geopolitics and identified the main vulnerabilities for the country derived from the present situation. Third, it assessed the new geopolitical features that have emerged with the energy transition and positioned China in this new dynamic.

The first part showed that there are two dimensions that influence China's energy security concerns. On the one hand, China perceives the international environment as potentially hostile and therefore seeks self-reliance in its energy supply. On the other, the government's utmost priorities are domestic legitimacy, stability, and economic growth. These three main concerns reinforce one another, and together they shape Beijing's interpretation of energy security. The government's effort to solve the problem of pollution is illustrative of this latter dimension. Furthermore, this conceptualization has also exposed how China often treats energy security and the energy transition as opposing categories, and how the country has often met its energy security needs with coal because of the context outlined above. The 2021 power shortage has highlighted all these aspects and showed the limits of the energy transition in its current stage. It raised popular dissatisfaction, generated instability, affected the economy, and led the government to further differentiate between energy security and climate policies.

The second section depicted a complex geopolitical setting for China's current energy mix. Since the beginning of this century, the country has significantly increased its dependence on imported fossil fuels. This growth was mainly driven by oil and gas, while coal demand has mainly been met with domestic supplies. Moreover, though China has managed to diversify its suppliers, they are still concentrated in a few countries and regions, which further risks energy security. Apart from this high reliance, China also depends on maritime routes, straits, and overland pipelines to get the fuels from the suppliers all the way to China. The examination of the main routes and the share that each imported fuel has in the country's mix has shown that a significant part of China's energy resources navigate through geopolitical hotspots such as the Strait of Malacca and the South China Sea, or across overland borders in regions historically marked by geopolitical tensions, such as Central Asia. This scenario, when contrasted with the conceptualization of energy security of the first section, results in a high level of vulnerability and security risks.

As the energy transition advances, new geopolitical dynamics emerge that directly affect China's energy security. The third and final part of this chapter has analyzed those dynamics and the challenges and opportunities that arise with them. Three dimensions of this new context relate to energy security. First, the need for critical minerals creates further dependency relations, but this factor has so far worked in China's favor, as the country is the world's main producer or refiner of several minerals. Even for those minerals that China lacks, the strategy to establish joint ventures in overseas mines strengthens China's role internationally. This advantage also supports China's green technology industry. Therefore, the geopolitics of critical minerals enhances China's energy security, as the country is much more self-reliant compared to the imported oil and gas. Second, considering the conceptualization of the first section, China's high climate risk would directly affect the domestic tripod based on which the government assesses energy security, i.e., legitimacy, stability, and economic growth. As a consequence, the energy transition equally increases the country's energy security if the environmental aspect is taken into account. Third, the energy transition reinforces China's industrial advantage in green energy technologies and hence strengthens the economic aspect of the Chinese concept of energy security.

This last aspect illuminates one facet of the transition that might actually change the established concept of security of demand. While oil and gas suppliers are concerned about guaranteeing buyers for their resources per se, the emerging and future paradigm will be marked by technology producers concerned about assuring market share for solar panels, wind turbines, and other green energy technologies, instead of electricity in itself. In this context, while in the fossil fuels era China's energy security has revolved around classic security of supply concerns, in the future paradigm it could shift toward a more demand-oriented security, given the country's low-carbon energy industry development. In turn, this situation could also result technological disputes, especially as the conditions of the international environment deteriorate and rivalries between China and the West, and particularly the US, exacerbate. This could pose a challenge to Beijing in this regard.

Therefore, by comparing current and emerging/future energy geopolitics, the energy transition generally enhances China's energy security despite potential challenges and, by doing so, better positions China in international relations. In other words, through the means found in this chapter, and considering the complex geopolitics revolving around China's energy scenario, energy security therefore works as a mediating variable between the energy transition and China's position internationally. This variable thus strengthens this dissertation's theoretical mechanism.

Chapter 6: China's Changing Image in Global Climate Governance

China's participation in global climate governance has been changing over the last few years. This shift has at least three dimensions. The first is within the United Nations Framework Convention on Climate Change, in which China has been more willing to cooperate. This is well illustrated by the difference in China's behavior from Copenhagen to Paris. The second is the inclusion of climate-related topics in official Chinese speeches in meetings and events not specifically related to climate. Examples of this range from China's announcement of its carbon neutrality goal at the UN General Assembly to Xi's speech at the 2022 Winter Olympics. In addition to that, the third dimension, which intersects the two previous ones, is that China has been bringing along its own concepts and initiatives, blending them into the country's discourses, even though it has encountered resistance in advancing those ideas throughout the global climate governance architecture.

The shift is marked by China moving from a more defensive position centered on the right to development and the principle of common but differentiated responsibilities to a more committed position and, according to some experts, even trying to step up as a leader. Such changes at the international level cannot be assessed in and of themselves, as they also reflect a domestic trajectory of increasing climate policies, to a great extent motivated by the need to improve the country's pollution records and allowed by a context of change in their economic growth model.

However, while China has indeed acted more cooperatively in international climate negotiations, its credibility and reputation still depend on how much and how fast China can deliver its pledges. For now, it is not a political leader able to set an example and push global climate cooperation. In this context, China's energy transition and its ability to enable large-scale affordable clean energy technologies is the most successful story that Beijing can share with the rest of the world.

Therefore, this chapter shows that it is not China's more active position in the global climate governance architecture that helps China improve its image and then profit from this in international relations. Rather, it is the energy transition that benefits China's image, which in turn improves the country's position in global climate governance, which is a central domain of international relations. Hence, this chapter assesses how image works as a mediating variable between China's energy transition and the country's position in international relations. To that end, the first section of this chapter assesses how Chinese participation in the global climate governance architecture has evolved and how these changes are intertwined with domestic climate and energy policies. The second section then addresses how China's image in this field has shifted and the centrality of the energy transition in this process.

6.1. China's Evolving Role in Global Climate Governance

China's impressive growth rates over the past decades has led to a considerable rise in domestic energy demand and resulted in the country becoming the world's largest consumer of energy and the country that most contributes to the global energy demand growth. As this demand was primarily met with fossil fuels, and especially coal, in 2006 China became the world's largest polluter.

China is expected to continue to grow and, consequently, so is its energy demand. Nevertheless, some important features of its economic growth have been changing, as the country seeks to transition its economy from rapid growth to high quality development (Xi 2017, 25) – which in practice has been a change from low/middle tech export oriented growth to middle/high tech domestic oriented growth. The path towards this new phase of development has, in turn, impacted the country's energy needs in three major ways. Firstly, China's economy has been transitioning, though in a limited way, its focus from the energy-intensive heavy industry to the light industry and towards a services economy, which impacts the country's energy intensity and thus gives more room for a low-carbon energy transition. Secondly, the country is increasingly electrified – in the transport, industry, and services sectors, with the increased use of big data and the internet of things. Such electrification process also pushes for an increase in low-carbon sources. Thirdly, China has become an exporter of renewable energy technology, which has had a significant decrease in their costs, thus boosting its use[29].

[29] As was analyzed in Chapter 4.

This is the economic context in which several changes in China’s energy policy have taken place especially since the second half of the 2000s. The 11th Five-Year Plan, encompassing the period from 2006 to 2010, set the target to reduce 20% of energy consumption per unit of GDP, as well as to reduce 10% of total emissions of major pollutants (which refer to sulfur dioxide and chemical oxygen demand). Even though the Plan also included the development of fossil fuels, it aimed to implement investment policies and mandatory market share for renewables, and to encourage its production and consumption thus increasing the proportion of renewable energy in primary energy consumption.

In this context, the Renewable Energy Law, passed in 2005, effective on January 1st 2006, and amended in 2009 has set the regulatory framework for renewable energy in the country. Adopted at the 14th Meeting of the Standing Committee of the Tenth National People's Congress, it was seen at the time as a breakthrough in the development of this kind of energy in China (Schuman 2010). The Renewable Energy Law (Ministry of Commerce 2013) makes the development and utilization of renewable energy a state priority in energy development, through the development of a renewable energy market and the setting of a target for the development and utilization of this source. The national target was later set in 2007 with the Medium and Long-Term Development Plan for Renewable Energy in China (NDRC 2007), which established the goal of increasing to 10% the share of renewable energy in the primary energy consumption by 2010 and to 15% by 2020. Additionally, the Plan aims for the development of a renewable energy technology innovation system by developing technologies and industries. Of particular importance, Article 14 of the Renewable Energy Law has established an important mechanism for advancing the renewable energy market, as it guarantees the purchase of renewable energy generated electricity in full amount. This is an important feature of the law, because it has given investors incentives to invest, especially back then, when the price for generating electricity from renewables was much higher than in the present.

At the international level, concomitant with the domestic initiative to establish the Renewable Energy Law, the Kyoto Protocol (United Nations 1997) entered into force in February 2005, seven years after it was negotiated in Japan[30]. Based on the principle of *common but differentiated responsibilities and respective capabilities*, the agreement has only bound developed countries (listed at Annex B of the Protocol), thus excluding China from any obligation. Still, the agreement played an important role in the country, which strongly benefited from the Clean Development Mechanism offered by the Protocol. This market-based mechanism allowed countries from Annex I to implement an emission-reduction project in non-Annex I developing countries thus earning certified emission reduction credits that can be counted to meet their own Kyoto targets.

According to the CDM database (UNFCCC 2021), of the 7854 registered CDM projects, 3764 are in China – which represents almost half of the world's total – and 3536 of them, the vast majority of the projects implemented in China, are related to energy industries. This is also a significant share as compared with the world's total in this sector, which was of 6601 projects. Most of the projects hosted in China (1819 of them) were registered in 2012, the last year of the first commitment period of the Kyoto Protocol, and the last one was registered in 2017.

The centrality of China in the CDM mechanism demonstrates the intricate relation between the global and domestic levels. On the one hand, China needed the financial resources to finance renewable energy projects and thus fulfill its own mitigation strategy. On the other, China represented an opportunity for annex I parties due to the country's renewable energy potential and development needs. The domestic energy policy landscape, through initiatives such as the Renewable Energy Law and the 11th Five Year Plan, has thus facilitated the attraction of CDM projects.

Additionally, even though it was not a mandatory component of CDM, technology transfer (TT) is a co-benefit of the mechanism and has played a role for the host countries. Several authors have investigated technology transfer in CDM projects in China (Wang 2010), its regional distributions (Hong et al. 2013), as well as the specific cases of wind (Lema and Lema 2013) and solar PV (Lema and Lema 2016) sectors. A UNFCCC report shows that, until June 2010, 19% of CDM projects in China had explicit technology transfer claims and this rate was above 50% from 2004 to 2006 (UNFCCC 2010). Importantly, under the mechanism, not only

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[30] China ratified the Kyoto Protocol in 2002.

developed countries are sources of TT. In fact, in 2010, China was a supplier of technology transfer in 7% of the CDM projects (UNFCCC 2010).

More than one decade later, in 2009, the Fifteenth Conference of the Parties (COP 15) took place in a context of high hopes. These expectations were, nevertheless, highly frustrated and no legally biding substitute for the Kyoto Protocol was reached. Although China alone cannot be blamed by the conference's failure, the country's participation seemed "calculated to frustrate progress", as it assumed an "enigmatic and obstructive" (Christoff 2010, 639, 647) behavior in at least three realms. In procedural terms, it deliberately delayed COP's working groups and plenaries. Substantially, it demanded the exclusion of Annex I and global targets from the Accord and other negotiating texts. In the diplomatic stance, Chinese premier Wen was absent or replaced by junior officials in several high level negotiations and meeting with other heads of state, including Obama (Christoff 2010).

In Copenhagen, China was seen as "the bad guy" (Interview 14), and the Conference showed that China was not prepared to take the duties expected, in particular, the specified targets for CO_2 reductions and the "Border Tax" proposed (Interview 18). Therefore, COP 15 put in evidence the contradictions both within China's rhetoric and between the country's discourse and its real actions regarding climate change. There was a mismatch at that point between the initiatives taken at the domestic level and the avoidance of any formal compromise at the international negotiating table. Combating climate change was thus subjected to wider developmental needs and to China's own idea of sovereignty. Additionally, trying to enact a certain leadership role while at the same time limiting its international participation to the defense of the principle of common but differentiated responsibilities adds to the complexity of China's climate diplomacy at that moment. For instance, much of China's participation at COP 15 was articulated through the BASIC group[31], especially when precluding the inclusion of targets in the Accord.

Still, China announced at the Conference that it would reduce its CO_2 emissions per unit of GDP by 40-45% (from 2005 levels) by 2020, and increase the share of non-fossil fuels in primary energy consumption to 15%. At the domestic level, this was reflected in the 12th Five Year Plan, for the years between 2011 and

[31] The BASIC, formed by Brazil, South Africa, India and China, all large emerging polluters, was officially created a few days before the Conference to coordinate these countries' position at COP 15.

2015. This Plan builds on the energy and environmental dimensions of the previous FYP, but it goes even further in including targets for CO_2 emissions per unit of GDP, which were planned to decrease in 17%. The document also establishes a 3.1% increase in non-fossil fuel share in primary energy consumption, which should have reached 11.4% of the total by 2015, and a 16% decrease in energy consumption per GDP unit. Also, major pollutants this time included not only sulfur dioxide and chemical oxygen demand, like previously, but also ammonia nitrogen and nitrous oxides. The target for the former two is a reduction of 8%, and for the latter two, of 10%. Additionally, the 12th FYP intends to promote the development of new strategic industries, including energy conservation and environmental protection industries, new energy industries, and new-energy automobile industry.

In 2012, China signalized it had its own conception of sustainable development when it included the concept of Ecological Civilization in the Constitution of China's Communist Party (CCP), thus turning its promotion into a Party's goal. The term had already entered CCP's ideology in 2007 (Hansen, Li, and Svarverud 2018) following the Report to the 17th National Party Congress[32], delivered by then president Hu Jintao. Nevertheless, it was only in 2012 that the term gained political prominence, as the Report to the 18th National Party Congress dedicated an entire section to it[33].

The importance of Ecological Civilization in the Report to the 18th National Party Congress has also a symbolic dimension, as Hu Jintao was passing to his successor Xi Jinping the task of, as the title of section VIII states, "Making Great Efforts to Promote Ecological Civilization" as his legacy (Marinelli 2018). Xi has reiterated his support for the ecological civilization during the Third Plenary Session of the 18th Central Committee of the CPC in 2013, and in 2018 the Ecological Civilization was ratified in the country's Constitution.

The growing relevance that the concept of Ecological Civilization has equally prompted questions on whether it is another Propaganda phrase, an empty slogan that the Party can use as it suits them, or a guide for action, and whether it has a domestic or international reach. One way to interpret it is as a framing, and from this

[32] In the English version of the Report to the 17th National Party Congress the Chinese concept of Ecological Civilization (*shengtai wenming*) is translated as conservation culture or conservation.
[33] In the English version of the Report to the 18th National Party Congress the Chinese concept of Ecological Civilization (*shengtai wenming*) is translated as *ecological progress*.

perspective China is not the only country to have a concept depicting its energy transition. For instance, Germany is particularly proud of its Energiewende (Interview 02). This term has become known beyond Germany and the German-speaking community and has represented “Made in Germany” knowledge and technology and the country’s leading role in the global energy transition (Auswärtiges Amt 2019, Maas 2019, Kemfert 2016). In this sense, what Energiewende or Ecological Civilization entail is that the energy transition goes beyond the energy sector, that it is not purely a technological change, but it is also a wider societal change, and those narratives are powerful ways to achieve this sociotechnical transition (Interview 02).

In this sense, the fact that Xi often mentions the Ecological Civilization in his international speeches and that the concept is part of the BRI’s thinking are indicators that China also hopes to export this concept (Interview 05):

> As China rises they of course want to impact international discourses, norms, values, the way we see the world, and the slogans are kind of tools to advance their political discourses and of course they use these discourses in all the diplomatic talks that they take part in different sectors. Climate politics is not the only forum where these slogans are used. It’s part of the bigger transition of the world into normative building blocks of international society (Interview 21).

However, this movement toward internationalizing the idea of building an ecological civilization has encountered strong initial resistance:

> I think China would like to see this concept going global and gradually it is. In the beginning when China launched it as always a lot of people who wanted to avoid it because they don’t want to use a slogan developed in China and even said it was very dangerous, but then gradually everyone understood this is not a Chinese slogan (Interview 13).

Similarly, another example of a context-specific concept going global is the idea of Mother Earth, the English language equivalent of the Andean notion of Pachamama:

> I recall a parallel development. About fifteen years back the concept of Mother Earth was developed in Latin America, largely by Evo Morales and his people in Bolivia. A lot of Europeans and Americans were skeptical about Mr. Morales and they said this term is extremely dangerous, and I told people please tell me the difference between the

> indigenous concept of Mother Earth and the Christian concept of God creating the world. Isn't that exactly the same? Where is the danger? And then president Obama himself started to speak about Mother Earth and everybody said well this is not as dangerous, we can now speak about Mother Earth. I bet it is the same with Ecological Civilization (Interview 13).

Nevertheless, on the other hand, amidst an international context marked by increasing tensions, the advance of a Chinese conception of environmental change will potentially encounter enhanced resistance within the global climate governance architecture since even though the Ecological Civilization is a concept tailored by the Chinese understanding of how the country could achieve its transformation it also has global implications. The logic behind it is that while the Western countries led the Industrial Revolution and the US led the Information Revolution, now it is China's turn to lead the world toward an Ecological Civilization – which is not to say that there is a generalized perception about that around the world, but there is a greater awareness that China is taking steps in that direction (Interview 14).

> There has been a lot of resistance. Some years ago diplomats were sometimes using these terms that China uses but then now [...] this EU diplomat says they don't want to use these China slogans or discourses because that would mean they accept China's policies. China's influence would be [deeper] so for the EU it's important to resist these slogans. The US has also been very careful not to use these concepts like ecological civilization. It's something that is so interpreted with China's socialist views so it's not something that the Western countries would put forward (Interview 21).

Another mark to understand China's change in behavior in the climate field happened in 2014, during the annual session of the National People's Congress (NPC), when China's premier Li Keqiang declared "war on pollution". Such a strong declaration demonstrates the magnitude of the problem domestically. In 2017, over 1.24 million deaths were attributable to air pollution (Yin et al. 2020) in China and a 2015 Pew Research Center report shows that pollution is the second concern in the country, with 35% of the Chinese considering it "a very big problem" and 41% "a moderately big problem" (Wike and Parker 2015).

At the same time, at the international level, China was less resistant and more willing to cooperate in climate talks. In 2015, China's participation at COP 21 was strikingly different from that in Copenhagen. The reasons for the change in behavior include China's shift to a new normal model of economic development and the increasing alignment between the country's economic and environmental policy agendas (Hilton and Kerr 2017). It is also due to a combination of international pressures, which include China's own power aspirations globally, and domestic factors, such as concerns on pollution and energy security, and the opportunities of developing a green economy (Schreurs 2016). Additionally, the institutional framework and the several measures taken domestically to mitigate climate change and foster an energy transition were stronger and more consolidated, which allowed China to engage in a more cooperative way at the Conference, pleasing the international community while not putting its own development at risk. Another dimension of the shift in behavior, with China being even attributed to the success of the Paris conference, is the environmental awareness that had been enhanced from 2009 to 2015 and which was fostered by the idea to build an ecological civilization, the government's efforts to clean up the country, and the change in China's economic growth model (Interview 14).

Also important for the success of COP 21 was the US-China diplomatic articulation to avoid repeating the "diplomatic fiasco" (Christoff 2016) that had previously taken place in Copenhagen. To that end, even though still constrained by their respective domestic contexts, both countries pursued "common ground in a climate of virtuous competition" (Christoff 2016, 771). The signs for this cooperation came even before Paris, as the US and China made a joint announcement on climate change after nine months of quiet negotiations (Landler 2014). The U.S.-China Joint Announcement on Climate Change included targets for both countries and Obama and Xi's compromise "to work closely together over the next year to address major impediments to reaching a successful global climate agreement in Paris" (The White House 2014). One expert stresses that such joint declaration was so important that some of the articles of the Paris Agreement are copied and pasted from that document (Interview 04).

China's NDC determines that the country will (i) peak its carbon dioxide emissions around 2030 (with efforts to achieve this goal earlier), (ii) lower its carbon dioxide emissions per unit of GDP by 60 to 65 percent (from 2005 level), (iii) increase the share of non-fossil fuels to around 20% of primary energy consumption, and (iv) increase the volume of forest stock by around 4.5 billion cubic meters (on 2005 level) (NDRC 2015). Even though China's target to peak its emissions by 2030 was seen as "a significant break with the past" (Schreurs 2016), it was also assessed as "a highly conservative upper limit from a government that prefers to under-promise and over-deliver" (Green and Stern 2017, 14). It is important to remark that the Chinese goal is fully inconsistent with the global carbon budget and that Obama attempted unsuccessfully that peak emissions were settled for earlier than that.

Still, the NDC highlights the centrality of achieving an energy transition for the overall target. Moreover, even though China still defended the principle of *common but differentiated responsibilities and respective capabilities*, it also diffused the idea of being "a responsible developing country" thus actively engaging in international cooperation (NDRC 2015). This change signaled a move toward a more prominent Chinese role in international climate negotiations at that point. However, by 2015 China was already in the way to dispute with the US the world hegemony. Consequently, the narrative of being a developing country was indicator of how ambiguous and poorly cooperative the country was.

One important feature of this international role is exercised through infrastructure planning. In 2016, China launched GEIDCO[34], a non-governmental international organization that aims to construct a global energy interconnection (GEI) or, in other words, a global grid. GEIDCO is recognized by the UNFCCC as a partner that works to implement the UN initiative Sustainable Energy for All (UNFCCC 2021a). The idea of creating a global energy interconnection gained international visibility in 2015, during Xi Jinping's remarks at the United Nations Sustainable Development Summit, in which he announced that China would "propose discussion on establishing a global energy Internet[35] to facilitate efforts to meet the global power demand with clean and green alternatives" (Xi 2015). GEI is based on renewables and on the ultra-high voltage (UHV) technology.

It is difficult to categorize GEIDCO. According to the UNFCCC it is a non-governmental international organization, but while GEIDCO claims to be an international organization, it is closer to a Chinese organization that has sought

[34] Chapter 4 has initiated the discussion about GEIDCO, focusing on the technology dimension of this organization.

[35] "Internet" and "network" are used interchangeably depending on the translated version. For instance, China's Ministry of Foreign Affairs' (2015) version uses "network".

international partners to advance Chinese interests. For instance, the fact that State Grid holds the global expertise of UHV nowadays raises the question of whether GEI could be better understood as "an image-building exercise to support China's pitch for global climate leadership while strengthening China's transmission sector and aiding its outbound expansion" (Downie 2019). Therefore, and also considering the geopolitical challenges to advance the organization's main idea, GEIDCO, like the Ecological Civilization concept, has found difficulty to achieve solid accomplishments. One expert close to Beijing's energy policy makers tells me that while he came across people involved with GEIDCO a lot in the past, he has not seen much of them lately: "Maybe I have to look them up but in my world usually if people are successful and active, I get to see them regularly, and I haven't seen them regularly so that's a bit of a worrying sign" (Interview 23).

In any case, GEI is a project of a continental magnitude, in a strategic sector, and led by Beijing. Beyond that, the organization is recognized by various world leaders and that advances a Chinese proposal of energy infrastructure for the entire world. Regardless of its effectiveness and feasibility, the proposal shows how China is furthering its own initiatives (and interests) within the global climate governance architecture.

Also in the realm of international infrastructure building, China released three documents in 2017 with the objective of greening its latest and most ambitious international project, the Belt and Road Initiative: the Guidance on Promoting Green Belt and Road (Ministry of Ecology and Environment 2017), the Belt and Road Ecological and Environmental Cooperation Plan (Ministry of Ecology and Environment 2017a), and the Vision and Actions on Energy Cooperation in Jointly Building Silk Road Economic Belt and 21st-Century Maritime Silk Road (National Energy Administration 2017). Considering that the initiative has been a main destination for China's fossil energy investments, the attempt to "green" the BRI had so far remained more at the rhetoric level, but China's 2021 announcement to stop investments in overseas coal-fired power plants could change that.

One event of major importance in this context is the election of Donald Trump, a climate skeptic, for the US presidency in 2016. This event has affected US-China climate cooperation, and the engagement that had existed under the Obama administration dissipated during Trump's tenure (Interview 03). Even though there was still some engagement between think tanks, they were not very effective (Interview 03). Trump's later announcement in 2017 that the US would withdraw from the Paris Agreement opened up space for China to try to project itself as the leader able to fulfil the American vacuum. For the Chinese government, it seemed to be China's time to raise its voice and lead this campaign (Interview 17). This does not mean that China was trying to compete with the EU, which has been the climate leader since the beginning of the century, but that Beijing was trying to show more international engagement in this field and that it had more space to do so given the US posture at the time.

Trump's election and the course undertaken by his administration has introduced yet another element to this context, which is related to a systemic dimension affecting China's role in global governance. In China, among both the people and the political elite, the perception of the US decay and the crisis of the democratic system was increased even further during his tenure[36], as shown by an expert:

> Until Trump's term, I had strong belief in a democratic system and thought that it should be accepted universally; but this was destroyed heavily by Donald Trump. Of course, Trump was not the symbol of democratic system, but his behavior and foreign policy had really put me off and undermined the US political system considerably. Sometimes you just need one person to ruin the image of the whole system, unfortunately (Interview 18).

The events in the US have thus encouraged China to take a more active, and sometimes even aggressive, position internationally in several areas including climate. The difference between Trump's attacks on the environmentalists and his support for the US fossil energy industry, on the one hand, and China's claims to support global efforts on climate change mitigation and to advance an energy transition at home, on the other, helped China to advance the idea of being a green leader. However, it is not very difficult to claim climate leadership in a world where the US president tweets that "the concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive" (Wong 2016). Therefore, the standards to

[36] The perception about Washington's decay had already started with the 2008 financial crisis.

assess leadership were low. Besides, during Trump's tenure American emissions continued lowering while China's continued to increase[37].

At the domestic level, this increasingly active international role since the Paris Agreement matches China's national plans. In the 13th Five Year Plan for the period from 2016 to 2020, China established the target to further reduce CO_2 emissions in 18%, to reduce energy consumption per unit of GDP in 15%, and to increase the share of non-fossil energy in primary energy consumption in 3%, thus reaching 15% in 2020 – all the targets from 2015 level. It also aims for 10% of reduction in chemical oxygen demand and ammonia nitrogen, and 15% of reduction in sulfur dioxide and nitrogen oxide. In terms of energy conservation, the Plan innovates in relation to previous ones by setting a limit in China's total energy consumption, which should not exceed 5 billion metric tons of standard coal.

More recently, and closer to the release of the 14th Five Year Plan, China took more measures towards the advance of the country's energy transition. In 2020, a draft Energy Law clearly stated the priority of renewable energy for development and the obligation of energy planners to consider environmental costs and damage, emphasized emissions reduction, and called for the inclusion of the cost of emissions and environmental damage in the price. The content of the draft indicates a greater consideration of these dimensions in the energy sector, even though the Law does not institute new policies but rather serves to codify policies that already exist (Hove 2020).

Later that same year, at the annual session of the UN General Assembly, Xi Jinping announced that China would achieve carbon neutrality by 2060. As a consequence, in order to achieve that goal, China will have to speed its energy transition, increasing the share of renewables in the country's energy mix. Also, at the international level, the fact that China made that pledge helps to better position Beijing in terms of climate diplomacy, but only in a limited way since the 2060 target is very far away from what is needed.

[37] These considerations do not imply that there is a dispute between the US and China (neither between the EU and China or the EU and the US) for climate leadership. Moreover, in absolute terms, the EU is the uncontested leader. These observations rather serve to understand the dynamics involved in China's participation in global climate governance. Actually, the fact that neither the US nor China are examples of climate leadership while at the same time they are fundamental to the solution of the problem explains why minimum dialogue between the two gains so much attention.

All things considered, Xi's government has intensified its focus on environmental issues, at least at a rhetoric level, and China has claimed an increasingly prominent role in this realm. China's claim for more space within the global climate governance architecture combines both the participation in "traditional" institutions of the Liberal International Order such as the UNFCCC and the advancing of Chinese initiatives such as GEIDCO and the Ecological Civilization. For instance, while China has engaged with US president Biden's climate summit in April 2021, Xi did not announce any major commitments except for reassuring its 2030 and 2060 goals. China's modest participation at the US-led summit signals its preference for multilateral institutions.

Much expected after China's pledge to achieve carbon neutrality, the 14th FYP, for the years between 2021 and 2025, has divided experts' and media's opinions on whether the planned domestic targets would be enough for China to keep its international promises (Lui, Liu, and You 2021; Vallejo 2021; Harvey 2021). The Plan aims for a reduction of 13.5% in energy consumption by unit of GDP and a reduction of 18% in CO_2 emissions per unit of GDP. These are similar targets in comparison with previous Plans but a MERICS analysis found that the number of projects that involve environment and sustainability in the 14th FYP is half that of the 13th FYP (Grünberg and Brussee 2021) Also, under the security category – and not green ecology – the Plan establishes a minimum level of energy production, instead of setting a limit like in the previous versions of the FYP (Liu, Liu, and You 2021). This change indicates the direction of the energy policy in the next few years as well as its place in the energy politics, more as a means to achieve security and less as a path for carbon neutrality. Besides, even though the plan reinforces China's 2060 pledge, it does not establish a limit for carbon emissions.

During the 76th Session of the UNGA in 2021, Xi announced that China would stop investing in new coal-fired power plants abroad. This decision could shift the focus of China's future cooperation, especially within the frameworks of the South-South cooperation, the BRI, infrastructure planning, and aid assistance from fossil fuels to renewable energy, which would impact China's relations with other countries that would benefit from the change (Interview 04). Moreover, at the global level, the announcement will potentially enhance the energy transition in recipient countries since those that have traditionally received Chinese investments for their coal industry will now have to redirect those investments, possibly to low-carbon energy.

Later that same year, in the context of COP 26, China submitted its revised NDC. Though China's targets have improved relative to the 2016 version, the updated document merely formalized goals that had already been previously announced by China in other occasions. The table below summarizes the main differences between China's first NDC and the revised version.

Table 10: China's Revised NDC

		First NDC (2016)	Revised NDC (2021)
Enhanced targets (by 2030)	Peaking of CO_2 emissions	Around 2030 and making best efforts to peak early	Before 2030
	Carbon intensity	Reduction by 60% to 65% from the 2005 level	Reduction by over 65% from the 2005 level
	Share of non-fossil fuels in primary energy consumption	Increase to around 20%	Increase to around 25%
	Forest stock volume	Increase by around 4.5 billion cubic meters on the 2005 level	Increase by 6 billion cubic meters from the 2005 level
New targets	Carbon neutrality	-	Before 2060
	Wind and solar installed capacity	-	Over 1.2 billion kilowatts by 2030

Source: Own elaboration based on the two versions submitted to the UNFCCC (NDRC 2015 and People's Republic of China 2021).

The lack of ambition of China's updated NDC, the proposal, together with India, to change "phase out" to "phase down" coal in the final text of the Glasgow Climate Pact, and Xi's absence from COP 26 frustrated environmentalists' expectations about China's participation at the conference. Especially Xi's nonattendance served as a symbolic indication of China's potential absence from the leaders' table and a possible recalibration of Beijing's climate policies pace. His absence was also criticized as a big mistake by US president Biden, who took the opportunity to question China's claim for a leading role: "How do you do that and claim to have any leadership mantle?" (Harvey 2021a). Moreover, the Chinese delegation was smaller than usual, and many of the people that usually attend those conferences did not go this time (Interview 03).

Amidst this context of general disappointment with China, the US–China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s was appreciated by the climate community. Despite the fact that there was limited novelty to it and that it was not ambitious, the fact that both countries reiterated their pledges and said they would work together on the issue gave COP 26 a lot of momentum (Interview 12). For instance, the EU–China Joint Press Communiqué released before COP 26 in September 2021 was more progressive and has committed China to a greater level of action than the US-China one, but it was much less noted by the media (Interview 23). The reason for that is related to the broader deterioration of the bilateral relations at the systemic level, which has encompassed several areas of international relations. Amidst this environment, the joint declaration has thus worked as a sign that the two countries are not going to stop cooperating in climate change, even with the mounting geopolitical and economic tensions that have been increasingly dividing them.

> Based on the historical impact of the first joint agreement [in Paris] and the second one in Glasgow, their cooperation is at least a safeguard [...], the lower standard, the lower end of where ambitions should be in global climate actions. You can't go lower than what the US and China have pledged. Despite the trade war, the Huawei thing, [the fact that] the two countries are still sitting together and working on climate change is a comforting sign that climate change can be a stand-alone issue that the countries are still willing to leave it as a stand-alone issue (Interview 04).

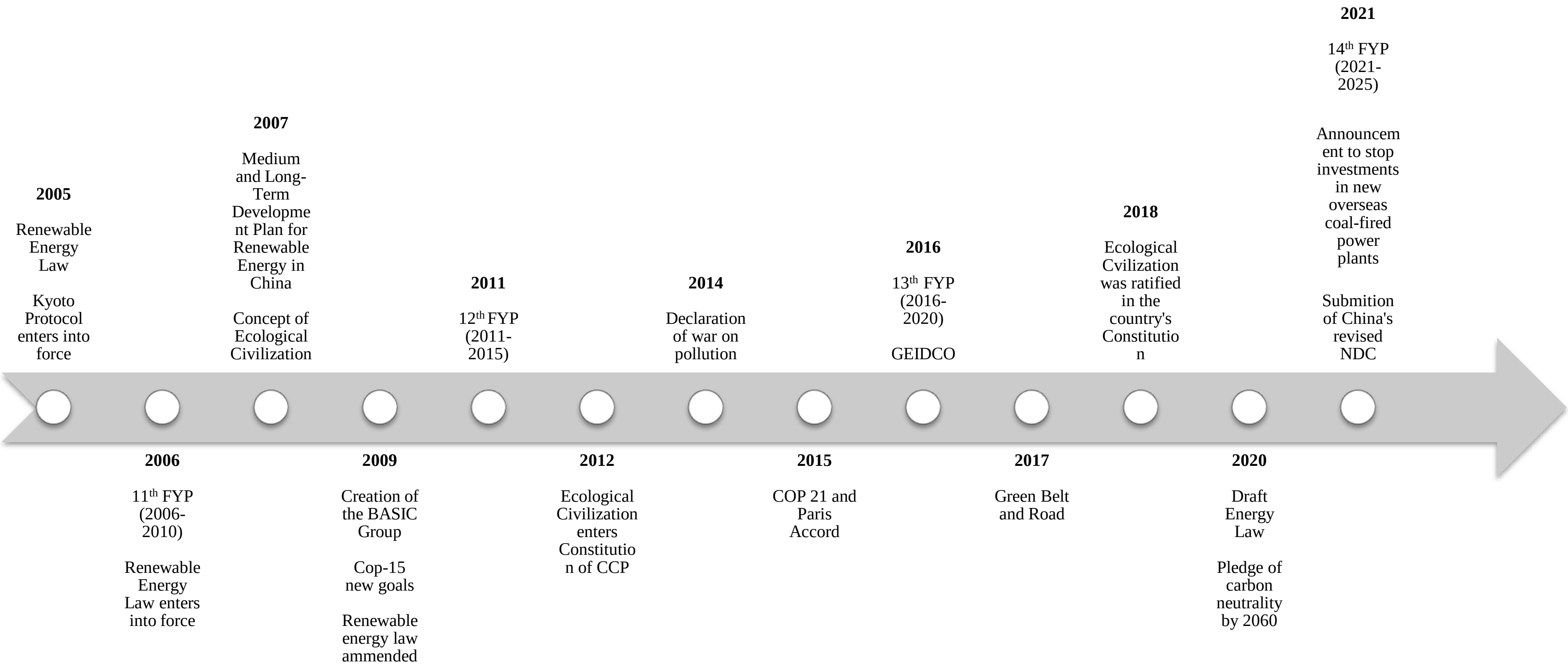
Nevertheless, as the geopolitical divides between Washington and Beijing deepen, the ability of both countries to keep the climate field as a separate sphere in their bilateral relations diminishes. That message was clearly delivered in China's foreign minister Wang Yi's warning to the US climate envoy John Kerry during the latter's visit to China in September 2021: "The U.S. side hopes that climate cooperation can be an 'oasis' in China-U.S. relations, but if that 'oasis' is surrounded by desert, it will also become desertified sooner or later" (Buckley and Friedman 2021). On the one hand, his message can be interpreted as China telling the US to stop the constant attacks and start treating China better (Interview 23). On the other, it could mean that Beijing is trying to use climate cooperation as leverage in other areas, such as Taiwan, Xinjiang, or the trade war (Interview 08). In any case, it is a worrying sign that cooperation on climate could be affected by broader US-China tensions.

> The subtext there is [that] you're creating a relationship where if the US doesn't collaborate on other areas or provide concessions in other areas then the Chinese side will say ok you're not collaborating on trade so we're not moving ahead on this climate piece. So even if everything is dressed up as cooperation and joint interests, the subtext is very transactional and that kind of transactional dynamic in fact works better after Trump shifted the baseline on trade policy. So now you have all these policies that you could back, tariffs, [and] barriers to the entry for Chinese firms to the US market, so if you're playing this right it's a bitter starting point for negotiations but a starting point that China uses to get everything they want in trade and market access. So what's alarming to me is that there seems to be a lot of nativity about where the dynamics and motivation were during the Obama negotiations and how much things have changed in both countries since then (Interview 05).

Another factor why what happens in and between the two matters is that the level of climate commitment in one country can engage the other in either a virtuous or a vicious circle with larger impacts in terms of global climate governance. Evidences for this argument date back to the Obama administration, during which one of the main arguments against US domestic climate policies was the fact that China's emissions were rising and the perception that China was not doing enough (Interview 05). But from a Chinese perspective, the US engagement at that point worked as an incentive for China to engage as well and the result was the Paris Agreement. Similarly, when Trump removed the US from that accord, it did not make sense for China to make any ambitious pledges, and there was a four-year pause (Interview 07). So, even though Washington's withdrawal from any kind of leadership in global climate governance did open up space for China to step up, the bar was very low, and Beijing did not adopt any ambitious targets during that period. On the other hand, on the US side, Trump could use China's position to justify Washington's lack of action, since China was not taking any either. With Biden claiming that "America was back" and showing that this also applies to the climate sphere, there was more incentive and pressure for China to take more action. The announcement to stop investing in overseas coal-fired power plants is an example of this push.

The timeline below illustrates the temporal sequence of the events analyzed in this section, at both the domestic and international levels. China's participation in global climate governance has not changed in a linear way, but has nevertheless evolved toward a more active behavior. As China seeks to profit from these changes in reputational terms, the next section assesses how the energy transition helps to improve Beijing's image in the international climate sphere.

Figure 13: Timeline of China’s engagement with global climate governance



Source: Author’s own elaboration.

6.2. Shifting Images: From China as a Problem to China as a Solution

The previous section has highlighted China's changing behavior in global climate governance toward a more active participation, even though this shift did not occur in a linear way. While China's motivations for such a shift are mainly domestic concerns[38] (Interview 10, Interview 12), China's energy and climate policies could result in the improvement of its international image. However, China's position as the world's largest emitter and the rising tensions that currently characterize international relations impose significant limitations to Beijing's ability to leverage in this sphere.

As China seeks a leadership position globally, it would be unhelpful for it to be seen as a pariah in the sphere of climate change, which is one of the main topics of the international agenda (Interview 01). However, the fact that China's per capita emissions are already above those of the EU, that emissions are still rising, and that China alone has contributed to two thirds of the emissions increase over the past decade are indicators that China is not leading the world toward lower emissions in a meaningful way, and, in fact, China is the main reason why global emissions haven't declined yet (Interview 05). Therefore, even though China's reputation started to change at the time of the Paris Agreement (Interview 03), there is a significant difference between stop obstructing negotiations like it did in Copenhagen and taking a role as a leader, an image that Beijing tried to construct in the period between Paris and Glasgow. Even when Trump came to power in the US and Xi tried to position himself and China as the defenders of the Paris Agreement, Beijing could not meet the expectations of the climate community:

> if you say you're a leader you're setting high expectations for your actions [...] I would have of course hoped, and I guess everyone in the climate community, that the answer would have been different, that yes we are prepared to turn things around fast enough, that we can say that we are leading, that we are responding to those expectations but that was not the case. Already before the Covid-19 crisis, the trade war led to back tracking on the economy transition goals that China had had (Interview 05).

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[38] China's motivations are not within the scope of the research, but the two previous chapters have shown how concerns about tackling pollution, maintaining the economic growth, and securing market for Chinese low-carbon energy technologies rank higher than internationally-driven pressures among Beijing's priorities.

Likewise, China still claims it is a developing country and that, as such, should have common but differentiated responsibilities, which is contradictory with any quest for leadership. However, the political cost of being the world's emissions champion is high in terms of image, and that is a risk that China understands to be inconvenient.

> In terms of practical numbers, unless China's emissions growth that we have seen over the past two decades comes to a head permanently, there is no way [the] global effort is going to add up to meeting the goals of the Paris agreement, and if that doesn't happen then China will be remembered as the country that has [undermined] the agreement (Interview 05).

In this context of questionable reputation, the energy transition is the relatively most positive and successful story in the climate domain that China can share with the world. While the international credibility of its climate pledges still depends on the results that the country will deliver – for instance, its capacity to peak emissions low and well before 2030[39] – the energy transition has already shown results that have had worldwide effects.

In this sense, the kind of position that China wants to have in the climate sphere is as part of the solution, including as the provider of the technologies that will make the energy transition possible for the world (Interview 01). Therefore, even though China is the largest carbon emitter, it is trying to boost its positive image beyond that toward one as an actor trying to solve the issue (Interview 09). And the way Beijing is doing that is through the supply of affordable renewable energy technologies. China adopted those technologies when they were not yet economical and despite the argument that it was still a middle-income country (Interview 02), and even though these technologies were first developed elsewhere, China brought them to such a scale that ensured their affordability to the rest of the world (Interview 13).

> Without the supply chain mostly dominated by China, Western countries would have to pay more. That is a scale of hundreds of billions more to

[39] Credibility here does not refer to China being able to keep its promises but to its ability to go beyond them. Beijing usually makes long-term promises that it can guarantee and is therefore known for under-promising and over-delivering.

> install the same level of today's deployment. And in the future, if they move to domestic manufacturing, they would pay higher price for their technologies. So that is one aspect of the green leadership or global contribution that China paid (Interview 25).

This dimension affects its image in the sense that China has a successful story to tell the world in this field. Indeed, the fact that China started to receive better international press for its efforts in the climate area since Paris was to a significant extent enabled by the speed of its energy transition, the diminishing costs of renewable energy, and innovations such as those in power transmission (Interview 03). As the country transitions toward cleaner resources relatively fast, the government could claim this is quite astonishing considering that it is still a developing country and did not start out at the same position as the first movers of the energy transition (Interview 02).

> I don't think that the energy transition would be really feasible, and I'm not even sure the Paris climate agreement would have been feasible, if China had not already scaled up manufacture of wind and solar [...]. I don't see where the world would be in adopting clean energy now because we wouldn't be able to see a clear path toward a zero carbon future (Interview 02).

Hence, the transition would be more costly and slower if China had not adopted those technologies in large scale, which has made them accessible worldwide[40]. Therefore, the energy transition even contributes to the Party's legitimacy[41] in the sense that, as China seeks to position itself as a major supplier of low-carbon energy technologies and reduces its own emissions, it enhances the narrative of China's leadership and of the success of its political and economic model (Interview 01). Moreover, China has been receiving a lot of criticism in a wide range of spheres, from its human rights policy and its political regime to its international behavior increasingly pivoting toward wolf warrior diplomacy. So being the country

[40] This observation does not imply that China has deliberately scaled up technology motivated by potential improvements in its image. On the contrary, domestic reasons usually prevail. But in a context marked by poor climate goals, controversial participation in climate negotiations, and continuous use of coal domestically, China's role in making these technologies accessible is the most concrete contribution of the country in the climate sphere.

[41] A discussion on energy and legitimacy can be found in Chapter 5.

that provides the green technologies of the 21st energy transition is instrumental for China to improve its image:

> I think the Communist Party and the leadership want an issue where they can be seen as a responsible, positive contributor because obviously there aren't that many of those [issues] in the international perspective, and climate is one where they think they can do that (Interview 05).

In other words, China doesn't want to be seen as "the bad guy": "China still needs to show that it is doing something and actually do something as well because if it doesn't, Europe and the US can say they are the bad guy not just in [the issue of] Taiwan [and the] Uyghur, but here [in climate] too" (Interview 08). The concern about China's environmental image has thus increased in relevance and has become an important part of Beijing's core goals:

> when [they] have that 2035 socialist modernization [...] it can't be that the rest of the world is looking at china and [saying] they have money, nice cars, nice apartments, but it is a complete ecological disaster. So [China] is making ecological protection and environmental protection a part of that long term vision (Interview 05).

At the global stage, by using the energy transition to improve its image, Beijing desires to tell a better story of China to the rest of the world (Interview 06). One example of this effort is the China Council for International Cooperation on Environment and Development (CCICED), a high-level international advisory body. Its vision is to build "a more beautiful China and a green and bountiful world" and it is dedicated to promote ecological civilization and sustainable development. The organization works as an exchange platform between China and the world that serves to promote "collaborative efforts to achieve ecological civilization, and for advocating innovative and better governance system of the global environment" (CCICED 2022).

This organization is chaired by China's Vice-Premier and composed of both Chinese and international senior officials and experts. This includes people that have been ministers and prime ministers, heads of UN programs such as UNEP and UNDP, and of the World Bank, and who deeply engage with China in a trustful and cooperative way (Interview 23). According to an international expert and member of

CCICED, it's a very influential group because many issues that have been raised, discussed, and researched in this group have became policy in China some years later (Interview 23). However, since its foundation in 1992, the organization has been shifting the direction of its communication and advisory purpose:

> Previously, a lot of the focus of this organization was on advising China, what can China do to better protect the environment, etc. And then in 2016-17 the focus shifted a lot to overseas investments and then even more recently we are also spending more time sharing with the world some of the successful efforts that are being made in China, which sometimes can be relevant to other countries so the council is very much part of China's soft [power]. This is diplomacy at a very high level [...]. I think it's really a soft power thing as well because the advisors that come get some access to China's policy making and leadership and vice versa, China's environmental policy makers and leaders get some access and influence with these international leaders. So they will gain a much better understanding of China's intentions and China's efforts and etc. So they are more likely to speak to the rest of the world and to their own organizations and to their colleagues and other leaders in a more informed and constructive way about China (Interview 23).

This change reflects China's confidence with its transition trajectory and the attempt to share this story with the rest of the world and thus improve Beijing's position in global climate governance. It also corroborates the argument that China wants to be part of the solution when it comes to climate change, and the energy transition is the most successful way in which they can do that.

That story could be even more successfully received in the developing world, as China's energy transition represents valuable opportunities, especially for those countries. For instance, Beijing's latest decision to stop financing new overseas coal-fired power plants has changed the investment profile of Chinese state-owned enterprises abroad, which could have a great impact for the countries that receive those investments (Interview 02, Interview 09). The new policy serves as an indicator that China wants to contribute in a green and renewable way (Interview 17). In this sense, the energy transition works as an asset for China to try and improve the press that the BRI has gotten by trying to frame that as China doing its part, which is much easier to do in places like the Middle East, Africa, South and Southeast Asia than in the US and Australia (Interview 03). The narrative behind the effort to build a better image is that Beijing providing affordable solutions is even more important for countries that are less developed than China (Interview 04, Interview 13), so China would be helping those countries (Interview 17). Moreover, its energy transition serves as an example for other developing nations that, like China, are still heavily reliant on fossil fuels and struggle with the transition (Interview 09, Interview 20).

> Our assumptions are that large countries tend to care less of what other countries think about them and if you are an authoritarian country you probably care even less. China has shown to be very receptive to the reactions and opinions of these developing countries that host BRI projects [...] and I think that has real implication for how China might approach international dimensions of its energy cooperation. Tangibly I think it would mean if for example the US calls out China to stop funding overseas coal plants, China is not going to respond to that [...] but if a number of its host country partners [...] say they want to move away from coal, then China is going to pay attention to that, it's going to care about that image because it doesn't want to be seen as being a predatory actor in these countries (Interview 24).

However, broader geopolitical tensions at the international stage in fields other than climate and energy pose an increasing challenge for China to leverage in terms of image. Increasingly fraught perceptions about the country's human rights record or commercial practices overshadow even the positive effects of China's energy transition policy (Interview 12). For instance, reports on China using Uyghur forced labor to produce solar panels have negative reputational effects on the country's image, despite the success of its solar industry.

Moreover, as the West has converted its relationship with China into a more existential crisis between democratic and authoritarian governments, there is a bias toward criticizing every effort as not enough compared to those of democracies (Interview 24). Of course the argument works both ways, as China considers its system of governance superior to the decadent West. From the Chinese perspective, this scenario further increases the feeling of being underappreciated internationally and not getting the credit for what it has done, despite all of the problems and limitations in its transition process (Interview 03, Interview 04, Interview 25). Besides, these divides could potentially deepen as China, despite its efforts to stay neutral, keeps a cooperative relationship with Russia amid the war in Ukraine. This geopolitical instability could affect the level of trust between the West and China, which is needed to address climate change and to jointly take more ambitious actions (Interview 23). So, it is not only about climate policy, but it rather involves many intertwined power dynamics (Interview 20). The tendency toward competition reaching also the climate field was clear in a speech delivered by the US Secretary of State Anthony Blinken a couple of days before the Leaders Summit on Climate:

> It's difficult to imagine the United States winning the long-term strategic competition with China if we cannot lead the renewable energy revolution. Right now, we're falling behind. China is the largest producer and exporter of solar panels, wind turbines, batteries, electric vehicles. It holds nearly a third of the world's renewable energy patents. If we don't catch up, America will miss the chance to shape the world's climate future in a way that reflects our interests and values, and we'll lose out on countless jobs for the American people (Blinken 2021).

Despite those limitations, China is an indispensable part of the climate crisis solution, since there is no tackling climate change without Chinese cooperation. No international agreement to reduce emissions or accelerate the transition will be effective without including China. Moreover, because of the country's size, its energy and climate policies have consequences much beyond China. Therefore, climate remains a sphere of international relations where China maintains a central seat at the negotiation table, even amid broader international geopolitical tensions. However, its image in this domain is undermined by the lack of linearity and ambition in its international pledges and the continuous use of coal and rising emissions domestically. In this context, the energy transition is the way through which China presents itself as part of the solution, as the country that has enabled the commercial deployment of renewable energy and the one who can provide the world with the key green technologies that will enable decarbonization. It is regarding this aspect of China's role and not a political leadership in global climate governance that Blinken was referring to.

6.3. Preliminary Results and Conclusion

China is a latecomer in global climate governance, and for a long time the country held an extremely conservative position regarding any international climate commitment that would undermine its domestic development. This chapter showed how China's participation in global climate governance has been changing toward a more collaborative posture and active behavior. However, this shift has been neither linear nor constant, in the sense that it has been back and forth depending on both domestic and international contexts.

On the one hand, China has made important announcements and climate pledges in international forums. Interestingly, the most relevant targets were made at the UNGA and not in specific climate-related conferences such as those within the UNFCCC framework. This preference indicates China's willing to reach a broader audience for its climate policy and possibly profit from the perception of change in its image. At the same time, China has been using those same organizations to forward Chinese concepts, initiatives, and organizations, such as the ecological civilization and GEIDCO. However, on the other hand, it has found resistance within the international community to advance those ideas, and the reason for that is the inconsistence of the idea if compared with the hard fact of a country dramatically emitting more than a half of global emission. It is also located in broader systemic tensions between the West and China. Issues related to Taiwan, Hong Kong, Xinjiang, China's commercial practices, the origins of the corona virus, and the trade war have not only affected relations with China in a broader geopolitical sense, but also in the specific climate domain. Moreover, even in the climate field, Beijing has insisted that its responsibilities should be equal to those of developing countries, and therefore its climate targets have been less ambitious than the international community expected and focused on the long term.

Therefore, the way China can claim a political leadership role in global climate governance is restrained by several limitations both climate-related and not. Therefore, the chapter has shown that it is not China's more active participation in global climate governance that helps China to improve its image, but rather the energy transition. This specific aspect of China's climate politics is the most successful story that Beijing can tell the world in the climate domain. It works to construct an image of China as part of the solution, which basically means a supplier of affordable clean energy technologies. In other words, by forwarding its energy transition, China improves its image, which in turn enhances its credibility within global climate governance. Image thus works as a mediating variable between China's energy transition and its position in international relations. However, this variable is much more contested that technology advantage and energy security, and it is more dependent upon the international geopolitical and ideological landscape of the moment.

Conclusion

This dissertation was born from the observation of a set of phenomena in two main spheres. On the one hand, energy, which has historically played a central role in power dynamics in international relations, is changing as the world has started to transition from a fossil fuels based energy paradigm to a low-carbon one. On the other, the international system is becoming increasingly decentralized with new powers rising and growing their absolute and relative power capabilities in international relations. An additional phenomenon that intersects those two spheres is that China is a central actor in both of them. The dissertation was thus structured in a way that could provide an understanding of how these two aspects of the international reality were connected in the case of China.

The examination of what this study has called the 21st century energy transition has shown that this is a complex and multifaceted process that involves changes not only in the main source of energy, but also in the entire energy system. It therefore involves much more elements and technologies than previous transitions, including generation, transmission, storage, critical minerals, and multiple sectors. Moreover, because it is still an ongoing transition, its meaning and scope might vary as new technologies emerge and also depending on the specific local context in which it occurs.

In addition to the plurality of elements it comprises, another major feature that differentiates the current transition from past ones is that it is part of wider efforts to decarbonize the world's economy and tackle climate change. Therefore, it encompasses a dimension of purpose and urgency and a notion of responsibility. This consideration has theoretical and practical implications since it entails leadership, technology innovation, and international cooperation coordination.

This complexity and plurality of elements composing the 21st century energy transition and the fact that it is a still ongoing process pose significant challenges for theory. As a multidisciplinary subject, progress has been made in and outside of the Social Sciences, but it is still an incipient topic in IR. In the fossil fuels era, and especially since the 1970s, IR has made significant contributions to advance the understanding of energy politics, which has included themes such as energy security and interdependence, the energy regime and energy governance, resource nationalism, and energy wars. However, the assessment of how the current energy transition influences the power dynamics in international relations is still at an initial and exploratory stage.

The reason why the emerging energy paradigm requires theoretical adjustments and innovations in the field is that the relation between energy and power changes across time, and this variation has to do with both the type of resources composing the world's energy mix and the power configurations of the international system at a specific time. Moreover, due to its complex, multifaceted, and multidisciplinary character, the energy transition does not fit into one single IR theory. Even though using one theory to focus on one dimension of it would also have been a valid contribution, this dissertation has opted for a broader exploratory assessment that better agrees with this incipient and ongoing process and therefore has adopted theoretical eclecticism.

The study has reflected on IPE's insights on technology development and how the transition might create new winners and losers, considering that it is much more centered on technology innovation than in the extracting industry, thus reconfiguring the international division of labor. The theoretical framework has also revisited major geopolitical assumptions that no longer apply to the low-carbon paradigm, such as the transferring of geopolitical dynamics that have characterized the fossil fuel era to the critical minerals supply chain, a renewed resource curse, or the use of electricity as a geopolitical weapon. Moreover, considering the paramount role of technology, the tendency to replicate the argument that control over resources automatically provides states with power in the international system must be revisited. This emerging geopolitical context not only creates new energy security dynamics between states but can also lead to a new concept of energy security. The classical and most widely used definition as the uninterrupted and affordable access to energy sources will not reflect a reality in which accessing technology is more important than a liberal conception of free energy flow. Therefore, the energy transition will likely place clean energy technologies at the center of the concept of energy security from both demand and supply perspectives.

In addition to these approaches, energy governance requires the same revision of basic assumptions. However, it is more relevant to this dissertation's research question to place the energy transition in the broader global governance architecture, where responsibility and leadership can be more appropriately observed. As this dimension is tied with the purposeful and urgent character of the 21st century energy transition, these elements are related to a country's image internationally and are expressed in terms of soft power. The strands of these approaches, eclectically highlighted and pragmatically combined, have formed the theoretical framework of this dissertation and helped to delimit the research's variables and its operationalization.

The first variable examined was technology. The analysis of policy documents and expert interviews has evidenced that the Chinese government has for long considered the development of those technologies not only as a way to address the climate issue, but also as a means to obtain economic leverage in an industrial sector that rises in importance globally. The data has shown that China has strategically placed the clean energy industry at the heart of the country's economic and technology policy for mainly two reasons. First, the urgency to decarbonize the world's economy and tackle climate change has created opportunities for the countries that possess the technology solutions to achieve those climate-related goals. Second, whereas China is a latecomer in various industries, including the fossil fuels', it still finds space to compete as one of the frontrunners in the clean energy technologies sector. This strategy has involved multiple forms of innovation, including the scaling up of technologies first developed outside of China, the development of indigenous technologies that should transform the country's industry from Made in China to Created in China, and the setting of international standards that could better position China in the governing bodies that set the rules for those technologies and thus further enhance its market position.

These findings were backed by the analysis of data on installed capacity, patents, and manufacturing of green technologies, which have indicated China's leading position in the majority of the main technologies assessed. Moreover, even in incipient and less used low-carbon energy technologies, such as geothermal and ocean energy, China is investing in incremental solutions and trying to expand its capacity. The country also holds a substantive share of patents in the sector and has been successful in setting international standards for transmission technologies.

Therefore, the technologies of the 21st century energy transition represent a technological arena in which China can have a leading role, instead of simply being the world's factory. Technology is thus one dimension of how the energy transition affects China's position in the international system, and this conclusion is supported both by the official government understanding and the de facto developments of this industry in China.

The second variable assessed was energy security. The contextualization of the meaning of energy security to the Chinese perspective resulted in the identification of two sets of concerns influencing the understanding of this concept in China. The first is the perception of the international environment as potentially hostile, which leads to Beijing's pursuit of energy self-reliance. The second is the priority of three domestic concerns: legitimacy, stability, and economic growth. This conceptualization indicates that the government mainly addresses energy security and the energy transition as two separated and often opposing categories. Moreover, it exposes how China's understanding over energy security is still strongly anchored in coal, due to the availability of this resource in China. The 2021 energy crisis has supported these findings and deepened the differentiation between energy security and the transition. It has also exposed the many limitations of the energy transition in China at this point.

This understanding is the setting against which current and emerging geopolitical dynamics with direct impact on China's energy security can be assessed. In this context, the examination of China's increasing energy demand and how it has been mainly met with oil and gas imports concentrated in a few countries and regions has highlighted the insecurity of the country's energy supply. Moreover, a closer assessment on how these imports depend on maritime routs, straits, and pipelines that cross geopolitical hotspots has further underlined China's vulnerability to security risks in the current configuration of its energy mix.

The geopolitics involving the energy transition affects the energy security dimension in three main ways. First, the geopolitics involving critical minerals increases China's energy security, as the country is much more self-reliant in those resources as compared to the imported oil and gas. The analysis of data on critical minerals has shown that while their crucial importance in the context of the transition creates new dependency patterns, this scenario is favorable to China, as the country either is the main producer and refiner of many of those minerals or is succeeding to guarantee access to them overseas through joint ventures. Second, the energy transition enhances the country's energy security when taking the environmental dimension into account. China's climate risk is high, and the extreme weather events that are already unfolding and that are likely to increase will directly affect the domestic tripod of energy security, that is, legitimacy, stability, and economic growth. Finally, and related to the technology variable, as the energy transition provides China with an industrial advantage, it also benefits the economic dimension of the Chinese concept of energy security.

As the theoretical framework has highlighted, in the context of the 21sr century energy transition, technology is likely to be at the heart of the concept of energy security. In the case of China, which has been traditionally concerned over resource supply, this means that the country could shift its focus toward a demand-oriented perspective of security. In other words, by advancing the energy transition, Beijing's energy security concerns would be more tied to finding markets for its low-carbon technologies. On the other hand, the technology advantage could also turn into conflict considering that energy has historically been a geopolitical battleground. In this sense, as the overall international environment becomes increasingly more competitive, the low-carbon technologies could be an important arena for disputes between China and the West, a situation that would challenge Beijing.

All things considered, energy security is another dimension of how the energy transition affects China's position in international relations, as it diminishes Beijing's current vulnerabilities related to energy imports and transportation as well as environmental security risks. However, at this point energy security in China is mainly related with coal, which means that given the limitations that the energy transition still faces in the country, the Chinese government strongly prioritizes coal over the energy transition for the enhancement of its energy security.

The third variable considered was image in global climate governance. While China is a latecomer in this sphere of international relations and has for long maintained a very conservative position, the analysis of the country's participation in international climate negotiations and its international climate-related pledges has shown that this posture is changing toward a more collaborative and active behavior. Nevertheless, this change is still limited as China's climate goals are extremely poor -

it continues to produce half of global carbon emissions every year – and fully inconsistent with the global carbon budget. Moreover, China insists that its responsibilities in this arena should be the same as those of developing countries – while it is one of the two superpowers. This indicates that the country is not willing to make any sacrifices, which is incompatible with a leadership role.

In this context of climate goals that are incompatible with the global needs, of controversial participation in international climate negotiations, and of promises in contradiction with the current use of coal domestically, the energy transition works as the most successful contribution of China in the climate arena. Put differently, the partial energy transition is a more positive element amongst Beijing's limited, conservative, and controversial climate politics that can be told as a successful story. China's advances in the transition, especially in the technology domain and the country's role in scaling up technology for the entire world help frame an image of China as part of the solution, that is, as the provider of affordable low-carbon technology.

Hence, the energy transition can improve China's image in global climate governance, which thus increases its international credibility and influences its position in this particular field of international relations. However, image depends more on external factors than the other two variables, such as the geopolitical and ideological contexts of the international environment at a given point in time. For instance, issues related to Taiwan, Xinjiang, Hong Kong, the trade war, the cult of Xi's personality, the "social credit system" of social control, or even the origins of the Corona virus create a context that affects even the more positive sides of China's image.

The three variables explored in this dissertation have therefore provided the empirical support to the effort to map how the 21st century energy transition influences China's position in the international system. Even though this is a single case study that did not aim for generalization, the three mediating variables could be further applied to other cases, even though the country-specific characteristics related to the energy transition must be considered and therefore could result in variations within the variables.

The current stage of low-carbon energy development in China evidences that this is still a *transition* at its beginning and, as such, it still carries many contradictions along the way. However, it is precisely the urgency to bridge the existing gaps that drives innovation and presents opportunities for countries like China. In other words, the leverage is precisely related to the fact that this is an ongoing transition and not a newly established energy paradigm. If it were established, the advantages would also be established, but as an ongoing process, the finish line is still open to all the racers.

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Appendix: Resumo Expandido [Expanded Abstract in Portuguese]

Estrutura da Tese

Energia é um elemento primordial das sociedades moderna e contemporânea e um aspecto intrínseco de nosso estilo de vida. Além disso, é uma fonte estratégica de poder estatal. A relevância e centralidade dos recursos energéticos foi enfatizada pela crise do petróleo durante a década de 1970. A partir de então, muitos governos começaram a interpretar as interrupções de energia como uma possível ameaça à segurança nacional e, portanto, passíveis de serem respondidas por meios militares. Desde então, sucederam-se numerosos eventos envolvendo interrupções energéticas, incluindo a atual crise energética europeia.

Desde a Revolução Industrial, a base da matriz energética mundial tem sido composta majoritariamente por combustíveis fósseis, mas ao longo da história ocorreram duas grandes transições energéticas: da madeira para o carvão e do carvão para o petróleo e gás, embora o carvão tenha mantido uma participação relevante. Mais uma vez o mundo testemunha uma transição energética, desta vez centrada em fontes de baixo carbono. Considerando-se que energia e poder estatal tiveram uma forte interconexão ao longo da história, é interessante notar a existência de um fenômeno paralelo à transição energética. O sistema internacional está cada vez mais descentralizado, com mais potências crescendo e aumentando suas capacidades de poder. A ascensão da China e seu papel na transição energética do século XXI intersectam esses dois fenômenos e o país é um caso interessante para observar como a transição transforma as relações até então conhecidas entre energia e poder nas relações internacionais.

Esta tese centra-se, portanto, na intersecção de duas questões definidoras das relações internacionais contemporâneas: uma transição energética global em curso e a ascensão da China. O estudo conecta esses dois processos abordando a seguinte pergunta de pesquisa: como a transição energética da China para fontes de baixo carbono influencia sua posição no sistema internacional? Em outras palavras, a pesquisa procura contribuir para a compreensão de como a transição energética da China implica poder em determinadas dimensões das relações internacionais, considerando-se que a energia, em suas múltiplas formas, esteve historicamente atrelada às dinâmicas de poder no sistema internacional.

A transição energética do século XXI é um processo complexo e multifacetado vinculado a objetivos mais amplos relacionados ao clima e, portanto, envolve noções de propósito, urgência e responsabilidade. Além disso, ainda é um processo em andamento cujos resultados só podem ser avaliados parcialmente à medida que a transição evolui, embora certamente a velocidade da transição não corresponda à velocidade do aquecimento global. Essas características apresentam desafios metodológicos e teóricos. O resultado é que, embora tenha havido avanços dentro e fora das Ciências Sociais, os esforços dentro da disciplina de RI para incluir a transição em seu escopo ainda são incipientes. Portanto, considerando-se o estágio atual de pesquisas sobre o tema, este estudo adota uma abordagem exploratória. Trata-se de um estudo de caso de métodos mistos, ancorado no ecletismo teórico e no pragmatismo metodológico, que se concentra em um exemplo (China) de um fenômeno mais amplo (a relação entre a transição energética de baixo carbono e o poder nas relações internacionais).

O estudo visa, portanto, contribuir para os esforços de compreensão de como a transição energética do século XXI afeta a dinâmica de poder envolvendo energia e relações internacionais. Propõe-se um afastamento das lentes tradicionais amplamente utilizadas pelos estudos de energia para avaliar as implicações políticas do paradigma energético dos combustíveis fósseis em direção a um arcabouço teórico eclético capaz de analisar as especificidades da transição atual. Embora esta seja uma pesquisa exploratória e, portanto, não vise testar nenhuma hipótese pré-definida, o pressuposto subjacente é que os efeitos da transição energética vão além do campo da energia em si e impactam certas dimensões internacionais de poder. Isso diferencia o presente estudo de parte significativa da literatura que tem se concentrado em como a transição ocorre, ou na necessidade de alcançá-la e como. Para operacionalizar a pergunta de pesquisa, o estudo coloca três variáveis mediadoras entre a transição energética da China (variável independente) e a posição do país no sistema internacional (variável dependente). São elas: tecnologia, segurança energética e imagem na governança global do clima. Em termos de limites cronológicos, a pesquisa abrangerá eventos de 2005 a abril de 2022. O ano inicial marca a aprovação da Lei de Energias Renováveis da China, seguido pelo 11º Plano Quinquenal em 2006, que marcou a inclusão de questões ambientais no escopo destes documentos. O limite final refere-se à data da última entrevista realizada para esta pesquisa.

Esta tese está estruturada em dois pilares principais divididos em seis capítulos além desta introdução e de uma conclusão. A primeira parte é composta pelos três primeiros capítulos e apresenta os arcabouços conceituais, teóricos e metodológicos da pesquisa. O Capítulo 1 define o escopo do que esta pesquisa chama de transição energética do século XXI, seu significado e como ela difere das transições anteriores. Também evidencia-se o caráter complexo e multifacetado da atual transição, bem como o propósito e a urgência que ela envolve. O capítulo também fornece um relato do status atual da transição energética tanto globalmente quanto na China. Em seguida, o Capítulo 2 leva em conta essa definição e propõe um arcabouço teórico eclético para a tese que combina de forma pragmática vertentes de algumas teorias de RI, especialmente economia política internacional, estudos de geopolítica e segurança energética, governança energética global e soft power. Por fim, o Capítulo 3 define esta pesquisa como exploratória e descritiva, de métodos mistos e ancorada no pragmatismo. O capítulo também apresenta o desenho da pesquisa como um estudo de caso com foco na China e operacionaliza a pesquisa.

A segunda parte engloba os três últimos capítulos, que compõem a parte empírica do trabalho, cada um com foco em uma variável mediadora. O Capítulo 4 concentra-se em tecnologia e examina a política relacionada ao desenvolvimento de tecnologias de baixo carbono na China. Em seguida, o capítulo mapeia e examina as principais tecnologias da transição energética do século XXI. O Capítulo 5 é dedicado à segurança energética. Ele traça a evolução da segurança energética da China e as mudanças que o conceito sofreu. Em seguida, contrasta o contexto geopolítico atual com o emergente trazido pela atual transição energética e discute as implicações de segurança energética dessa mudança. Por fim, o Capítulo 6 analisa a imagem da China na governança global do clima. Ele primeiro avalia a evolução da participação da China nessa esfera das relações internacionais e como essas mudanças estão entrelaçadas com as políticas domésticas. Em seguida, aborda as mudanças de imagem da China nesse campo e a centralidade da transição energética nesse processo.

Resumo dos Resultados e conclusões

A primeira variável examinada foi tecnologia. A análise de documentos e entrevistas com especialistas evidenciou que o governo chinês há muito considera o desenvolvimento dessas tecnologias não apenas como uma forma de solucionar a questão climática, mas também como um meio de obter vantagem econômica em um setor industrial que cresce em importância globalmente. Os dados mostraram que a China colocou estrategicamente a indústria de energia limpa no centro da política econômica e tecnológica do país principalmente por dois motivos. Primeiro, a urgência de descarbonizar a economia mundial e enfrentar as mudanças climáticas criou oportunidades para os países que possuem as soluções tecnológicas para atingir essas metas relacionadas ao clima. Em segundo lugar, enquanto a China chega atrasada em vários setores, incluindo o de combustíveis fósseis, ela ainda encontra espaço para competir como um dos países pioneiros no setor de tecnologias de energia limpa. Essa estratégia envolveu várias formas de inovação, incluindo a utilização em larga escala de tecnologias desenvolvidas primeiramente fora da China, o desenvolvimento de tecnologias chinesas para transformar a indústria do país de "Made in China" para "Created in China" e o estabelecimento de padrões internacionais (standards) que poderiam melhor posicionar a China nas organizações que definem as regras para essas tecnologias e, assim, aumentar ainda mais sua posição no mercado.

Em complemento, a análise de dados sobre capacidade instalada, patentes e fabricação de tecnologias verdes igualmente indicaram a posição de liderança da China na maioria das principais tecnologias avaliadas. Além disso, mesmo em tecnologias de energia de baixo carbono incipientes e menos utilizadas, como a geotérmica e a oceânica, a China está investindo em soluções incrementais e tentando expandir sua capacidade. O país também detém uma parcela substancial de patentes no setor e tem sido bem-sucedido em estabelecer padrões internacionais para tecnologias de transmissão.

Portanto, as tecnologias da transição energética do século XXI representam uma arena tecnológica na qual a China pode ter um papel de liderança, em vez de ser simplesmente a fábrica do mundo. A tecnologia é, portanto, uma dimensão de como a transição energética afeta a posição da China no sistema internacional, e essa conclusão é apoiada tanto pelo entendimento oficial do governo quanto pelos desenvolvimentos de fato dessa indústria na China.

A segunda variável avaliada foi segurança energética. A contextualização do significado de segurança energética para uma perspectiva chinesa resultou na identificação de dois tipos de preocupações que influenciam a compreensão desse conceito na China. A primeira é a percepção do ambiente internacional como potencialmente hostil, o que leva Pequim à busca da autossuficiência energética. A segunda é a prioridade de três preocupações domésticas: legitimidade, estabilidade e crescimento econômico. Essa conceituação indica que o governo aborda a segurança energética e a transição energética como duas categorias separadas e muitas vezes opostas. Além disso, essa conceituação explica como o entendimento da China sobre segurança energética ainda está fortemente ancorado no carvão, devido à disponibilidade desse recurso na China. A crise energética de 2021 corroborou esse entendimento e aprofundou a diferenciação entre segurança energética e a transição, além de expor as muitas limitações da transição energética na China neste momento.

Esse entendimento é o cenário no qual as dinâmicas geopolíticas atuais e emergentes com impacto direto na segurança energética da China podem ser avaliadas. Nesse contexto, a análise da crescente demanda energética da China e como ela tem sido atendida principalmente com as importações de petróleo e gás concentradas em alguns países e regiões destacou a insegurança do abastecimento energético do país. Além disso, uma avaliação mais detalhada de como essas importações dependem de rotas marítimas, estreitos e oleodutos que atravessam pontos de tensões geopolíticas sublinhou ainda mais a vulnerabilidade da China a riscos de segurança na configuração atual de sua matriz energética.

A geopolítica que envolve a transição afeta a segurança energética de três maneiras principais. Primeiro, a geopolítica envolvendo minerais críticos aumenta a segurança energética da China, pois o país é muito mais autossuficiente nesses recursos em comparação com o petróleo e o gás importados. A análise dos dados sobre minerais críticos mostrou que, embora sua importância crucial no contexto da transição crie novos padrões de dependência, esse cenário é favorável à China, pois o país é o principal produtor de muitos desses minerais ou consegue garantir o acesso a eles no exterior por meio de joint ventures. Em segundo lugar, a transição energética aumenta a segurança energética do país quando se considera a dimensão ambiental. O risco climático da China é alto e os eventos climáticos extremos que já estão ocorrendo e que provavelmente aumentarão afetarão diretamente o tripé doméstico da segurança energética, ou seja, os pilares de legitimidade, estabilidade e crescimento econômico. Finalmente, e relacionado com a variável de tecnologia, uma vez que a transição energética confere à China uma vantagem industrial, ela beneficia também a dimensão econômica do conceito chinês de segurança energética.

Como o quadro teórico destacou, no contexto da transição energética do século XXI, a tecnologia provavelmente estará no centro do conceito de segurança energética. No caso da China, que tradicionalmente se preocupa com o fornecimento de recursos, isso significa que o país pode mudar seu foco para uma perspectiva de segurança orientada para a demanda. Em outras palavras, ao avançar na transição energética, as preocupações de segurança energética de Beijing estariam mais voltadas a encontrar mercados para suas tecnologias de baixo carbono. Por outro lado, a vantagem tecnológica também pode se transformar em conflito à medida que o ambiente internacional se torna cada vez mais competitivo e as tecnologias de baixo carbono podem ser o próximo campo de batalha para disputas entre a China e o Ocidente, uma situação que desafiaria Beijing.

Assim, segurança energética é outra dimensão de como a transição energética afeta a posição da China nas relações internacionais, pois ela diminui as vulnerabilidades atuais de Beijing relacionadas às importações de energia e ao seu transporte, bem como aos riscos de segurança ambiental. No entanto, neste momento a segurança energética na China está majoritariamente relacionada ao carvão, o que significa que, dadas as limitações que a transição energética ainda enfrenta no país, o governo chinês prioriza fortemente o carvão em relação à transição para o reforço de sua segurança energética.

A terceira variável considerada foi a imagem na governança global do clima. Embora a China seja um retardatário nessa esfera de relações internacionais e tenha mantido por muito tempo uma posição bastante conservadora, a análise da participação do país nas negociações internacionais do clima e seus compromissos internacionais relacionados a essa questão mostrou que essa postura está mudando para um comportamento mais colaborativo e ativo. No entanto, essa mudança ainda é limitada, pois as metas climáticas da China são extremamente insuficientes – o país continua a produzir metade das emissões globais de carbono a cada ano - e totalmente inconsistentes com o orçamento global de carbono. Além disso, a China insiste que suas responsabilidades nessa área devem ser as mesmas dos países em desenvolvimento – sendo que é uma das duas superpotências – o que indica que o país não está disposto a fazer sacrifícios, e isso é incompatível com um papel de liderança.

Nesse contexto de metas climáticas incompatíveis com as necessidades globais, de participação controversa nas negociações internacionais sobre o clima e de promessas em contradição com o uso atual de carvão no mercado interno, a transição energética funciona como a contribuição mais bem-sucedida da China na área climática. Em outras palavras, essa transição energética parcial é um elemento mais positivo entre as políticas climáticas limitadas, conservadoras e controversas de Beijing que podem ser contadas como uma história de sucesso. Os avanços da China na transição, especialmente no domínio da tecnologia e o papel do país na expansão da tecnologia para todo o mundo ajudam a construir uma imagem da China como parte da solução, ou seja, como fornecedora de tecnologia de baixo carbono acessível.

Assim, a transição energética pode melhorar a imagem da China na governança climática global, o que aumenta sua credibilidade internacional e influencia sua posição neste campo específico das relações internacionais. No entanto, a imagem depende mais de fatores externos do que as outras duas variáveis, como os contextos geopolítico e ideológico do ambiente internacional em um determinado momento. Por exemplo, questões relacionadas a Taiwan, Xinjiang, Hong Kong, a guerra comercial, o culto à personalidade de Xi, o “sistema de crédito social” de controle social ou mesmo as origens do coronavírus criam um contexto que afeta até os aspectos mais positivos da imagem da China.

As três variáveis exploradas nesta tese forneceram, portanto, o suporte empírico ao esforço de mapear como a transição energética do século XXI influencia a posição da China no sistema internacional. Além disso, o atual estágio de desenvolvimento energético de baixo carbono na China evidencia que esta ainda é uma *transição* em seu início e, como tal, ainda carrega muitas contradições ao longo do caminho. No entanto, é precisamente a urgência de preencher as lacunas existentes que impulsiona a inovação e apresenta oportunidades para países como a China. Em outras palavras, a vantagem está justamente relacionada ao fato de se tratar de uma transição em andamento e não de um paradigma energético recém-estabelecido. Se já estivesse estabelecido, as vantagens também estariam, mas como um processo em andamento, a linha de chegada ainda está aberta a todos os competidores.