Faculty of Humanities and Social Sciences

Bachelor in Global Communication

Final dissertation

China's geopolitical strategy in the energy transition: *the ends, means and motives of renewable energy policy*

Author: **Angélica Rodríguez Peña**

Supervisor: Ariel James Trapero

Universidad Pontificia de Comillas

Madrid, Abril de 2023.

Executive Summary

This study examines China's geopolitical position in the energy transition, as seen in its dominance over renewable energy technologies. Using the field of grand strategy as a theoretical foundation, it provides an alternative theoretical model that includes the ends, means and also the motives behind China's approach. It examines this country's current and projected dominance over renewable energy supply chains, from raw materials to technology manufacturing and exports. It describes the means by which China has acquired its position, by providing an extensive account of the country's comparative advantages and effective decisions, as seen by its politico-economic system and its assertive industrial policies. When analyzing the system, the concept of authoritarian capitalism is explored as a basis for understanding the comparative efficiency of China's development model as compared with less centralized political structures. Finally, it argues that there is a complex set of motives behind China's efforts to control renewable energies, including physical security or the threat of climate change; energy and economic security; and ideological security or geopolitical dominance. It concludes that China's approach in the energy transition, at the deepest level of analysis, reflects not only a desire for technological superiority in general, but a broader vision of China as the leading global power in the 21st century.

Key words: climate change, energy transition, geopolitics, critical minerals, renewable energy, Grand Strategy, Authoritarian Capitalism, industrial policy, physical security, energy/economic security, geopolitical dominance.

Table of Contents

1. INTRODUCTION

With its booming economy and growing global influence, China is a country that everyone seems to be talking about by various reasons - and the fight against climate change is no different. There has been a significant and increasing number of studies regarding the green energy transition and China's overall role in the global equation of the management of climate change. Within this field, China's control over certain essential **raw materials** in the manufacture of renewable energy technologies, such as solar panels, wind turbines, or electric vehicle batteries, and over the **technologies** themselves have gathered special attention. And for good reason. China is increasingly believed to be "the outright winner" of the energy transition (Pitron, 2020. p.128).

In order to tackle climate change as the global challenge that it is, all countries should ideally contribute to a global solution. However, there are certain nations whose role has special importance, whether it be because of their relative power or weight in the international arena, or because of their contribution to global carbon emissions, or both. China is one of those special cases. The present study aims at analyzing the **changing geopolitical landscape** created by the need to develop a greater quantity of renewable energy sources, viewed from China's perspective. It will attempt to assess China's general and long-term approach in the transition, its goals and policies, as well as the strategies it has taken to achieve them.

In this sense, this study will, on one hand, consider China's current dominance over the renewable energy sector, from 'critical' raw materials all the way up to technological development. It will then assess China's projected renewable energy policies or future **goals** in this area. After evaluating where China currently stands and its desired projection, it will consider how the country achieves its goals. In other words, the **means** or variables that serve to explain its success. When considering the means, a special attention will be given to the comparative advantages of China politico-economic model as a key variable in China's strategy. On the other hand, this study will analyze the **motives** behind China's national strategy regarding renewable energies. In this sense, it will attempt to define why the country pursues its current policies – why China does what it does in renewable energy development.

By attempting to provide a comprehensive account of China's approach in this matter, this study aims to shed a light on one of the most important disruptions of our time – namely the entire transformation of our global energy system. The overarching goal will therefore be to explore the

geopolitical implications of China's position and to open the question of what it means for our efforts to address climate change, but also for future energy relations and for international security. We will hopefully see how the story of China's renewable energy sector is really the story of China's rise, and of an evolving international environment and global distribution of power.

2. PURPOSE AND MOTIVATIONS

From a **theoretical point of view**, the study will seek to evaluate the extent to which China's geopolitical positioning in the transition towards renewable energy sources fits within the frame of Grand Strategy theory; this meaning, how it follows the logic of a means-end chain. Additionally, it will consider how the concept of Authoritarian Capitalism, and the current conception of the Chinese political and economic system, plays a role in China's policies against climate change and in its idea of energy security. The novelty of the present paper will then consist of the aggregate analysis of the mentioned aspects of renewable energy production from this theoretical landscape, attempting to determine the intentions, the decision-making process and the rationale behind Chinese decisions in this subject.

From an empirical perspective, it will consider China's policies mainly over the last decades, with an inclusion of the most relevant ones of the last century. It will analyze scholarly review and literature, and the diverse analyses crafted by international experts and commentators. Additionally, it will take into account official documents and government guidelines, as well as declarations stated by Chinese leaders and ministers, mainly from the Chinese Communist Party (CCP) and its current leader Xi Jinping. Within these, special importance will be given to broader framework documents, such as the different Five-Year plans, or presidential speeches. Beyond the words or official discourse, diplomatic actions and foreign policy decisions taken by China in this respect, will also be included in the study.

Finally, **the main practical motivation** for this research is to not only to further the knowledge on the best practices to promote the move towards renewable sources, but also on the best ways to ensure the green transition does not jeopardize international energy security by creating a significant dependence on a single player. This study may thus be useful in determining the practical implications for energy supply chains in this process, and the best way to secure a diversification of suppliers for the necessary minerals and technologies. Consequently, it could be of value for experts, guiding future policies designed to stimulate the transition both at the national and international level. Understanding China's role in the global transition to renewable energy is crucial to navigating a changing geopolitical landscape and shaping a sustainable future for all.

3. STATE OF THE ART

The geopolitics of the energy transition

"No one can embargo the sun or interrupt its delivery to us"

-Jimmy Carter, former president of the United States.[1]

For all the research papers, events, documentaries and global conferences about climate change and the impact of fossil fuel emissions on our planet, the stark reality is that we are putting more carbon dioxide into the atmosphere than ever. If there is something that the reopening of countries around the world after the COVID-19 pandemic has made evident is that our economies are still both importantly interdependent and predominantly based on hydrocarbons. What has also become evident, as global temperatures continue to rise year after year and extreme weather events become more common every year, is that our global energy model needs to change in order to prevent climate catastrophe (Crow and Saran, 2021)[2]. In the words of U.N. Secretary General António Guterres in his speech at COP27 last year: "We are on a highway to climate hell with our foot on the acceletaror*"*(Harvey & Carrington, 2022, para. 3).

This necessary change in our energy model is commonly known as the energy "transition", the gradual move from fossil fuels towards renewable and carbon-free energy sources, in order to establish a more sustainable system for economic growth and development. This transition has the potential to reshape our world in fundamental ways, specially from a geopolitical perspective (Crow and Saran, 2021). For many decades, the geopolitics of energy has basically been synonymous with the geopolitics of gas and oil (O' Sullivan, Overland, & Sandalow, 2017). There are rich historical descriptions by several international relations scholars regarding the role of fossil fuels in energy security, geopolitics and political economy, most of which have left renewable energy largely unaddressed. Renewable energy experts, for their part, have primarily focused on the technical aspect of the transition, that is, on "getting there" rather than on the geopolitical ramifications. However, as other sources of energy have started to be developed within the

[1] As cited in IRENA (2019), p. 50.

[2] Climate change is a well-documented and scientifically proven global phenomenon characterized by rising planetary temperatures, mainly because of accumulated emissions green-house gases (CO2 and methane being the most common ones) products of burning fossil fuels (mainly oil, gas and coal). This process has several cascading consequences that are destructive for the environment; thus, there is scientific consensus that the current fossil fuel-based system is not a sustainable model of economic growth. See also *Note 1* in the Appendices (at the end of the document).

framework of a transition, leaders and researchers have become more interested in analyzing how this development might impact energy and power relations (Scholten, Bazilian, Overland & Wetphal, 2020).

Probably one of the most systematic and holistic analyses on the literature regarding the geopolitics of renewable energy is the one done by **Vakulchuk, Overland & Scholten (2020**). In this article, the authors find that, although most of the literature dealing with the geopolitics of the energy transition has been published from 2010 onwards, it can actually be traced back to the 1970s and 1980s[3]. In this analysis Valukchuk et Al. (2020) define the field and its history, its resurgence in this century, the most important publications and authors, as well as the essential core themes and the key debates or points within them. It is significantly thorough and complete, including more than 204 sources and proposing clear definitions for what the terms "geopolitics" and "renewable energy" might mean.

According to the authors, most of the earlier publications had been done by US agencies and experts, such as the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA). In the 2000s, the field started to be dominated by Northern European authors, given that this region was the one that witnessed the first widespread take-off of renewable energies (initially wind and solar), and then within a few years Nordic researchers joined the debate.[4] The authors divide the literature into six core themes: (1) the international security implications of renewable energies (the more "peace" or more "conflict" potential); (2) the geopolitical winners and losers of the transition; (3) the impact on the relations between states; (4) critical minerals, and (5) cybersecurity (Valkuchuk et Al, 2020). **Figure 1** illustrates this division.

[3] They also find, interestingly enough, that in most of the work there is, among other things, an unwarranted assumption that little has been published in the field previously. What this means that most authors seem to believe that it is a rather unexplored topic, even though it has been more and more talked about, especially in recent years. This perception might be the result of a contrast between the literature on the geopolitics of oil (a more widely explored field) and of the geopolitics of renewable energy, probably creating the inaccurate impression of scarcity in this last field. The authors even include a chart to compare the number of results for web searches in each topic and there is about six times more results for the first topic than for the second one (Valkuchuk et Al, 2020).

[4] Northern Europe countries in this case include Germany and Benelux countries in particular, while Nordic refers traditionally to Norway, Finland, Denmark and Sweden. An important part of the research has in fact been funded by ministries of foreign affairs in many of these countries, and there has been significant collaboration between them. Some of the most important authors and publications that will be furtherly discussed, such as the IRENA report (2019), were in fact born out of this context (Valkuchuk et Al, 2020).

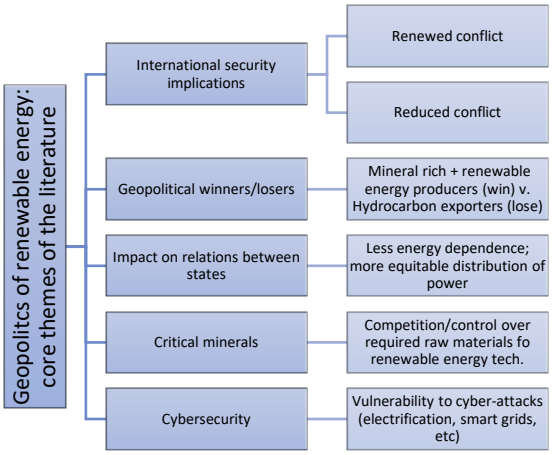


Figure 1 - The core themes of the geopolitics of renewable energy literature (Source: author's own elaboration, based on Valkukchuk et Al, 2020)

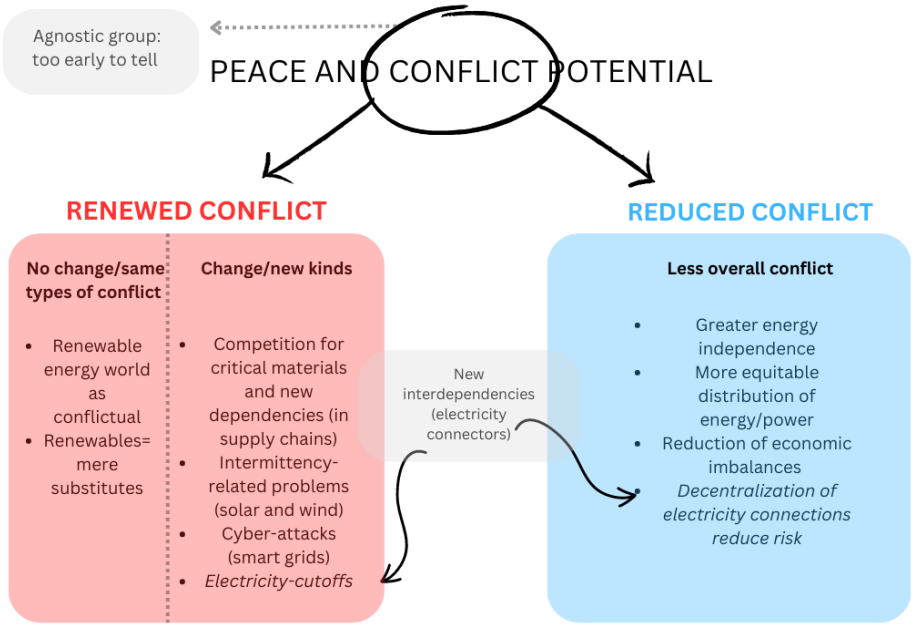
This division is very useful, since most of the analyses before and after this review touch in one way or another one or more of these core themes. It would be out of the purpose of this research paper to discuss the debates and key points in each core topic, since they are all very complex and nuanced, and some of the points will be considered throughout the analysis. However, as a way of example, one could illustrate a simplified version of the **"peace/conflict potential" debate** (as presented by Valkukchuk et Al, 2020), a theme roughly divided into the "**renewed conflict" camp of authors**, on one hand, and the **"reduced conflict"** camp, on the other. The first group believes that **a renewable energy-fueled world is no less conflictual than a fossil fuel-based one.** Within the group, some predict that states will face the *same* types of conflict, others that they will face *new but just as severe* ones. Continuing high-energy consumption creates new energy vulnerabilities; trade wars will succeed petroleum wars and, perhaps most importantly, competition for "critical materials" used in renewable technology will create huge geopolitical tensions. In the larger picture, renewables are seen as mere substitutes, and they do not change the geopolitical landscape all that much in terms of conflict (Valkukchuk et. Al, 2020).

The "reduced conflict" camp by contrast, while recognizing some of the potential risks, believe that **geopolitical tensions will decrease in a world fueled by renewables**. A more geographically dispersed distribution of renewable energy resources, which makes them harder to unilaterally control or manipulate, leads to greater energy independence or self-sufficiency. A more equitable energy distribution will signify in turn a more equitable distribution of power and could even reduce economic imbalances between different parts of the world. New risks or

challenges might exist but all in all, the world might be a less conflictual place (Valkukchuk et. Al, 2020).

It should be mentioned that the subject of new interdependencies, mainly because of electricity interconnectors but also in relation to different types of renewable energy supply chain, is stuck between the two camps. And there is a third group of "agnostic" scholars who argue that the context is still too uncertain and that predictions about geopolitical tensions are premature (Valkukchuk et Al, 2020)**. Figure 2** illustrates this debate, with some additional nuances. For example, intermittency-related problems refers to the intermittent nature of some renewable sources, notably wind and power (Fares, 2015), while "smart grids" make reference to a digitalized energy grids, potentially more vulnerable to cyber-attacks (Khoei, Slimane and Kaabouch, 2022)[5].

Figure 2 - – Example of a core theme (1): "Peace and conflict potential" of renewable energies (Soyrce: author's own elaboration, based on Valkukchuk et Al, 2020).



Source: Author's own elaboration, based on Valkukchuk et aL (2020)

Finally, the authors extract some important **aggregate conclusions from the literature**, some of which might serve as an ideal point of reference or starting assumption. First, renewable energies seem to broadly benefit international security in comparison to fossil fuels, but they are thought to heighten geopolitical tensions related to **competition over critical materials** and

[5] See also *Note 2*.

cybersecurity**.** Second, former hydrocarbon exporters seem to be the greatest losers of the transition[6]. Third, many of the publications share some commons weaknesses, notably a lack of theorization, failure to define basic concepts such as "geopolitics", limited use of forecasting or other scenario-building methodologies, and lack of distinction between the risks associated with *different types* of renewable energies or between the geopolitics of the *transitional* phase and those of the *post-energy* transition world. Finally, a disproportionately large amount of the literature focuses on the role of critical materials and cybersecurity, while a relatively small parts deals with the decline of fossil fuel powers[7]. All in all, this systematic analysis illuminates many of the publications in the field and provides a useful starting framework.

Among some of the relevant authors and publications included in the study that should be considered separately, the report developed by the **International Renewable Energy Agency (IRENA) in 2019** has a particularly special place.[8] Titled "*A New World: The Geopolitics of the Energy Transformation",* this report is considered to be another of the **most influential and holistic publications** in the field. It explored **key points** that also set the tone of the discussion, from new power shifts and relations between states to the significant opportunities, challenges and risks presented by the energy transition. It makes sure to note that this is not merely the change from one source of energy to another, but the complete and radical transformation of the energy system that has fueled economic growth and has moved the world for the last centuries (IRENA, 2019, p. 14). It therefore entails not only the change of the foundation of modern lifestyle but also the redesign of the geopolitical map, with shifting alliances, new patterns of trade, a new kind of energy statecraft, a new set of socioeconomic tensions, among other things. As it will be exposed, many of the points made by different authors and publications are similar or recurring ones. In the case of the IRENA report, it might be worth considering some of the already mentioned ideas more in-depth.

[6] The debate on the winners and losers of the transition is actually more nuanced than the simplistic narrative about the decline of fossil fuel exporters and the increasing geopolitical importance of mineral-rich countries. There are many factors that will determine the competitive advantages during the transition, and it is not clear that geopolitical winners and/or laggards can be determined in a clear-cut fashion. See also *note 3.*

[7] They also point out that within the literature that deals with the decline of fossil fuel producers, there is an overfocus on oil producers or a lack of attention to countries that rely significantly on other sources, such as coal [China among them] (Valkukchuk et Al, 2020).

[8] For more on the context of the report, see also *Note 4.*

For example, one of the most important aspects frequently remarked by the study is the potential for a new kind of **energy "independence"** that the transition offers for states in general, but specially energy-importing states, given that by switching to renewables they will be less at risk from vulnerable supply lines and volatile prices. Again, we find the core idea that, unlike fossil fuels, which are concentrated in specific geographic locations, most countries potentially have access to one form of renewable energy or another. In this sense, the transition might mean the relative geopolitical decline of fossil fuel exporters, most of which have traditionally based a big part of their global geopolitical weight on their natural resources. They may be also vulnerable to socioeconomic tensions, especially if they fail to diversify their economies. Some developing economies might be able to leapfrog a fossil fuel-based system, if they are able to capitalize on the opportunities offered by renewable energy technologies (IRENA, 2019).

The IRENA (2019) report also mentions some trends that might potentially derive from the changing balance of power and energy relations include: the relative importance of current energy choke points, sea routes or narrow channels critical to the global supply of oil might change; fossil fuel-related conflicts might significantly diminish; alliances based predominantly on the energy might be rethought, and the use of "energy" as a geopolitical tool might become less frequent as fossil fuels differ in significant ways from renewable energy sources.[9] The report at one point illustrates this idea by using the words of from president Jimmy Carter, found at the beginning of this section: "No one can embargo the sun or interrupt its delivery to us" (p.50).

Indeed, renewable energy sources might not only offer a more sustainable model, but one that can actually enhance **energy security.** The energy transition not only presents itself as an environmental necessity but as a wise geopolitical strategy. In broad terms, the report sets a rather positive and enlightening tone for the energy transition, while recognizing some of the most important challenges and broad geopolitical implications it entails. Its core ideas resonate more with the "reduced" conflict camp of the debate presented by Valkukchuk et. Al (2020), given that, while recognizing some challenges, they insist on the potential advantages and benefits of the transition for energy security.

[9] In this point, the report also mentions risks such as new dependencies on minerals, supply cuts on critical minerals (such as rare earths, for example), electricity cuts as a geopolitical tool, and cybersecurity risks. Although many of these points are also considered by other authors, these risks are not accurately comparable to those traditionally posed by the weaponization of fossil fuels (Scholten et Al, 2020). See also *Note 5*.

The topic has been explored by other authors and energy experts, especially in recent years. One of the most important works that preceded the report was done by **O'Sullivan, Overland and Sandalow (2017),** who developed a working paper regarding the geopolitics of renewable energy. They discuss different mechanisms through which renewable sources could shape geopolitics, including negative and positive elements: critical materials supply chains, competition for access technology and finance, and new "resource curses" on one hand, but sustainable energy access and climate change control, on the other. Interestingly enough, they also developed different forecasting scenarios for the energy transition, all of which envisage growth in renewable energy, but none of which predict a revolution in which this type of energy overcomes consumption of fossil fuels for the next several decades (O'Sullivan et Al, 2017).[10]

After the report, the research done by **Scholten, Bazilian, Overland and Westphal (2020),** for instance, provides some additional nuances. They predict some important changes in the global energy market, such as a less oligopolistic organization, decentralization of production and local empowerment, changing volume and nature of energy trade, and the electrification of energy systems. While they recognize renewable energies as a "a game-changer", they also admit the great deal of uncertainty around them. They notice that current energy demand projections imply that the transition will most likely look like a "coexistence" of fossil fuels and renewables, rather than a "substitution", at least for some decades (same idea as before, then). In this sense, they emphasize the necessity of understanding the transition within a temporal perspective, with short-, medium- and long-term scenarios (Scholten et Al, 2020).

From where we are to where we are going, we could expect different gradual trends. For example, while in **the short-term** renewables will soften oil and gas related geopolitical tensions, in the medium-term, competition over critical minerals and specialized knowledge in green technologies will create geopolitical frictions and incentivize a new era of industrial leadership. In the (very) **long-term**, in a world where renewable energies supply most energy needs, fossil fuel-related tension will be softened, while "grid politics" (the power dynamics related to electrical grid infrastructures) and cybersecurity, will become the most important issues. However, perhaps one of the key points Scholten et Al (2020) add to the discussion has to do with the **competition in**

[10] This is accurate with most present forecasts, as Bordoff (2022) pointed out, annual demand for oil and gas, as well as global emissions are going up, not down is, every year, revealing a real tension between "*today's energy reality and tomorrow's energy ambition and climate ambition" (*min 26:38).

renewable generation technologies, which might be often overshadowed by the discussion over raw materials. It may be the case that conflict over the control of technological patents and intellectual property rights in general ends up being as important as, or even more important than, conflict over raw materials.[11]

Lastly, there are many other experts and authors that could be mentioned. **Hafner and Tagliapetra (2020),** for instance, develop another systematic analysis of the literature regarding the global energy transition. They start by providing a useful summary of the general state of the art of knowledge regarding "global trends". Additionally, they explore in-depth the literature by region and by topic. While the regions they consider are Europe, the United States, Russia, Middle East and North Africa (MENA), the topics include growth and income distribution, the global south, mineral and metals for low-carbon technologies, governance, finance, and also the geopolitics of renewable energy specifically.

Within this last topic, there are some additional authors and works that could be considered that have not been mentioned. **Hache (2018)** for example, analyzed new challenges and new dependencies associated with the transition, highlighting increasing geopolitical complexity; Stratfor (2018) as cited in Hafner and Tagliapetra (2020) assessed geopolitical shifts, predicting some countries will be clearly better positioned that others in the process, including China; and finally, **Johansson (2013)** explores the security implications of the transition according to the economic-political, technological and environmental risks, concluding that the main long-term advantage of renewables for **energy security** is precisely the fact they are inexhaustible.

Much has been written about the energy transition, and new publications or studies come out with regular frequency. Beyond this complex web of ideas, there are some key points to have in mind moving forward: (1) renewable energies have potential to increase energy independence/security; (2) competition over critical materials matter but (3) control over the renewable technologies themselves matters as well, or even more. And (4) we do not really know what all this means for international security, geopolitical balance or overall relations between states.

[11] It is a key point because it goes against the mainstream idea in the field those critical minerals will be the most important area of competition. Including the role of renewable energy technologies in the analysis can potentially change the calculus over the potential losers or winners of the transition. See also Note 6.

What seems relatively clear is that the energy transition is increasingly perceived as one of the most massively disruptive geopolitical forces of the 21st century (Bordoff, 2022, 23:55). The energy sector and the search for energy sources has at times given rise to instances of international cooperation, but it has also historically been the cause of conflict and disruption across the world. Exploring the geopolitical implications of the transition, as seen from China's strategy, can hopefully serve the higher purpose of this paper: to understand why geopolitics "remain at the very heart of the changing energy landscape." and why "the inverse is also entirely true." (Crow and Saran, 2021, p. 3).

4. THEORETHICAL FRAMEWORK

Renewable energy and geopolitics

For the purpose of clarification, it might be ideal to establish the meaning of several key theoretical terms. this research will broadly assume the following definitions of renewable energy and geopolitics:

For "**renewable energy"** the definition provided by the International Energy Agency (IAEA) is useful: "energy that is derived from natural processes that are replenished constantly, [such as] solar, wind, biomass, geothermal, hydropower, ocean resources [tidal and wave], and biofuels, electricity and hydrogen derived from those renewable resources" (as cited in Valkukchuk et Al, 2020, p.2). This definition should be then considered in contrast to:

Non-renewable energy which is energy that: "*comes from sources that will run out or will not be replenished in our lifetimes—or even in many, many lifetimes*Most of these sources are fossil fuels such as coal, petroleum, and natural gas, which are made up predominantly of carbon. (Morse, n.d., para 1).

Low-carbon energy which is energy that produces low amounts of carbon dioxide. The reason why it should be distinguished from renewable is that while all renewables are low or zero-carbon sources of energy, not all low-carbon sources are renewable, as in the case of nuclear energy. For example, solar power is renewable because it is "replenished constantly" (infinite) and it is also low carbon, because it does not produce carbon emissions. Nuclear energy is low carbon for the same reason, but it is not renewable because nuclear material is exhaustible (Moses, 2017).

For **geopolitics**, this study will adopt the conventional and confined definition provided by Overland (2015): "*great power competition over access to strategic locations and natural resources"* (as cited in Valkuchuk et Al, 2020, p.2).

Energy mix is a term that refers to the combination of primary sources of primary energy, ranging from fossil fuels to nuclear energy and renewable energies, that a specific geographical area has in order to meet its *energy needs*. It varies from country to country depending on availability of resources, policies choices, and specific energy needs. It is different **from power generation mix or electricity mix,** which is a more restrictive term, referring to the combination

of sources that account for *electricity generation* is a given geographical area – thus excluding energy use in major parts of transportation, housing or industry (Planète Energies, n.d).

Grand Strategy

"Grand Strategy is the calculated relationship of means to large ends. It's about how one uses whatever one has to get to wherever it is one wants to go"

-John Lewis Gadis, 2018[12]

The theoretical field of "Grand Strategy" is one with filled extensive and rich literature. The proliferation of analyses done by academic and policymakers alike throughout the years has resulted in a set of conceptual inconsistencies and general analytical confusion about what exactly grand strategy is. Despite the apparent disagreements among scholars in the field, there seems to be a consensus around the core ideas, as expressed by two definitions that appear in almost every major recent study on the subject (Friedman Lissner, 2018). The first of these is provided by Paul Kennedy, a Yale University professor who, drawing on previous work by other academics, said:

"The crux of grand strategy lies therefore in policy, that is, in the **capacity of the nation's leaders to bring together all of the elements,** both military and nonmilitary, for the preservation and enhancement of the nation's long-term (that is, in wartime and peacetime) best interests*."* (Kennedy, 1991, as cited in Friedman Lissner, 2018. p.55).

The second definition belongs to Barry Posen, who belongs to a similar strategic tradition and attempts to define grand strategy in a more compressed manner:

"[Grand Strategy is] a political-military, means-end chain, a state's theory about how it can best cause **security** for itself*"* (Posen, 2014, as cited in Friedman Lissner, 2018, p.55)

These two definitions provide an important starting point to understand the basics of grand strategy[13]. Some insights can be derived when considering the nuances, they present. Posen's definition, on one hand, seems to limit grand strategy mainly to the political-military realm and

[12] As cited in Friedman Lissner (2018), p. 62.

[13] Despite the fact that these two definitions are widely used, grand strategy originally derived from the concept of "strategy" as applied in the military realm. It should be mentioned that the key progenitor of the ideas behind the concept was B.H. Lidell Hart, who drawing on Prussian military theorist Carl von Clausewitz said that there was a "higher" level of strategy whose role was to coordinate and direct all national resources towards the object of the war (Silove, 2017).

focuses on the security of the state, by which he means the "preservation of sovereignty, safety, territorial integrity, and power position*"* (Posen, 2014, as cited in Silove, 2017, p.20). Kennedy's definition, on the other hand, encompasses the use of all resources, military and non-military, and focuses on the nation's long-term interests (one of which could be assumed to be security). He also emphasizes the agency of the nation's leaders, recognizing the capacity to bring together the necessary means to achieve the ends is somehow dependent upon leadership.

In any case, although they slightly differ both in their content or focus, they are not inherently contradictory, and they may in fact complement each other (Friedman Lissner, 2018). Another definition that might be useful, for instance, is the one provided by Brands (2014), as cited by Friedman Lissner (2018), who argues that grand strategy is akin to a conceptual framework or scheme that helps states determine where they want to go and how to get there, including an evaluation of what their key interests, threats, resources, and policies are. He believes it serves as a guide for leaders who seek security for their countries in a world that is increasingly complex and insecure.

Brands (2014) thus integrates in a sense the previous definitions by highlighting the element of security, while adopting a broad definition of the factors that are considered in the design of grand strategy (Brands, 2014, as cited by Friedman Lissner, 2018). In order to fully grasp the elements of this theory, one might look beyond the mainstream definitions of the concept. There are at least two systematic theoretical analyses in the literature of grand strategy that might be worth mentioning. Each of them offers different conceptualizations and identifies key elements on the subject.

The first is that of Silove (2017), who, in the process of developing a theory about the concept of grand strategy, found that the main problem was that scholars used it to signify three different meanings: a *deliberate, detailed plan* designed by individuals; *an organizing principle* that is consciously held and utilized by individuals to guide their decisions; and a *pattern of state behavior*. In short, the three uses given to grand strategy are those of "grand plans", "grand principles" and "grand behavior". Silove (2017) argues that each of these conceptualizations provides a valuable addition and that not one of them should prevail over the rest. She defines them the following way:

> "The three concepts are structurally similar in two important respects. First, as a consequence of their origins in the concept of strategy, they are each constituted by two elements: ends and means. Grand plans specify ends and the means by which to achieve them in detail. Grand principles do the same in more general terms. Grand behavior is a pattern in the relative allocation of means to certain ends, regardless of whether that pattern is the result of a grand plan, a grand principle, or some other factor." (Silove, 2017, p. 19).

The second way in which these concepts are structurally similar, she adds, is in the three necessary characteristics they all share and that define their "grandness". In this sense, regardless of the conceptualization one uses, she argues that grand strategy is always **long-term** in scope; is **holistic** in that it includes all national resouces, and it pertains to **the most important** or **vital interests** of the state (Silove, 2017). In sum, grand strategy, whether one is referring to grand plans, grand principles or grand behavior, is "grand" because its long-term, holistic, and important.[14] Its long-term nature differentiates it from the narrower concepts of foreign policy, statecraft, military strategy or strategy in general[15]. Its holistic aspect implies it concerns not only the military, but also diplomatic or economic sphere. Lastly, its importance is derived precisely from the nature of the interests it deals with, which many scholas recognize as "ultimate," or "vital", implicitly adopting the focus on security that Posen proposes without necessarily using the term security (Silove, 2017). However, it should be mentioned that what is understood by security can often differs depending on the state, and that states may have other interests besides mere security, such as the expansion of their territory, the protection of trade or the promotion of their political ideology (Narizny, 2007 as cited in Silove, 2007, p.21).

The second systematic analysis that might be worth considering is the one developed by Friedman Lissner (2018). She explores what she calls "the conceptual minefield" of grand strategy and proposes a different approach to its study. She believes grand strategy could be theoretically

[14] The author argues that the features "coherent" and "balanced" are also candidates for factors that characterize grand strategy, given their mention by several scholars. However, she shows how neither of them condition the existence of grand strategy, which can be incoherent and/or unbalanced, and still exist. She furtherly explores the questions of existence, intentionality, and other relevant variables in the debate on grand strategy (Silove, 2017).

[15] For example, foreign policy lacks the same long-time horizon, while statecraft generally refers to the practice of international relations as seen in the conduct by states; military strategy applies to military ends/means and the general concept of strategy, which can apply to many other contexts (Friedman Lissner, 2018). In fact, the "long-term" characteristic derives from Hart's idea that grand strategy extends beyond the current war and aims to plan for future peace (Silove, 2017).

conceptualized through three different agendas: variable, process or blueprint. As a "process" grand strategy focuses on the importance of grand strategizing, whether in a governmental context or in a generic rational decision-making mode, applying to all endeavors in which means are used in order to achieve a given end. As a "blueprint," grand strategy deals with broad visions that aim to impact governmental behavior and guide future policy. In this sense, while the "process" agenda is both descriptive and prescriptive, the "blueprint" agenda is merely prescriptive (Friedman Lissner, 2018).

Perhaps the most relevant of the conceptualizations for this research is the "variable" agenda. This one is defined as a prism through which to study the origins of state behavior, paying special attention to the way the interaction between agency and structures produces grand-strategic outcomes or results. It attempts to discover where grand strategy comes from and how it changes, which is why it is a mostly **descriptive** agenda (Friedman Lissner, 2018).[16]

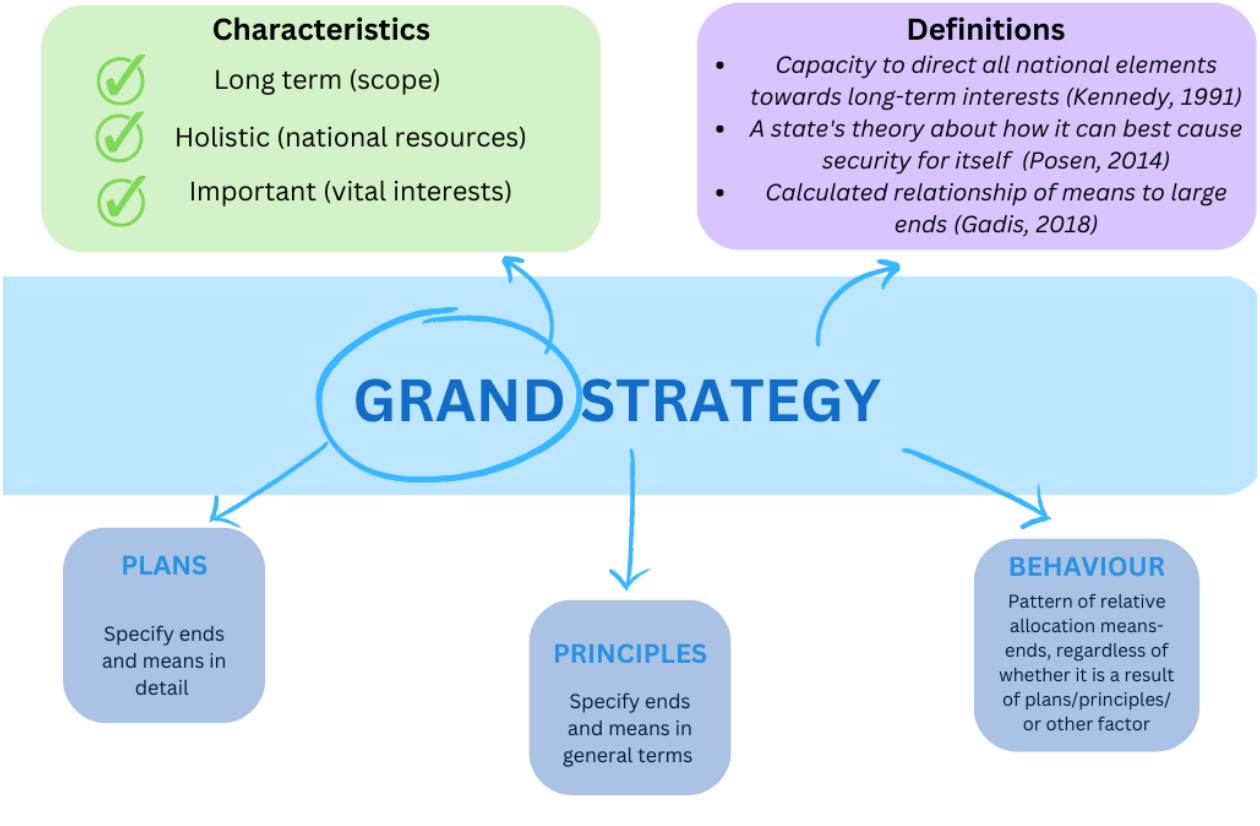
The brief recollection of the subject can allow us to identify the basic elements that constitute grand strategy, that will be considered as a theoretical guide for the present study. Some of the archetypical definitions of the term, together with the conceptualizations offered by the authors who have developed systematic analyses, provide an effective framework for doing so. It seems clear that grand strategy is a field that generates debate, diverging positions, and competing conceptualizations.

When it comes to the conceptualizations, one can adopt the non-exclusive notions proposed by the aforementioned authors. The agenda of grand strategy as a "variable" to explain the origin of state conduct given by Friedman Lissner (2018) potentially includes Silove's (2017) division of grand strategy in its three distinct meanings of grand plans, principles and behavior, together the essential characteristics they all share. The current study, as an attempt to explain state conduct, will consider Chinese grand strategy by identifying whether there are guiding plans, principles or patterns of behavior, as illustrated specifically in the preparation for the energy transition. However, perhaps the most relevant input of these conceptualizations is the provision of the

[16] The author mentions that a key part of the literature within this agenda is the one that deals with questions surrounding major strategic pivots adopted by states. Scholars that consider grand strategy as a variable attempt to answer questions such as "*Why did Japan turn towards autarky in the late 1930s?"* or "*Why did Great Britain change its appeasement strategy into a more confrontational approach towards Nazi Germany?"* (Friedman Lissner, 2018, p. 58).

essential characteristics of grand strategy as provided by Silove (2017). In this sense, the analysis will consider whether China's approach to the energy transition can be characterized as long-term, holistic, and seen as 'vital' or important. A visual summary of the core part of the theoretical framework can be found in **Figure 3.**

Figure 3 - A theoretical framework of grand strategy
(Source: author's own elaboration, based on Silove, 2017).

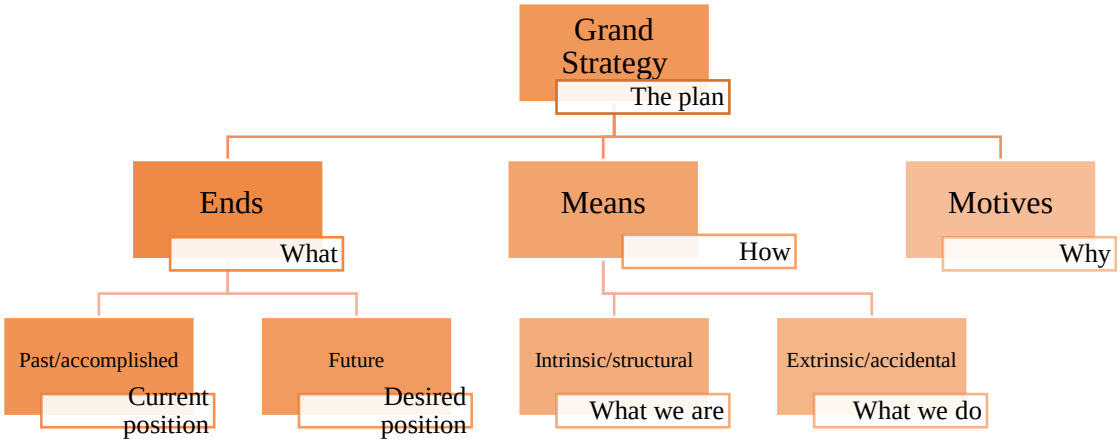


Source: Author's own elaboration, based on Silove (2017)

When it comes to the definitions, a common element is the emphasis on the means-end relationship, which is why Gadis' articulation of grand strategy (found at the beginning of this section) arguably captures the core idea behind the concept: how one uses one's resources to get to where one wants to go (Gadis, 2018, as cited in Friedman Lissner, 2018). This basic idea will be the guiding principle in the analysis, which will provide an alternative structure of grand strategy in the analysis for the purpose of answering the question at hand, but which will

nonetheless follow a means-end chain. However, it will also add a missing or third variable in this simplified concept, which are the "motives" or "intentions" in the grand strategy. An alternative way to think about grand strategy, which was designed for the purpose of this paper is visually summarized in **Figure 4.** The way this structure fits in the current case is explained in the methodology.

Figure 4 - Alternative "Grand Strategy" theoretical framework
(Source: author's own elaboration).



Authoritarian Capitalism

There used to be a broad consensus in the West that democracies were better for economic growth, and that political liberalization and economic liberalization went hand in hand. Within this consensus, two ideas stood out. The belief that countries that opened up economically and reached a level of prosperity would eventually demand political freedoms, and the belief that there was something intrinsic to democracy that made it more apt for growth. It would be fair to say that this consensus no longer exists (Kagan, 2008 as cited in "Illiberal capitalism", 2008).

The concept of "authoritarian capitalism" has grown in importance in recent years, especially as more and more countries defied the long-settled expectations, China among them.

One of the problems with the concept is that it is at times mishandled, poorly defined, or used to refer to completely different systems. The fact that it has often been applied to a very heterogenous group of countries makes it more difficult to define. At its most basic level, it includes the simultaneous presence of a capitalist economy on one hand, and the absence or erosion of a democratic political system on the other (Kinderman, 2021).

More complex definitions include additional nuances. These allow a more specific conceptualization of what authoritarian capitalism is, and how it differs from related concepts, such as state capitalism. In this sense, **state capitalism** broadly refers to configurations of capitalism where the state plays a strong role in the supervision and administrations of capital accumulation, either by owning or controlling capital (Alami, Dixon, Gonzalez-Vicente, Babic, Lee, Medby and Graff, 2022).[17] **Authoritarian capitalism,** however, is characterized precisely by the authoritarian nature of state intervention. This could entail a direct infringement on key principles of the rule of law, an erosion of the boundaries between public and private, and an existence of mechanisms that allow the governing elites to shift those boundaries at discretion (Sallai and Schnyder, 2020).[18]. In this sense, not all interventions are authoritarian interventions, and not all authoritarian interventions are the same.

Within this theoretical framework, the important point is that China has often been characterized as an authoritarian capitalist state or a variation of it. In this characterization, the main aspect that Western commentators particularly have focused on has been the **centralization of power**, and on the potential advantages it might sometimes present in comparison to more democratic systems. There was therefore a shift from the mere abandonment of the 'marriage' between political and economic liberalization towards the more radical notion that authoritarianism could at times be more effective than democracies at delivering results. Put differently, we moved from one end of the spectrum to the exact opposite. The strong performance of authoritarian capitalist countries, combined with the cracks and self-evident faults of many

[17] The fact that state-owned enterprises (SOEs), policy banks, sovereign wealth funds (SWFs) and many other state-led organs have proliferated in global economic activity since the beginning of the century is evidence of how state capitalism is very much alive in the modern world. This trend is also closely associated with the emergence of new types of geopolitical tensions (Alami et Al, 2022). This is why the terms authoritarian capitalism and state capitalism really should not be used interchangeably.

[18] Another simple deduction that derives from these ideas is that all authoritarian capitalist systems are state capitalist, but not all state capitalist systems are authoritarian capitalist. Both concepts therefore would apply to China, although authoritarian capitalist is arguably more encompassing.

democratic countries reinforced this notion. A key turning point was the Global Financial Crisis (GFC) in 2008, but several events since then have contributed to the reinforcement of the theory as well (Horesh, 2015).

Among the comments that exemplify this phenomenon, we find:

"One-party autocracy certainly has its drawbacks. But when it is led by a reasonably enlightened group of people… it can also have great advantages" (Kinderman, 2021, p. 23); or,

"There's no question that China is an attractive model for autocrats who would like to be able to pursue economic growth without losing control of the levers of power." (Kagan, 2008 as cited in "Illiberal capitalism", 2008, para.1).

It should lastly be mentioned that many of these ideas often been accompanied with oversimplications of the Chinese system, which is anything but simple. The uniqueness and complexity of China's politico-economic system means that the application of this concept should be done with precaution, fitting rather uncomfortably or awkwardly to the Chinese case. However, for the purpose of simplicity, the main central idea might be worth considering in this study. The rise of China as one economic power has arguably been one of the most important case studies of an authoritarian government that pursues a government-led effort to achieve unprecedented economic growth, among other things, in a relatively short period of time with immense success.

This theoretical model can thus contribute in a secondary manner to our analysis of China's positioning in the global energy transition precisely because the Chinese state structure is potentially one of the main factors in explaining the degree of planning, partial efficiency and relative velocity that has characterized the Chinese approach in this area. It could be argued that the authoritarian nature of the system has in part enabled China its strategic positions when it comes to green energy raw materials and technologies.

5. RESEARCH GOALS, QUESTIONS AND HYPOTHESIS

Goals

The **general goal** of this research paper is to explore China's geopolitical positioning in the energy transition, as seen specifically in the development renewable energies, from raw materials to technological production. In this sense, it should be mentioned that China's climate or energy transition policy is made up of a large set of areas, which ranges from renewable energies to transport (electric vehicles, batteries) to industry, and many others. Although relevant policies in other areas will be mentioned, the focus on renewable energies allows the in-depth study of a specific area. Additionally, this policy arguably provides an ideal way to **illustrate** China's broader strategy in the energy transition, for several reasons.

One, energy sources are cross-sectional, since most sectors of the economic system need energy in one way or another. The development of renewable energy is one of the most essential steps of the transition, so it is arguably an adequate indicator for the rest of the areas. Two, the control over raw materials needed for different renewable technologies is also somewhat transversal, given that the required minerals are used in many areas of the transition not only in energy-generating technologies, but in many devices that are a key part of the overall scheme.[19] This means that the analysis of China's control over critical materials is at the bottom of all things pertaining to the energy transformation. Finally, the fact that renewable energy deployment involves a high degree of specialized technological know-how, it also serves as a reflection of the technological advancement in general of a state, which is crucial in all domains of the energy transition.

The **specific goals** of this paper are:

First, to determine how China's approach to the transition might follow a grand strategic scheme, and the nature and/or implications of this scheme. In this sense, it will attempt to identify the "ends" and the "means" of the strategy and assume that through these factors the key intentions or motivations of China can be inferred or deduced. It will this consider grand strategy as is has

[19] For example, lithium is a crucial element in the generation of lithium-ion batteries, which are used for storing energy created by renewable sources but are also used in many other industries. They are the preferred choice to power "*everything from mobile phones to electric vehicles and drones"* (Wood, 2021).

been theoretically defined - plans, principles or general patterns of state behavior that are long-term, holistic and 'important'.

Second, to consider in a tangential manner whether the Chinese politico-economic system is better fit for carrying out the radical energy transformation than less centralized or more democratic systems. In this sense, it will consider the general advantages and disadvantages of different features that characterize this system, some of which would fit within the definition of and "authoritarian" and "state capitalist" one, others of which are to some extent unique to the Chinese context. The centralization of power and the capacity to draw long-term plans will be among the key features, but the intrinsic comparative advantages of the Chinese economy.

Questions

It should be mentioned that the position of China in the energy transition has been analyzed from different points of view. Some authors have focused on China's dominance over rare earths and its potential geopolitical implications. Others have tried to emphasize the importance of its control over mineral supply chains outside its territory. And others have focused mostly on green technologies and investments. The narrative has been largely dominated by the perception that China is actively seeking to position itself as the leader of the energy transition. There are therefore several questions that arise from this story, mainly around the true intentions behind Chinese leadership. Exploring the legitimacy of this narrative and untangling the different layers or perspectives of the Chinese case is therefore the task at hand in this analysis. Put plainly, the **research questions** are as follows:

(1) *What **goals**, means and motives can be identified in China's renewable energy policy?* And regarding motives specifically,

- *Are China's efforts part of a greater strategy to **dominate future energy geopolitics**? Does China merely care about climate change, or are its efforts part of a plan to gain more **geopolitical weight or power** in the international arena?*

(2) *Is China's 'authoritarian capitalist' system better suited than more democratic systems to lead large-scale capital-intensive transformations, such as the energy transition?*

The first question, and its different formulations, will be the primary object in this research paper. From the analysis of both questions, the implications for future energy relations and for broader international relations could potentially be derived. This would hopefully serve to determine whether China's strategic pattern towards the energy transition represents an opportunity for cooperation, a realm of competition, or a national security threat for other international actors.

Hypothesis

The departing hypothesis of this paper will assume that China's approach towards the energy transition, as illustrated from its policies regarding critical raw materials and renewable energy technologies, can be interpreted through the theory of Grand Strategy. In this sense, the hypothesis follows the two-fold structure of the research questions:

*(1) China's grand strategy in this realm is **partly, but not exclusively** aimed at dominating the future geopolitics of energy. In this sense,*

- *China's intentions include geopolitical domination, but also other factors, such as economic or physical security, and even 'ideological' security.*

- *Climate change policy is part of a broader vision of China as a 'superpower' and the transition is seen as a strategic opportunity to gain power in the international stage.*

(2) Despite some drawbacks, China's politico-economic system has some clear "advantages" for dealing with the energy transition, among which is the relative ease of policy execution in highly centralized or authoritarian systems compared to more democratic ones.

6. METHODOLOGY

Data recollection techniques

The recollection of information on the subject has been done mainly by accessing sources available through web searches in academic platforms and official sites. In order to develop a solid account of China's grand strategy, data has been often extracted directly from the **official documents** provided by the Chinese state (such as "Five-Year plans"), announcements by Chinese leaders or key party officials, including presidential speeches or documented declarations in other contexts.

Additionally, the process has entailed a systematic recollection of **reports** and data provided by leading international organizations such as the IRENA, but also by leading experts in the geopolitics of the energy transition, and in China's role in it. Within the works, **academic research** and extensive accounts that include **historical and anecdotal evidence** on the subject have been collected.[20] Several **analyses** and **conferences** done by opinion leaders and/or relevant think tanks, in particular attention to those which are specialized in one or more of the topics, have also been considered for this paper. Additional complementary sources include prestigious **journalistic works**, including articles or other audiovisual resources.

Data analysis techniques

The data analysis process has required several steps or techniques. Firstly, sources were organized according to different categories depending on their role for this study, as well as according to their nature. They were broadly separated into **official and non-official** sources, "official" meaning they stem directly from Chinese accounts. Within "non-official" sources, they were categorized along the lines of the **core themes** explored throughout the paper: the geopolitics of the energy transition more generally; China's positioning in the energy transition, subdivided roughly into general policies, raw materials and technological development; grand strategy and authoritarian capitalism, including the theoretical understanding as well as Chinese-specific analyses, and finally, "other" sources.

[20] Within these extensive accounts, Guillaume Pitron's book *The Rare Metals War (2020)* is of special importance to this research paper.

After the formal organization of the sources, the analysis was done according to the r**elevance** of a given source for the different sections or topic of this paper. As was expected, most sources can roughly fit exclusively within just one category or section, given that they provide important and varied insights in more than one topic being considered. Most sources have been used and analyzed in a cross-sectional and/or comparative manner, with a handful of extensive works providing an important bulk of the analysis.

Finally, **to provide a coherent analysis** of China's grand strategy in the energy transition, the discussion was therefore finally **divided into four** parts: the **ends,** the **means,** the **motivations,** and the **final reflections.**

Part I is divided into past ends and future ends. **Past ends** refer to the goals that have already been accomplished and that provide an idea of where China currently stands in the energy transition, from a geopolitical point of view, according to some of the implications or standards discussed in the literature. **Future ends** refer to China's projected goals in the transition, as stated by Chinese leadership. This enables a long-term perspective that considers both past and future trajectory, which are interrelated. Part I is then the equivalent of asking "*where are we now?"* And *"where do we want to go?"* from China's point of view.

Part II deals with the **means** of the grand strategy, which also includes an analysis of general means that have been used to achieve current goals – assuming some or most will continue to be used. Some of the "official" or technical means will be considered, but "unofficial" means will be included as well. What this means is that in order to analyze China's means we rely on formally laid-out strategies their discourse but also on state practice. The means have been divided according to **intrinsic** or **extrinsic** characteristics, intrinsic being understood globally as fixed, independent or structural factors (the "system") and extrinsic being understood as accidental or dependent factors (the "policies"). In other words, the means by which we get to our goals are a combination of what we are and have (intrinsic), and what we do about it (extrinsic). The discussion of the Chinese politico-economic system, for instance, fits within this section, as an "intrinsic" means.[21] Part II is the equivalent of asking: "*how have we gotten here?"* and/or "*how are we getting there?"*

[21] The presumed idea, again, is that the "system" is part of the reason China has managed to achieve its goals with unprecedented dimensions and growth rates. In this view, the system is a "means".

Part III contains the analysis of the **motives** or intentions of the Chinese state in its grand strategy. It is divided into three layers or perspectives, each one backed up by its own empirical, analytical, and/or anecdotal evidence. These are: **physical** security, **energy**/**economic** security, and **ideological security/geopolitical** domination. They are "layers" given they could be seen as different levels of depth along the same interrelated scheme. This part is considered to be a crucial, possibly missing variable in the grand strategy discussion, which mainly focuses on the "end-means" chain. But the reasons or intentions why we do what we do are a huge intervening variable in any strategy. It has therefore been added as part of an alternative yet not contradictory theoretical framework adapted to the needs of this paper. Part III is the equivalent of asking: "*why do we want to go there?"* Or "*what are we really searching for?"*

Finally, the conclusions will attempt to summarize the implications of China's goals, means, and motives in the energy transition, in relation to the aforementioned questions and hypothesis.

7. ANALYSIS AND DISCUSSION

The ends

Past/accomplished ends: China's current geopolitical position in the energy transition

> "No country has put itself in a better position to become the world's renewable energy superpower than China." (IRENA, 2019, p.40)

"In aggregate," the IRENA (2019) report continues, "*it is now the world's largest producer, exporter and installer of solar panels, wind turbines, batteries and electric vehicles, placing it at the forefront of the global energy transition."* (p.40). Just as much has been written about the geopolitics of the energy transition, especially in recent years, much has been written about China's place in it. Considering what China has achieved up to now or its geopolitical position in the energy transition involves looking at different "fronts" or scales. Although it would be difficult to consider every single fact, there are some basic ideas that need to be established, and they entail more than renewable energy technologies as the report mentions. The story begins much earlier.

Raw materials: critical minerals

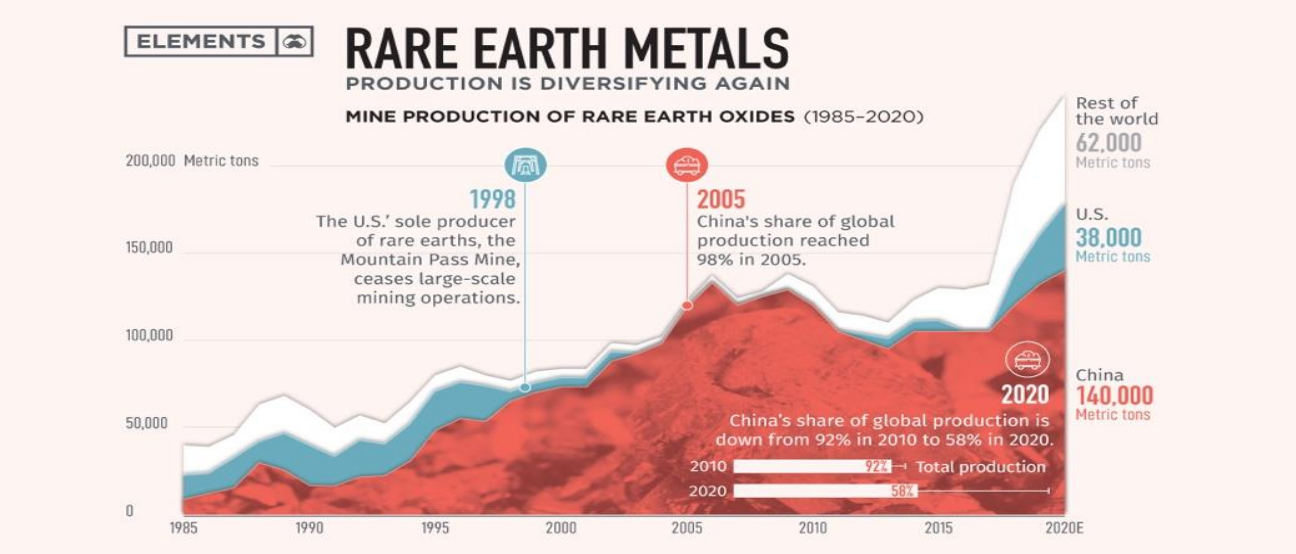
As it was mentioned when discussing the literature, "critical minerals" is one of the core themes that is often explored when dealing with the geopolitics of the energy transition. This is a highly complex and technical subject, both geopolitically and literally. The basic idea that needs to be understood is that the **mining sector** will play an essential role in the transition toward a low-carbon energy system. At least 23 key minerals will be "critical" to both the developments and deployment of necessary technologies, such as wind turbines, solar panels, electric vehicles and improved energy storage, hence the term use of the word "critical" (Church & Crawford, 2018).

Rare earths

When it comes to China, a great part of the attention goes to **"rare earths",** or the slightly more refined products of "permanent magnets" or rare earths metals. And for good reason. The term "rare earths" refers to 17 different elements that are often found mixed together in the Earth's crust. Both the demand and supply of rare earths are concentrated in China, which accounted for 80% of production in 2017 and has 36% of world reserves. And its near monopoly over this market

is expected to continue for the coming decade (Church & Crawford, 2018). **Figure 5** illustrates both this monopoly, and the "response" to it – meaning the recent attempt by other countries, such as the U.S. to increase production (Bhutada, 2021b).

Figure 5 - China's monopoly over Rare Earth Metals
(Source: Bhutada, 2021b)

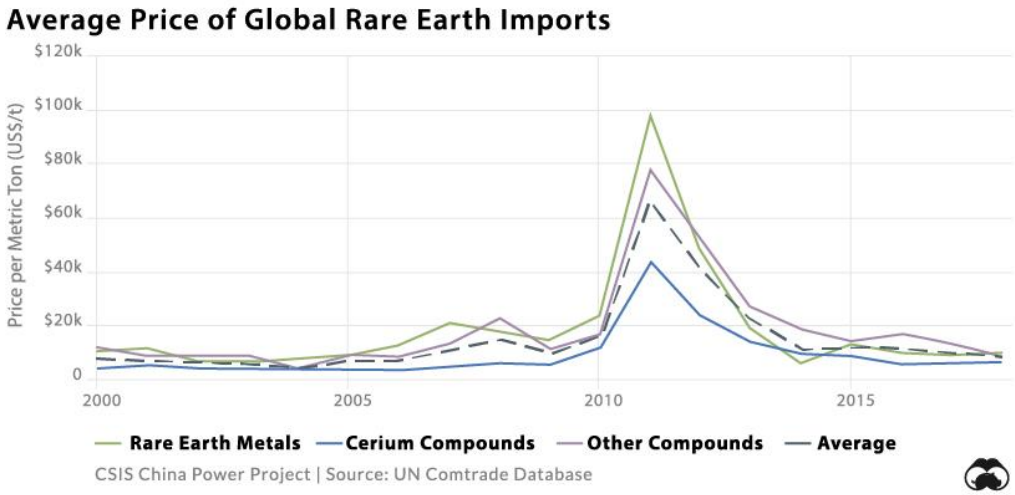


This significant control over the market has been a source of preoccupation outside of China, attracting the attention of several Western researchers and policymakers. The main reason for this has to do with the role that rare earths play in so many modern technologies. Historically, when concerns about China's dominance started to arise at the beginning of the century, they focused mainly on the importance of rare earths for military-use technologies such as radar and sonar. The concerns regarding their role in renewable technologies are relatively more recent, as the energy transition has gained steam (Chang, 2022), but rare earth metals are used in quite a few important industries beyond energy. Of course, they are crucial to the development of electric vehicles or batteries, but also to the development of smartphones or x-rays or guided missiles. As a way of example, a single iPhone contains up to eight different rare earth metals (Bhutada, 2021a).

The extent of China's monopoly and the manner in which it potentially represented a national security issue for dependent countries was truly understood a few years ago, in relation to two different events. The first alarms sounded in 2009, when China weaponized rare earth metals as a political tool for retaliation against Japan in a territorial dispute (Chang, 2022). This was

enough to raise eyebrows and questions beyond the directly affected country. The second alarms came the next year, when China enacted limited export restrictions on rare earths, resulting in skyrocketing prices worldwide, as shown in **Figure 6**. As a response, Japan, the US and the EU launched a joint trade dispute through the WTO, which China lost in 2014 (Bhutada, 2021a). These events, together with the role that these materials play, were enough to make several countries rethink their dependence on China.

Figure 6 - Rare earth price spikes as China restricts exports
(Source: Bhutada, 2021a)



It should be mentioned that about 88% of Chinese exports go to just five countries, among which we find technological powerhouses such as Japan or the US, which imports about 80% of its rare earths from China (Bhutada, 2021a). For many years, China was perceived as a reliable supplier of these materials, so manufacturers and end users did not display particular concern over its quasi-monopoly (Stegen, 2015). However, with China's readiness to adopt export restrictions as a means of political leverage or even as a price manipulation strategy, the situation changed. It was inferred that the monopoly over rare earths ultimately gives China the strategic upper hand over heavily dependent countries[22], and also affects negatively the reliability of the supply chain

[22] Japan and the US are the largest importers, accounting collectively for more than two thirds of all Chinese exports. The growing concern among these dependent countries has generated an intense response. The US added rare earth metals to its official list of "critical minerals" and former president Trump signed an executive order to encourage local production. Japan, for its part, has set the goals to reduce China's share of total rare earth imports to less than 50% by 2025 (Bhutada, 2021a).

in broader terms. Considering that as the energy transition advances, demand for rare earth metals is expected to nearly double by 2030 (Bhutada, 2021b), the strategic stakes are even greater.

Mining…and processing

However, there are certain misconceptions associated with the "rare-earth problem". The first derives directly from their name, which creates the misleading notion that they are geologically rare. They are not. They are found in many countries all over the globe, including Australia and the US. The reason why they are perceived as rare is that most of the production and the **mining** takes places in China, for a variety of reasons that will be furtherly explained (Stegen, 2015).

Another common and related misconception has to do with the idea that increasing mining outside of China is the first or most important solution to reduce this country's dominance over these materials. In fact, most efforts to decrease dependence have been focused primarily on increasing mining capabilities. The problem with that thinking, however, is that mining is only part of the story. The most fundamental issue seems to be **processing** of rare earths, especially "heavy rare earths"[23], which is overwhelmingly controlled by China. What this means is that even when other countries have increased their share of production, they still have to ship their raw materials to China for processing. At present, it is the sole nation capable (and/or willing) to process these materials, which is an incredibly capital-intensive, economically and environmentally costly process (Stegen, 2015).[24]

Other critical minerals: same pattern

If China's dominance over mining and processing were limited to rare earths, analysts would be right to call it a "rare earth" problem. However, its unique position regarding the raw materials necessary for the energy transition goes beyond the quasi-monopoly over rare earths. China is rich in several mineral resources that are needed for green energy technologies[25], and it

[23] Rare earths are generally categorized into the more common light rare earths, and heavy rare earths, which are harder to process (Stegen, 2015).

[24] Mining and industrial development in China have come at the cost of the environment, because of how destructive the processes can be (Church & Crawford, 2018). The byproducts or rare earth metals mining, refining, and smelting are often toxic or even radioactive (Chang, 2022). See also *Note 1* of this section in the appendices.

[25]China has some of the largest reserves of elements such as selenium, tellurium, lead, tin or zinc (crucial for solar technology), of graphite, lithium or titanium (needed in EVs and energy storage tech), and several other minerals such as bauxite, copper, iron, manganese, nickel or silver. Additionally, it is largest importer of cobalt, nickel, manganese

also imports huge quantities of other minerals, such as cobalt, lithium, or copper for **processing**. Most of the minerals that it imports are at the very least ***equally critical*** for the energy transition in different ways. Lithium and cobalt are crucial for battery development, which plays a role in both energy storage technologies and electric vehicles (EVs) for example (Church & Crawford, 2018). Copper, for its part, is a crucial component for wind turbines and solar panels, in addition to its current conventional uses in the power grid, appliances and electronics, construction or transport (Desjardins, 2018).

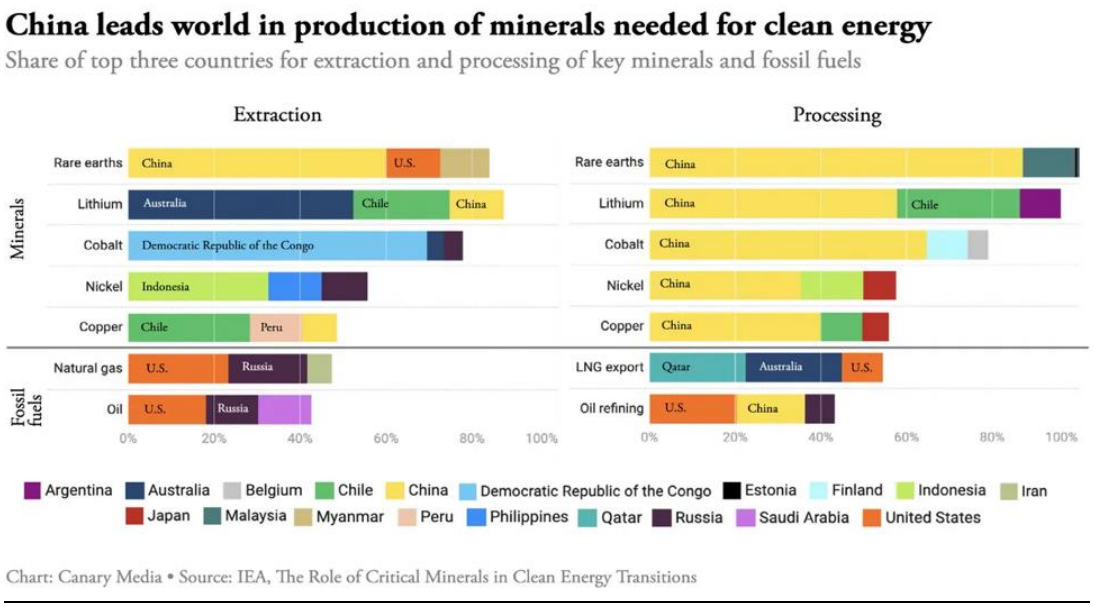
China's control over processing is best expressed in the words of Olivia Lazard, an expert in international conflict resolution, in her Ted Talk about the *Blind Spots of the Energy Transition:*

*"*So, if you look at a material such as lithium, countries like Chile and Australia tend to dominate extraction while China dominates processing. For cobalt, the Democratic Republic of Congo dominates extraction while China dominates processing. For nickel, countries like Indonesia and the Philippines tend to dominate extraction, while China, you guessed it, thank you, dominates processing. And for rare earths, China dominates extraction while China dominates processing." (Lazard, 2022, 04:58).

The following Figure 7 exemplifies what she means:

and lithium, as well as being the largest producer of graphite and of virtually all lithium-ion batteries (Church & Crawford, 2018).

Figure 7 - China's dominance over critical minerals processing
(Source: Olano, 2022)



China therefore has a unique global position when it comes to the control over raw materials necessary for the energy transition. By controlling the processing of minerals mined outside its territory, China achieves the dual objective of retaining its hegemony over critical minerals, while de-localizing some of the environmental burdens associated with mining (Pitron, 2020. p.170). The main strategic advantage over raw materials, again, is not the end of the story. One needs to move further up in the supply chain.

Renewable energy technologies

China is the largest renewable energy producer and consumer in the world. To be fair, it is the largest producer and consumer of energy in general, and it has been since 2009 (Finley, 2020). Within this context, renewables have played an increasingly important role in the Chinese energy mix and manufacturing sector. Not only does it lead the world in the production, exports and installment of solar panels, wind turbines, electric vehicles, and batteries (as has been mentioned), but it also leads the world in renewable energy patents, and it is the biggest location for renewable energy investments (IRENA, 2019). In 2021, China invested $266 billion in the transition towards renewable energies, representing more than one-third of total global investments (Center for Strategic and International Studies [CSIS], 2016). In reality, this means is that the same pattern of

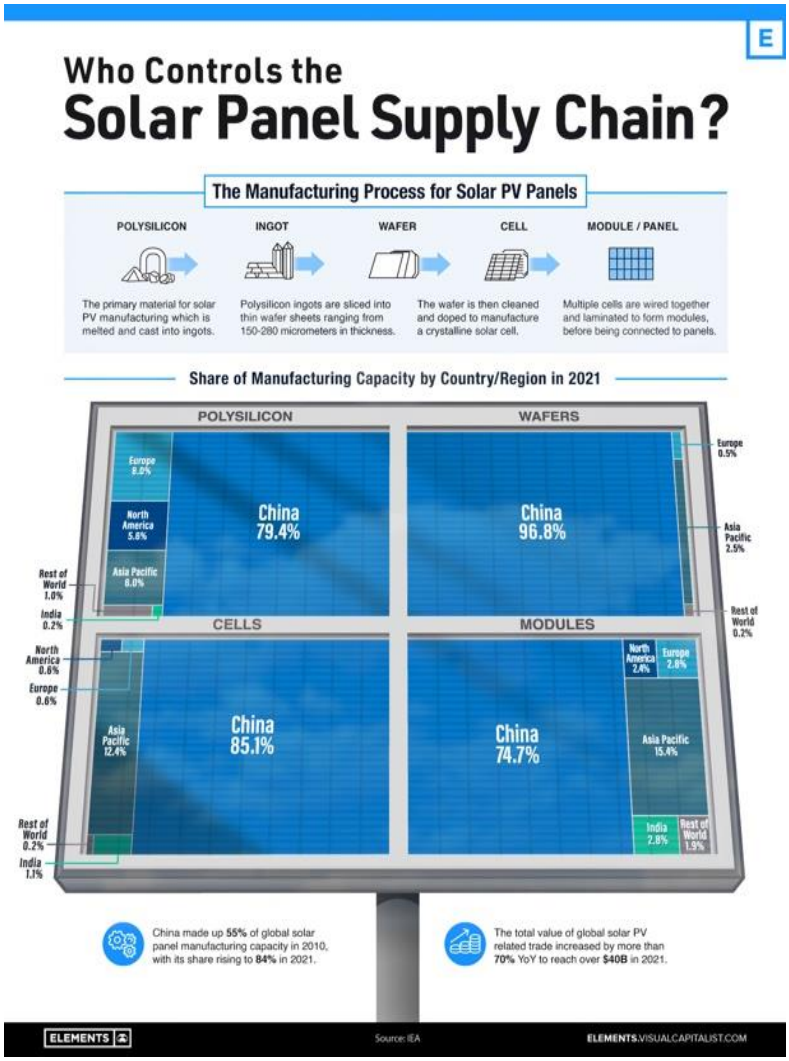
dependence or overreliance in China for critical minerals is practically reproducing itself for many renewable energy technologies.[26]

The scale of Chinese investment and manufacturing is difficult to grasp. It has the largest installed capacity of solar, wind and hydropower, this last source representing most of its renewable energy mix (Freeman, 2018). The installation rates are incredibly high, compared to most countries. In 2016 alone, China added 35 gigawatts of solar generation, which is about the equivalent of Germany's total capacity (Gardiner, 2017). In 2021, China built more wind turbines that all other countries together over combined, *in the previous 5 years* (Vetter, 2022). What is more is, according to Greenpeace estimates, every hour China deploys a wind turbine and installs enough solar panels to cover a soccer field (Gardiner, 2017). The examples like this are endless.[27]

[26] For policymakers that understand this asymmetrical situation as a potential or existing non-military conflict, the strategic stakes are very high. When asked whether "we" [the West] are on the winning or the losing side, a specialist in the French mining industry answered: "*we are not even putting up a fight!*" (Pitron, 2020. p.114).

[27] And again, they do not limit themselves to energy-generating technologies, but other types of key products such as EVs. In 2019, more electric vehicles were sold in China that in the rest of the world combined (Sandalow, 2020).

Figure 8 - China's control over renewable energy: the case of solar
(Source: Conte, 2022)



Perhaps the best illustration of the Chinese approach is provided by the case of solar energy. In a summarized manner, the manufacturing process for solar panels requires mainly (1) polysilicon as a raw material, which is then sliced into (2) thin wafer sheets. These are cleaned and doped to form a (3) solar cell, and then multiple cells wired together form a (4) module or solar photovoltaic (PV) panel. China owns the largest part of the world's solar panel supply chain by controlling 75% of every stage in panel manufacturing (Conte, 2022). as it is illustrated by Figure 8 and **Figure 9.**

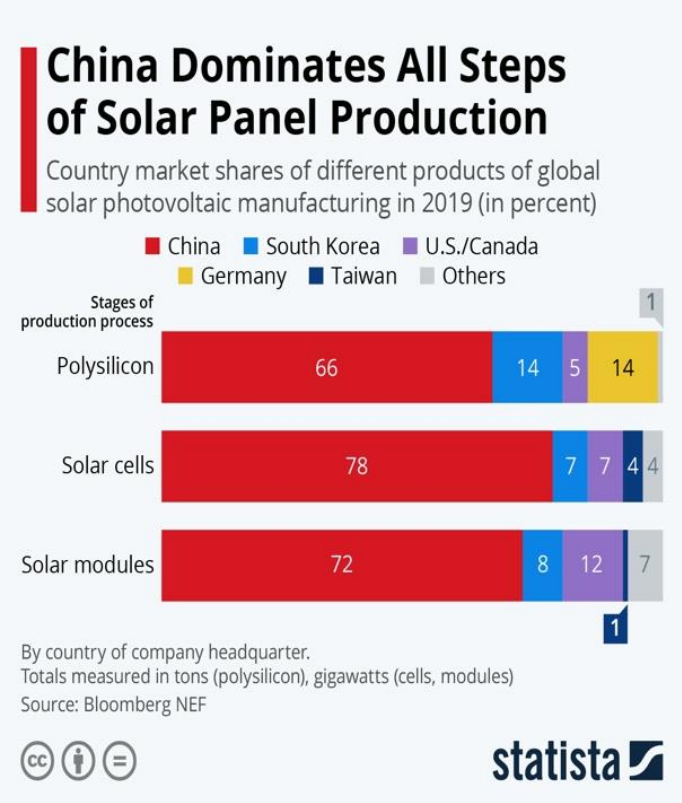


Figure 9 - China's control over renewable energy: the case of solar II
(Source: Buchholz, 2021)

Besides the massive deployment of installed capacity in wind and solar, the biggest renewable energy source is hydropower, representing about 8% of the energy mix[28]; wind and solar currently represent around 4% and 2% respectively (Ritchie, Roser, and Rosado, 2022). Additionally, nuclear is an important source of non-carbon energy generation in China, representing about 2.3% and growing every year. In addition to being the main driver of solar and wind capacity growth in 2021, China also led the strongest increase in nuclear generation capacity (4.2%) since 2004 (Ritchie et Al, 2022). It is also set to remain the single largest hydropower market through 2030, accounting for about 40% of global expansion (International Energy Agency [IEA], 2021).[29]

Why does this matter? Well, it matters because it shows how China is not merely increasing the share of renewables in its energy mix, but also focusing on diversification and on specialization in different energy sources with diverse advantages. In contrast to solar and wind energy, which depend on the sun and the wind by definition, hydropower and nuclear offer a control over supply, thus providing more energy security. (IEA, 2021)[30] This will be an important point to remember when trying to analyze China's motives in its energy strategy.

[28] Hydropower is even more important when we are considering the power generation mix, representing up to 16% of electricity generation in 2021 (Webster and Tobin, 2022)
[29] Despite this potential increase, it should be mentioned that China's share of global hydropower additions has actually been decreasing given a reduced availability of economically viable sites as well as social and environmental concerns (IEA, 2021).
[30] Hydropower in this sense offers a clear advantage, since hydropower plants can ramp their electricity generation up and down depending on demand very rapidly in comparison to nuclear or coal plants. It has unparalleled advantages when it comes to flexibility and storage of electricity, making it an attractive foundation and a key part in the energy transition (IEA, 2021).

The paradox in all of this is that while being an undisputed leader in clean energy technologies**,** China is now by far the largest emitter of carbon dioxide emissions, accounting for more than those of the United States, the EU and India combined. This position is due in part to its gigantic economic growth specially since the 2000s and its over-reliance on coal-generated electricity (Tooze, 2020). Since 2011, China has consumed more coal than the rest of the world combined (Center for Strategic and International Studies [CSIS], 2016). It is in fact, the world's largest producer, importer and consumer or coal, one of the most polluting and carbon-intensive of fossil fuels. Since 2000, its coal consumption practically more than doubled, representing in 2020 about 55% of its energy mix (Hung, 2022).1 out of 2 coal-powered electricity plants currently constructed in the world is installed in China (Webster and Tobin, 2022). It is for this reason that it is difficult to overstate the importance of China's role when it comes to dealing with climate change and the transition towards renewable energies (Tooze, 2020).

In any case, China therefore seems to have understood that competition in the energy transition is less about critical minerals only and more about specialized know-how in clean technology, intellectual property rights, and overall industrial leadership (Scholten et Al, 2020). The leading position in manufacturing is accompanied by its research and development (R&D) efforts, which aim to maintain leadership over innovation as well (IRENA, 2019). In this sense, the Chinese strategy to cover an ample field from raw materials mining and processing, to production, installment and exports of many renewable energy technologies to securing intellectual property rights. This does seem rather holistic. In short, "any discussion of green energy supply chains must pass through China*"* (Church and Crawford, 2018, p. 21).

Desired ends: where China wants to go

Framework: Peak in 2030 and Net zero by 2060

On September 22nd in 2020, China's president Xi Jinping made an announcement in a video link to the United Nations General Assembly (UNGA) in which he might have changed the global fight against climate change is just two phrases: "China will scale up its Intended Nationally Determined Contributions by adopting more vigorous policies and measures. **We aim to have [carbon dioxide] emissions peak before 2030 and achieve carbon neutrality before 2060"** (as

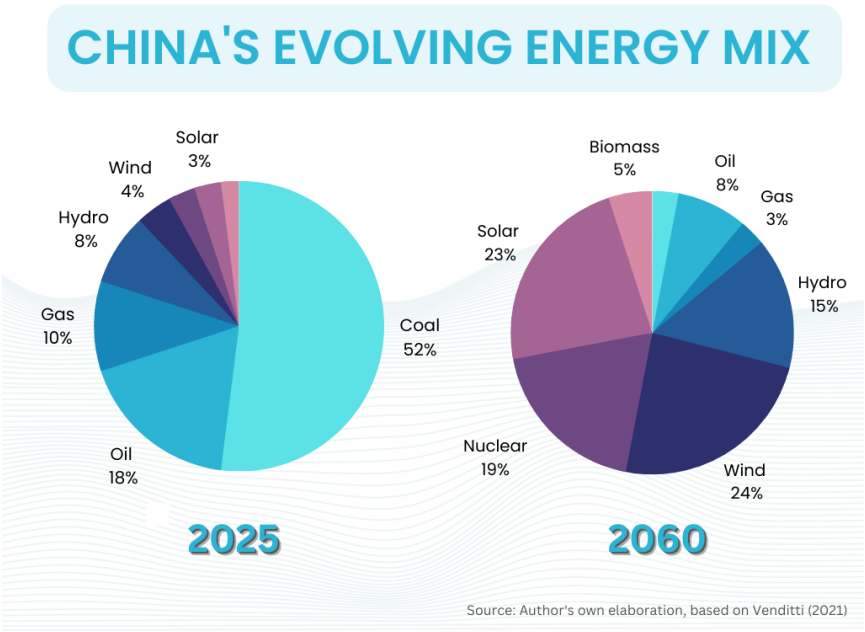
cited in Tooze, 2020, para. 1).[31] Translation: China's emissions, which are currently increasing, should start to diminish after 2030; by 2060, the total amount of carbon it produces should be zero in net terms. These are the two all-encompassing targets established by the highest authority in the Chinese State for tackling climate change.

These goals then break down into smaller, more specific targets that have been laid out in several official documents, and at times been reiterated by Chinese leadership. Some specific targets for 2030 include: increasing the share of non-fossil fuels in primary energy to about 20%, lowering emissions per unit of GDP by 60 or 65% (from the 2005 level) or increasing the forest stock volume by 4.5 billion cubic meters (Sandalow, 2020). When it comes to wind and solar, for instance, the idea is to reach more than 1200 GW installed wind and solar power by 2030 (Erbach and Jochheim, 2022)[32]. And in areas such as transportation, a key goal is promoting hybrid and electric vehicles, so as for them to represent about 40% of cars sold by 2030 (Mallapatty, 2021). What seems clear in any case is that retaining the advantage over key green technologies and accelerating renewable energy development will continue to be key priorities. By some estimates, the Chinese energy mix should look substantially different by 2060, as shown in **Figure 10.**

[31] Carbon neutrality is broadly defined as a balance between the amount of carbon emitted into the atmosphere and carbon that is absorbed from it, through naturally or artificial carbon sinks. Carbon sinks include all systems that absorb more carbon that they emit, which include natural systems such as soil, forests or oceans, and also artificial systems that remove and store carbon away, known mainly as carbon sequestration technologies (European Parliament, 2019).

[32] To help put this number into perspective, it is useful to know that just 1 GW is the equivalent of 3.1 million PV panels or 333 utility-scale wind-turbines. Other measures include: 100 million LEDs; roughly 1.3 million horses; 2000 Corvette Z06s or 9,090 Nissan Leafs (Rumph, 2022).

Figure 10 - China's energy mix 2025 v. 2060
(Source: author's own elaboration, based on Venditti, 2021)



Official documents: the 14th Five Year Plan and others

Some of the documents that support China's targets are the "**Action Plan for carbon dioxide peaking before 2030"** and a "**Working Guidance for carbon dioxide peaking and carbon neutrality"**,[33] as well as the 14th Five Year Plan for the period 2021-2025 [FYP] (as cited in Erbach and Jochheim, 2022, p.4). This last document deserves special mention for its role in the Chinese decision planning. It belongs to a specific set of strategic blueprints (known as "Five-Year Plans") that have been released by China's central government every five years short after the establishment of the People's Republic of China in 1949. These plans have typically outline economic goals and have been considered the centerpieces of China's industrial policy and planning (Kaja, Stein & Xiang, 2021) [34].

However, they have mutated to go beyond mere economic planning, by identifying top political, economic, and social priorities for the country in the medium to long-term horizon

[33] See also *Note 2.*
[34] This type of document emulates the Soviet command-style economic model and planning method. The first FYP was implemented by Stalin in 1928. This method of planning continued to be used in the Soviet Union and other socialist states (The Editors of Encyclopaedia Britannica, 2009).

(Cooper, 2021). In different terms, if there were official documents that established China's grand national strategy, these would probably be those.

FYPs and its secondary documents are developed mainly by the National Development and Reform Commission. In the case of the latest FYP, there are several sections and goals for 2035 specifically that should be mentioned. In energy specifically, it emphasizes the importance of accelerating the drive towards a low-carbon economy, promising to "*make a major push to develop new energy sources"*, while continuing to promote the "*clean and efficient use of coal"*. This apparent contradiction aligns with the fact that the 14th FYP is marks the first time China establishes "***energy security"*** as the key word in its blueprint (as cited in Cooper, 2021, para. 12)[35].

Additionally, a distinct but related point has to do in the section regarding the desire to turn China "*into a self-**reliant technological and manufacturing powerhouse**"*, and a leading country in innovation by 2035. This would entail achieving "*major breakthroughs in core technologies*", including among many other areas, new energy vehicles (Cooper, 2021, para 5.)[36]. This section relates to the government's "Made in China 2025" initiative, adopted in 2013, whose goal is to comprehensively upgrade Chinese industry, increasing efficiency, quality, innovation and integration of Chinese manufacturing across a range of critical industries, including energy (Kennedy, 2015).

There are doubts over China's future climate policy and ambitions. Achieving carbon neutrality by 2060 is a significant challenge for China, given the scale and the speed that will needed, which has never been tried before (Tooze, 2020.)**[37]** However, whether these goals are realistic or ambitious enough is not the point. The point is that China has set out ample long-term goals in the transition towards a more sustainable energy system and the fight against climate change. Its ends or goals should be taken with seriousness, as China's desire to achieve global leadership in green technologies will surely build on past successes (Holzman and Grunberg,

[35] See also *Note 3.*

[36] Other areas include artificial intelligence (AI), semiconductors, cloud computing, robotics, among others. (Cooper, 2021).

[37] There are many reasons to be skeptical of China's ability to keep its promises. Some observers have pointed to the increasing levels of investments in coal-generating capacity, and others have laid out some of the challenges that China will have to face, including its own fossil fuel lobby industry, and its potentially massive social disruptions. In fact, some commentators remarked that Chinese officials reportedly laugh when they ask the Europeans for advice on the "just transition" and realize that the entire German fossil fuel workforce is smaller than that of a single Chinese province (Tooze, 2020). See also *Note 4.*

2021). In this sense, it will probably count with the same "means" and resources that it has had up until now.

The means

This is where it gets tricky. In theory, one could try to distinguish between the structural/independent variables and the relatively accidental/dependent ones. This means that one could try to mark a key difference between the China's politico-economic system (what China is/has) and its policies (what China has done or does). In reality this distinction is less clear, given that these elements are intrinsically related, and they influence each other. However, for the purpose of clarification, they will be considered separately.

Let us begin with the system. Here is where the concept of authoritarian capitalism can provide useful insights, and where the relative advantages of the Chinese system in comparison to democratic systems will be explored.

Intrinsic/structural means: China's politico-economic system

An authoritarian capitalist state: power centralization and long-term planning

There are several ways to analyze the complex concept of "authoritarian capitalism" and how it fits China's case. However, two essential aspects often stand out when this term is used to refer to China: the benefits of power centralization and of long-term planning. These two features are interrelated but distinct, and they are theoretically common to several types of authoritarian states with state-directed pseudo-capitalist economies.

Power centralization

This element is somewhat intuitive. It is related primarily to the making and execution of policy decisions in an authoritarian system, which tends to be **top-down and centralized**. This process could arguably increase efficiency in the policy design and implementation, since less "opinions" are needed; leaders give orders, orders are followed. In practice, the centralization of power has spurred debate among academics about the real link between democratic systems and long-term economic growth. The fact that most advanced industrialized economies also happen to be democracies contributed to the attrition bias and the belief that these two factors had to be somehow related (Mitter and Johnson, 2021).

Several studies have been done to study this topic, which is incredibly more complex that what can be addressed here. In short, there is no direct link between democracy and economic growth. In fact, democracies have lower rates of **physical capital accumulation** that non-democratic countries, partly as a consequence of less bureaucratic barriers or attention to different groups or opinions (Tavares & Wacziarg, 2000). This seems to fit China's description, given its unprecedented rates of physical capital accumulation in the last few decades in practically all dimensions. What this means is that they have literally constructed a lot of *physical* things: roads, bridges, factories, buildings, skyscrapers, entire cities. To give an astonishing and often cited example, China used more cement in the period of 2011-2013 than the United States used in the *entire 20th century* (Swanson, 2015). This last sentence is probably worth reading again.

The idea that political liberalization and economic liberalization went hand in hand, and that democracy was a key element for economic growth were characteristic of the long-held system of beliefs in the West often called the "Washington consensus". The mere thought that great economic success could be achieved without either (a) having a democratic politic system or (b) eventually succumbing to it as the population got wealthier and starting demanding political participation was, to say the least, unimaginable. China broke something in the West's psyche. It defied all expectations of economic growth, while maintaining an ever more centralized authoritarian system (Ang, 2018). With this alternative model, China has attempted to establish what has become known as the "Beijing Consensus" (Turin, 2010)

In fact, seen from Beijing, many Chinese citizens do not seem to believe that China achieved economic growth despite having an authoritarian system; but *because* it has an authoritarian system (Mitter and Johnson, 2021). Experts in China's energy system have actually pointed out how top-down energy governance can be a key advantage. Targets are set, plans are designed, instructions get passed down: this mobilizes resources and drives economic growth (Yifan, Baiyu & Geal,l 2022). This works for energy, and for many other "strategic industries" as well, as will be explained when exploring the policies.

Even though this is, again, an oversimplification of the Chinese decision-making process or system, it is hardly undeniable that power in more centralized in it that in most democracies. The amount of discretion and control that the Chinese president has in comparison to, say, the US president, means that Xi Jinping arguably has more room for maneuver when deciding how to

deploy resources to favor national interests (Corr, 2016). And he can probably do it for a longer period of time.

Long-term planning

This is the second feature that typically gets mentioned: the ability to plan in very long-term horizons. In this narrative, democracies and democratic leaders are at the end of the day constrained by the "inconvenience of elections" (Horesh, 2015. para. 10). Most authoritarian leaders have the advantage of looking 20, 40 o 60 years into the future. In China's case, this feature is particularly pronounced, since the Chinese Communist Party has been and will remain for the foreseeable future the ultimate authoritarian impersonal "leader". Additionally, most China observers agree that Xi Jinping's consolidation of power is relatively unprecedented since the Mao Zedong era. The current president has gotten rid of most potential rivals within the party and changed the constitution to secure indefinite terms for himself (Ang, 2018).

The relative 'stability' of an authoritarian system enables leadership to play a "long game" in contrast to the more short-sighted or short-lived decisions in western democratic systems (Pitron, 2020, p.133). In the most radical interpretation of this story, prosperity has been enabled by "authoritarian stability", while democracy has been associated with disorder and misery (Ang, 2018). This notion is oversimplified as well, given that not all autocracies deliver economic success (Kinderman, 2021).[38] Additionally, the beginning of economic growth in China has been associated, to some extent, to the 'reform' and 'opening up' of Deng Xiaoping, and with subsequent gradual reforms in the bureaucratic system (Ang, 2018).

In sum, the Chinese model gives the impression that authoritarianism enables a type of vision that is more strategic or "grand": "The West is losing the argument, while the China model, despite its widening wealth gap, human rights abuses and disregard for the democratic process, is gaining credibility. The developing world sees that a Chinese leadership, unbothered by the inconvenience of elections and true public accountability, can create a long-term economic plan and follow it through uninterrupted (Horesh, 2015, para. 10).

[38] This idea is probably as simplistic as the "democracy causes growth" notion. There is nothing intrinsic to authoritarian systems that makes them more prone to economic growth either. The centralization of power needs to be accompanied with the correct set of policies and other variables (such as productivity) involved in economic growth. The point is that having an authoritarian system is not an obstacle to growth and can at times offer relative benefits (Kinderman, 2021).

More advantageous? Depends… but arguably yes

However, authoritarian systems have to face their own set of challenges as well. Just as authoritarian systems have, on average, higher rates of physical capital accumulation, democratic systems have, on average, higher rates of *human* capital accumulation, a key to innovation and to long-term productivity and economic growth (Tavares & Wacziarg, 2000). Innovation is an often-cited challenge when discussing autocracies, given the idea that autocratic system leaves little room for deviation and creativity (Pitron, 2020, p. 124). In this sense, it seems intuitive that freer systems are able to provide the economy with more strength and capacity to adapt than closed ones, where the flux of information is in the hands of the state (Kagan, 2008 as cited in "Illiberal capitalism", 2008).

There can also be problems of coordination, since a top-down approach can translate into limited policy tools for local governments, and the inability to work with other jurisdictions when it is necessary (Yifan et Al, 2022). The fact that decision making is highly centralized does not necessarily mean that decision execution is as well. This can translate into top-party officials declaring the goals, and local officials left wondering how precisely to achieve them. In this sense, the benefits of centralization are not as straightforward (Chang, 2022). And obviously, the ultimate price of authoritarianism is political oppression and lack of essential civic and political freedom, which are arguably valuable for their own sake. In this sense, relative economic freedom in this type of system is always limited to what is dictated by political elites, and businesses operate exclusively with the support (or sometimes the collusion) of the state (Kagan, 2008).

Be that as it may, China's astounding economic success still clothes the totality of its system and its strategy with a certain kind of allure. Its trajectory reinforces the notion that authoritarian political systems can be as legitimate as democracies, and perfectly functional bases for a social contract (Mitter and Johnson, 2021). It provides at last an alternative model for reaching strategic objectives and seems useful for leading physical capital-intensive transformations such as the energy transition. From this perspective, regardless of its problems, China's political arrangement has certain 'advantages' over less centralized or more democratic ones in this process. Because these advantages have certainly been influential in the rapid achievement of national goals, including in the energy sector, the political system can be seen as a "means" in the strategy.

But it cannot be understood in isolation, but rather jointly with the economic system – which has its own set of advantages.

Comparative advantages of China's economic system

From an economic perspective, China has essentially three comparative advantages: cheap labor, cheap capital (due to a policy of devaluating the yuan) and the gigantic size of the Chinese economy or market, which contributes to great potential for economies of scale. (Pitron, 2022. p. 122). These elements have partly provided political leaders with favorable starting economic conditions to work with in the first place.

The benefits provided by the political system, the comparative advantages of the economy, and the existence of a political will to craft and carry out successful long-term strategies in favor of national interests ultimately explain China's success story and contribute to its incredible future potential. It may lead us to believe not only that China might have something to teach in terms of long-term economic planning and successful market intervention (Horesh, 2015) but also those Chinese leaders then, seems "doomed to succeed" (Pitron 2020. p. 124). These structural factors are in turn combined with a set of extrinsic or 'accidental' means – with concrete internal and external policies – that maximize China's economic development strategy.

Extrinsic/accidental means: official and 'unofficial' industrial policy

Industrial policy refers broadly to the set of government interventions, in the form of guiding, supporting, restricting or coordinating its industries, enterprises or products for specific purposes, such as economic growth, innovation, greater competitiveness or efficiency, innovation, among others. From the late 1970s up to today, China started a process of "reform and opening up", evolving throughout the decades and achieving great success in industrial development. This has been done through a combination of market-oriented policies and a set of evolving or adapting industrial policies (Jigang, 2020).

Again, the policies that will be explored are intrinsically related to the politico-economic system. Not only are they many of them "possible" because of the margin of action that centralized political systems may have, but also many of them contribute to the creation of the economic "system" itself. For example, highly differential treatment of companies may be possible because of a higher tolerance of state-intervention in the economy in China than in other parts of the world.

While, as has been mentioned, what are now relatively "structural" characteristics of the economy – "cheap" capital or low productions costs due to "cheap" labor - are originally at least partly attributable to *policies*, in this case of devaluing the yuan or implementing lax labor regulations respectively (Pitron, 2022).

When discussing these policies, we need to keep in mind some ideas. Aside from the intimate system-policies relationship, we need to be aware that there are uncountable lines of action and only some of the most relevant ones will be mentioned here. In this sense, although reference to specific energy policies will be made, many if not all of these practices are broader in scope and nature – covering many other sectors as well. Some of them are "legitimate", meaning in accordance with international trade rules; some of them are not. Some of them are "internal", meaning inside China, and others are basically external, focused on the projection towards the outer world. Finally, some act as "pull" forces, meaning forces that attract others into China; some act more as "push" forces, supporting extraterritorial expansion.

All of them, however, in broad terms seem to be focused at giving Chinese companies an advantage over the rest, moving up the value chain, and developing the national industry. In practice this includes strategies such as giving domestic companies economic advantages; stimulating expansion and consolidation; conditioning market access for foreign companies on technology and intellectual property transfer; buying foreign assets, and even industrial espionage and intellectual property theft, among others. Let us start from the beginning.

Advantages and favorable conditions for domestic companies

Inside its territory, China's differential treatment of foreign companies has been a source of preoccupation for many years. Not only are foreign firms treated differently from domestic ones, but even domestically, private firms and State-owned enterprises (SOEs) also receive differential treatment. There is what has been characterized at times as an "excessive" role of the state in determining advantages – tax breaks, grants, subsidies, land allocation, preferential rates- which has created great market distortions inside and outside of China. Foreign investors have pushed for years to make the Chinese business environment more competitive and establish a better level-playing field for all industries. This has even been the subject of intense trade-war negotiations. Even companies that never enter the Chinese market are impacted by the sheer size

of the Chinese economy and the global expansion of its companies – they are just "too big to be ignored, whether in China or in Europe" (García-Herrero and Ng, 2021.).[39]

The system sets the conditions under which these "stimulation" mechanisms actually take place. Most "strategic" industries are dominated by huge State-Owned Enterprises (SOEs) over which the Chinese state can exert control more easily (Chang, 2022). While opening up economically to the outside world, the government has retained a high level of control over **strategic industries,** including banking, telecommunications and energy (Horesh, 2015). This allows it to set the rules of the game domestically, but also internationally, making it easier for the Chinese state to instrumentalize resources as leverage in disputes. And given that there is broad consensus that with Xi Jinping power has consolidated more than ever, wielding this power is also arguably easier than ever. (Chang, 2022).

In rare earths specifically, for instance, China's dominance is precisely the result of years of evolving industrial policies since the 1980s, which have included everything from tax rebates to export restrictions. In fact, many of the exploration projects outside of China, as well as the research obsession with rare earths and critical minerals in general were triggered by the famous the limited export restrictions of rare earths the China enacted in 2010 (Bhutada, 2021a). Another example is the development of nuclear power. This has been supported by **cheap debt capital** for the large SOEs operating the plants, allocating operating hours for electricity sales, beneficial prices, or aiding in the land allocation process (Sandalow, 2020).

Consolidation and expansion of large industries

In order to expand, SOEs are generally given preferential rates at Chinese state-owned banks, which combined with the fact they are very large companies, allows them to raise capital more readily and consolidate easily. The Chinese government has also strategically approved policies to promote domestic expansion. For instance, in 2021 it approved the merger of its three largest, rare-earth metals SOEs, to create the China Rare Earth Group, one of the world's largest producers of rare earths. This is just the latest effort in a decades-long campaign towards the consolidation of this sector in an attempt to gain greater control of, again, a "strategically important industry" for

[39] To complicate things further, the difference between what is private, or public is not as straightforward in China. The intimate relationship between the state and SOEs, and the complex structure of these, means the line is sometimes blurred. This makes negotiating solutions with China, as well as measuring the precise market distortions, a very complicated task (García-Herrero and Ng, 2021).

its key role in defense, energy, technology and communications, as recognized by Xi Jinping himself in 2019 (Chang, 2022).

Foreign expansion is important as well. When investments opportunities are recognized overseas, the State can compel its major banks to boost lending to national companies, using commerce as a means to promote national interests (Horesh, 2015). But we will get to that.

Forced technology transfer (FTT): the technology – low production costs exchange and 'indigenous innovation'

A practice that has been common in the Chinese economy across many industries, including mining or chemical companies in this case, is commonly known as "**forced technology transfer**" (FTT). This is a national practice by which a domestic government allows foreign companies' entry into a market on the condition that they share their technology, including intellectual property such as software code, industrial processes, designs, formulas, and so on. One way the Chinese government enforces this policy is by demanding that foreign companies partner up with local businesses through "**joint ventures" (JV**), which generally means sharing sensitive private technology (Frankenfield, 2022).

In order to incentivize the creation of these ventures, China has resorted to several 'stimulus' mechanisms. They have capitalized on the main attractive features of the Chinese economy, but they have also reinforced them. The sheer size of the market is somewhat fixed, but the overall business environment (cheap capital, cheap labor, and lax environmental regulation) is relatively malleable and influenced by policy. In this sense, they have engaged in a "**dual-dumping"** strategy: trade dumping and environmental dumping (Pitron, 2020, p. 62). These factors together ultimately mean **low production costs**. China pressured western companies across a range of industries from all over the West to relocate to China, in order to benefit from rock-bottom production costs. Many succumbed to the extremely attractive deal, given that at the end of the day, "it all comes down to cost" (Pitron, 2020. Pg 106). Even if it means transferring technology.[40]

[40] *"In building its nuclear fleet, China imported technology for the US (AP100), Canada (CANDU), Russia (VVER) and France (M310 and EPR). The Chinese government aims to localize these technologies and become self-sufficient in reactor design and construction" (*Sandalow, 2020, p.9). Again, this is a strategy common to many Chinese industries, not only energy.

This explains the partial **deindustrialization** of several European countries and of the United States, from the dismantlement of French mining or chemical factories to the closure of American manufacturing plants. It explains why the United States went from being the main producer of rare earths in the period between the 1960s and the 1980s, to importing most of its refined rare earth metals from China (Pitron, 2020, p. 60).

Companies that did not choose to relocate to China to guard their industrial secrets eventually had to face a different type of "stimulus". Aside from benefiting from/creating their economic advantages, China has also engaged in **price manipulation** as a complementary strategy. It has at time created artificial shortages and export quotas to drive up international prices of rare earths, for example, while keeping domestic prices incredibly low.[41] Many companies then had to choose between two difficult options: one, slow down production for lack of raw materials or two, relocate to China and get access to abundant supplies. Or three, close down. All the Chinese companies had to do was patiently wait, and play "the long game". This context explains what led a U.S. Senator to declare in a fiery speech in 2013: "*How can we compete when the Chinese are so brazenly cheating?"* (Pitron, 2020, p. 108).

Historically, many of these mechanisms have been developed under the framework set out by different industrial policy documents. The main one is a 15-year plan that dates back to **2006**, called the "Medium- and Long-Term Plan on the Development of Science & Technology". It set out a strategy called "**indigenous innovation**", entirely focused on the acquisition of advanced technologies. In **2010** it culminated by identifying "strategic emerging industries" (SEIs) vital to China's aim at becoming an advanced economy. The core of the plan was developing advanced technologies through investment in Research and Development (R&D) from state and industry sources, accumulation of intellectual property, establishment of technical standards, and perhaps most importantly, "leveraging access to the Chinese market in exchange for foreign technologies*"* (Kennedy, 2015, para. 8).

And that is exactly what China did. The 2006 document has been described by consultants as filled with good intentions and beautiful rhetorical language about international cooperation, although reality is more complicated than that. According to a US report published in 2010, the

[41] In addition to weaponizing supplies as geopolitical leverage in international disputes, as in the case with Japan (Chang, 2022). See also *Note 1*.

document was "a blueprint for technology theft on a scale the world has never seen (…) with these indigenous innovation industrial policies, it is very clear that China has switched from defense to offense" (as cited in Pitron, 2020, p.123). The current industrial policy blueprint? Made in China 2025, for example, stands out (among other initiatives). And this one seems to be much more comprehensive (Kennedy, 2015).

Unofficial acquisition: industrial espionage, cyberwarfare and intellectual property theft

When more conventional means have not been deemed as sufficient, China has additionally engaged in industrial espionage and cybertheft, with the cost of stolen intellectual property estimated at $300 billion a year (Brown and Singh, 2018). The total transfer of wealth from advanced economies to China, between legitimate and illegitimate means, has been calculated by some estimates to be at more than 4,000 $ billion, which is Germany's total GDP, or twice France's GDP (Pitron, 2020, p. 130). Again, this has been common to a wide array of industries, not only energy. The goal, deep down, seems to be the same: gathering and acquiring "useful" information, for the development of technology, organization of industry, or many other imaginable goals.[42]

Expansion: mergers and acquisitions (M&A)

Aside from attracting foreign investment, China has also incited its companies to purchase and acquire foreign assets and companies outside of its territory. China's overseas mining Mergers and Acquisitions (M&A) activity has in fact increasing significantly over the past decade, reaching $7.13 billion in 2019. The quest for metals such as cobalt, lithium, gold or copper has translated into Chinese enterprises exploring and launching projects domestically and internationally, from Latin America, to Africa, to Central Asia (Holden, Yao & Li, 2022).

This is particularly pronounced in its acquisition of critical mineral resources in several African countries, such as South Africa, Angola, Burundi or Magadascar, but it is really a global phenomenon, including deals from Canada or Australia to Peru and Vietnam (Pitron, 2020, p.. 169).[43] A famous or emblematic example would be the controversial deal between two Chinese SOEs and the former Congolese president Joseph Kabila, which consisted in exchanging Chinese

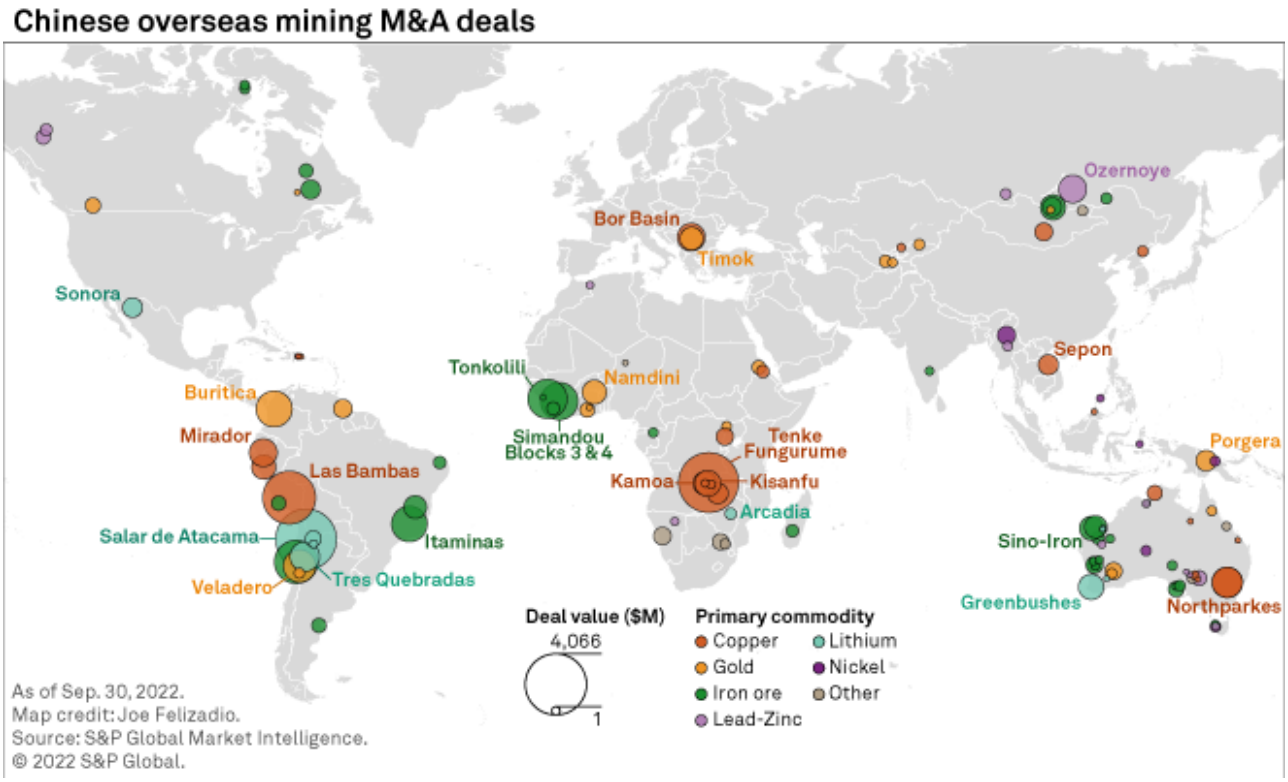
[42] See also *Note 2.*

[43] As explained by Vivian Wu, a Chinese official, the Chinese domestic market grows at such astounding rates that the Chinese fear they will run out of supplies in the course of the next years. Partly for this reason, they have started to secure resources outside their territory (Pitron, 2020. Pg. 169). Partly.

infrastructure for a 68% stake in a very large cobalt-and-cooper joint venture (the secretly revised and asymmetrical terms of the deal caused an uproar in the Democratic Republic of Congo [DRC]) (Chang, 2022)[44]. Other examples include, aside from partial ownership of foreign companies, taking diplomatic actions to prevent competitors from acquiring deals. For instance, the chairman of Stans Energy, a Canadian mining company with activities in Kyrgystan, accused China of pressuring the Kyrgys president to withdraw the Canadian company's operating license without any reason whatsoever (Pitron, 2020, p. 171).

It really does seem like China has secured itself the totality of its own strategic resources and supply chains and has moved towards a strategy of control overseas. In the words of Pitron (2020): "It's as if Saudi Arabia, which holds the largest proven reserves of oil worldwide, took it upon itself to control the oil reserves of the now thirteen oil members of OPEC" (p. 127). As the following Figure 11 illustrates, this statement is probably not an exaggeration.

Figure 11 - Chinese overseas mining M&A deals
(Source: Holden et Al, 2022)



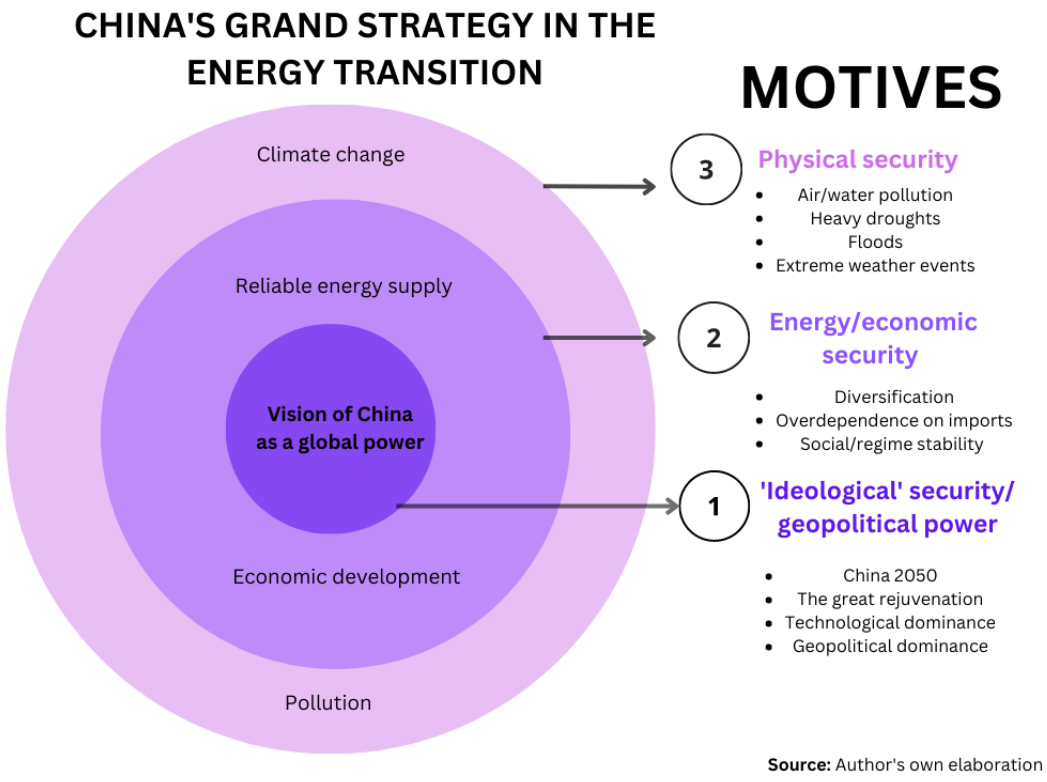
[44] In fact, China has already built a railway line in DRC specifically to get to the Katanga region in the south, known for being cobalt rich (Pitron, 2020, p. 170).

So, by now we have established that China's approach to renewable energy development can be accurately explained using Grand Strategy theory; in other words, considering the approach as a means-end chain. Given that China's goals and means in this part of the energy transition have been considered, let us move to the final section of the analysis and briefly explore China's potential motives. In other words, now that we have looked at the what and at the how, let us consider the *why.*

The motives

We are going to look at three layers or perspectives, from more external or superficial to the more profound: physical security, energy/economic security, and 'ideological'/geopolitical security (as visually summarized in the Figure 12). The argument is that all of these layers are perfectly valid and complementary explanations for China's actions. Thus, they should not be seen as alternative answers, but as part of the same complex set of motivations.

Figure 12 - The motives behind China's renewable energy policy
(Source: author's own elaboration)



Physical security

Impact of air pollution and climate change

The outer layer of analysis when considering China's motives is the actual impact of pollution and climate change in China. Here, it is important to clarify that, although intrinsically related, these two phenomena are not the same thing. Pollution broadly refers to immediate damaging byproducts of energy consumption, which can affect water and air quality in a particular location for instance, while climate change is the more gradual change of global temperatures. Air pollutants and greenhouse gases responsible for higher temperatures, however, often derive from the same sources, such as diesel-fueled vehicles and coal-fired powered plants (World Bank Group, 2022).

So, when it comes to physical security, the first element that should be considered in the case of China is air and water pollution. Air pollution in particular has been recognized for years as one of the primary concerns of the Chinese government and of the population as well. A UC Berkeley study found that this phenomenon is linked to an estimated 1.6 million deaths a year, representing about 17% of all deaths in China (Chiu, 2017).[45] It is not difficult to convince anyone in Shanghai or of how air pollution represents a problem; pointing at the sky is enough, as **Figure 13** and **Figure 14** show[46].

Figure 13 – Air pollution in China: boats in Shanghai

[45] Globally, air pollution is "the world's leading environmental cause of illness and premature death" and 95% of these deaths occur in developing countries (World Bank Group, 2022).

[46] These images were downloaded from Pixabay and therefore require no attribution and are free to use under content license rules.

Figure 14 - Air pollution in China: skyscrapers in Shanghai

It is therefore not surprising to discover why this was ranked as the second most important problem by residents in China in a 2015 international poll, only after government corruption. And it is not merely a public health problem, it is also a potential source for social unrest. In fact, a leading member of the CCP acknowledged in 2013 how environmental issues are a major issue for mass protests. (Chiu, 2017).[47]

Beyond air pollution, China has also already felt the very real impacts of climate change in its territory. In June 2015, the government acknowledged that China was "among those countries most severely affected by the adverse impacts of climate change*"* (as cited in Sandalow, 2020. P.16). The following month, the temperature in Xinjiang reached 50.3°C, which was the highest level ever recorded in the country (Sandalow, 2020 p.16). This is just one example of several risks and extreme-temperature driven events throughout the years:

"In August and September 2018, record rains fell in parts of Guangdong Province, requiring the evacuation of more than 200,000 people. In the first months of 2020, Yunnan Province suffered its worst drought in many years. Hundreds of millions of people are vulnerable

[47] Actually, rare earths production has been typically associated with public discontent in China, (Chang, 2022) and destructive mining techniques has often spurred protests, petitions or even violence. For example, in 2011, residents of the Qinghai province urged the government to take action against lead mining, which was causing high levels of water pollution and endangering their lives. Many other provinces have experienced similar events ((Church & Crawford, 2018).

to sea level rise in China's coastal provinces—one of the most densely populated areas on Earth." *(*Sandalow, 2020, p.16).

For all these reasons, there are objective physical challenges to security in China pushing its efforts towards renewable energies. Climate change is increasingly recognized by the Chinese leadership for what it is: a matter of national security (Moore and Melton, 2019). Former President Hu Jintao applied the term "ecological civilization" to China's own definition of environmentalism (Sircar, 2021). Xi Jinping has promised to make the country's skies "blue again" and has identified cutting pollution as one of the "tough battles" ahead (as cited in Sandalow, 2020, p.8) [48]. The importance of global climate leadership for China has done nothing but increase throughout the years, with expressed intention to continue, regardless of what other states decide to do – including the United States (Sircar, 2021). And given that China is the leading polluter in the world, whenever it moves up or down "the whole world feels it" (Mallapaty, 2020, p. 20).

In short, environmental degradation and climate change constitute one of the primary challenges for the China and for the stability of the Chinese Communist Party [CCP] (Sircar, 2021). These could therefore be seen as a first layer of motivations for advancing the energy transition. Given the Chinese government's insistence on maintaining domestic stability, advancing the energy transition and developing renewable energies is seen as a way to guard physical security – not only literally, but as a way to prevent socioeconomic uproar (Chiu, 2017).

In 2014, Xi Jinping said that "addressing climate change and implementation of sustainable development is not what we are asked to do, but what we really want to do and will do well". And in 2017, he declared that China would "take the driving seat" in international efforts to respond to this challenge (as cited by Sandalow, 2020, p.3). And, up until now, it certainly has.

Energy and economic security

Energy independence and economic growth

This second layer is also relatively straightforward. There seems to be a consensus among analysts that energy security is a key motivation for China's leadership in the energy transition. Let us remember the list of "energy superlatives" that China represents: *"*it is the world's single

[48] There have been a variety of policies to reduce dependence on coal and tackle are pollution in particular, including an Air Pollution Action Plan (Sircar, 2021).

largest consumer and producer of energy, the biggest consumer and importer of oil, the largest producer, consumer and importer of coal, and by consequence also the biggest emitter of CO2" (Freeman, 2018, p.187).

Depending on imported fossil fuels is not only financially costly, but also geopolitically risky. Supply of key sources of energy is therefore dependent upon factors such as instability in producer countries, problems along transportation routes, supply cut-offs, and increasingly, financial sanctions or export controls by the United States (Meidan, 2021).

This is why within China itself, the discussion regarding the geopolitics of energy in general has largely focused on securing access to fossil fuel resources. (Freeman, 2018). This is hardly surprising, given China's dependence on them. China has often sought to extend its influence and secure oil and gas transit routes to and from fossil fuel exporters, even with military protection. In fact, the protection of oil transportation choke points or bottlenecks is part of the reason China installed its first overseas naval base in Djibouti (Chiu, 2017).

That energy security is important to China is not difficult to prove. And it is way farther up in the list of priorities than climate change preoccupations are. As was mentioned before, the 12th 5YP marked the first time the term "energy security" was included in the plan (Cooper, 2021). And whenever there have been supply shortages or cut-offs, China has not hesitated to sacrifice all concern of the environment in favor of maintaining a stable supply of energy (Sircar, 2021). Energy security is at the heart of economic security and growth, but in a deeper level it is at the heart of society's functioning. The Chinese government has recognized the importance of energy for years, as stated in the Strategy for an Energy Production and Consumption Revolution by the National Development and Reform Commission in 2016: "Energy is the material foundation of the development of human society, and energy security is a major element in national security" (as cited in Freeman, 2018 p. 189).

The important thing to understand then is that the energy security argument goes hand in hand with the economic security argument. For decades China has achieved immense and unprecedented levels of economic growth, largely on the back of plentiful domestic energy resources, mainly coal. In this sense, access to sustainable energy supplies is essential for China to maintain its economic development and trajectory in the long-term. (Freeman, 2018). Already back in 2000, the International Energy Agency (IEA) had published a report called "China's

worldwide quest for energy security noting how China's rapid growth had sparked an increasing demand for energy. It stated how even though the country had attempted to exploit domestic sources, its growth was so overwhelming that it had led to increasing oil imports. Aware of its growing dependency on imported energy, the report states: "China seeks a more prominent position in the existing global system of energy production and trade. Where it can, China seeks to open new connections in global markets. Increasingly, external energy policies are entwined in foreign economic and security policies in general." (IEA, 2000, p.8).[49] And this was 23 years ago.

Economic development has been central for China's grand strategy for several decades, and it is considered an essential part of its national security. Since Deng Xiaoping stated that China should make "economic development the focus" in the late 1980s, this concept has been emphasized in key official documents as well as in leaders' speeches throughout the years. Economic growth has not only become increasingly associated with national greatness but with social stability and the legitimacy of the Communist Party. It has been argued at the core of what Xi Jinping has sometimes called "comprehensive national security" is regime or political security, and that economic security is its foundation (Zhang, 2021).[50] The 14th 5YP also mentions economic development as a key national priority (Cooper, 2021)

So, just as this quest for energy security has characterized China's approach to fossil fuels, it also partly explains its approach to renewable energies. Renewable energies present themselves not only as a way to build an ecologically sustainable economic model, but also as a way to diversify the energy mix and become less dependent upon other countries for energy supplies. The "energy independence" argument is found throughout the literature regarding the geopolitics of the energy transition (Valkukchut et Al, 2019).

China seems to have understood the potential of these new sources to curb its import dependency (Meidan, 2021). The country sees therefore renewable energies as a key strategy to become less reliant on unstable regions, since wind and sunlight are more evenly distributed

[49] The report continued to explore the energy relationships and partnership China had started to establish even back then across the Middle East, Southeast Asia, or Africa. It stated how China's position, trade and investment were likely to do nothing but increase and that before long, China would probably aim at being part of the actual management energy facilities abroad (IEA, 2000). Accurate prediction.

[50] With the current leader, however, there is some growing evidence that the pragmatic approach to economic growth is not as present as it seemed to be in previous years. Xi Jinping's hardened approach to political power has given surge to a kind of ideological revivalism in China that does not seem to prioritize economic growth above everything else (Rudd, 2022).

available resources (Chiu, 2017). In particular, China's approach to hydropower seems to confirm this desire for energy and economic security. The fact that hydropower is the most reliable in terms of security of supply, and that it also happens to be China's largest renewable energy source (Freeman, 2018), is not likely to be a coincidence.[51]

In this sense, access to sustainable energy supplies is essential for China to maintain its economic development and trajectory in the long-term. (Freeman, 2018). In short, if China did not diversify, it would become increasingly dependent upon fossil fuels, and more vulnerable to price fluctuations and supply interruption. From an energy and economic security standpoint, China cannot continue with business as usual (Tan, 2015).

Ideological security – geopolitical dominance

The deepest layer of analysis when it comes to identifying the motives behind China's energy policy is ideology. In this sense, ideology includes not only the coordinated set of political ideas that permeate the Chinese system but also the long-term vision for the country as established by the Chinese leadership, as seen by both rhetoric and practice. This would be the part of the strategy that is mostly associated in practice with the "master plan" argument – with the idea that China's "real" intention deep down is to become the global superpower of the century. Geopolitical dominance or control would then be at the core of China's approach.

A desire for technological dominance

This part of the discussion is complex, especially given the quantity of documents or policies, and the difficulty of distinguishing between what is said and what is done. What appears to be clear is that China's overall national strategy and has greatly evolved in the last decades, becoming ever more assertive and dominant in the international arena. Although this can be seen in several fields or areas, the one that is particularly important at the time is, as one might expect, **technology.** At the core of China's holistic efforts in the energy transition is really the desire for technological superiority in general. Seen from this lens, dominance in renewable energy technologies is just a reflection of this all-encompassing desire – it is just one more board in which to play the game. As a way of example, in 2018, China filed 1.4 million patents – more than any

[51] This has important geopolitical implications, quite literally. The control of rivers and the increase in dam projects have often been sources of disputes with neighboring states, such as India. The importance of control over water resources is therefore highlighted by China's desire to increase its hydropower capabilities (Freeman, 2018).

other country in the world (Pitron, 2020, p. 126). Vivian Wu, the Business Development director of an important Chinese rare earths company, overtly stated: "We want to use these metals to become the world leader in technology." (as cited in Pitron, 2020. p.127).

One typically cited example of the recognition of rare earths' strategic importance is when Deng Xiaoping, China's leader after Mao Zedong, famously said as far back as in 1987: "the Middle East has oil, China has rare earths" (as cited in Mabuni, 2023). However, if Chinese leaders had stayed there, China would now dominate the production and exporting of important low value-added raw materials, and that would be the end of the story. But we know that is not the end of the story. By now, it should be somewhat clear that China wants to become the uncontested leader in renewable energy generation, dominating every segment of the value chain: from the mines of rare earths and other minerals to the algorithms of smart grids, passing through electric vehicles, solar panels and batteries (Gomart, 2021, p. 90). The approach is so holistic that it seems to go beyond merely fighting climate change or securing energy supplies. The mere fact that it covers so many segments should be telling that there is something else going on.

The means used to acquire that technological superiority are also equally telling. The state-led strategy includes all kinds of mechanisms, regardless of their relative legality or transparency, to achieve the required innovation capabilities in this process. The "recipe" for this state-directed search for high-tech goes way back. This extract from Pitron (2020) is worth citing in-full:

> "The theoretical foundations of China's intellectual emulation were laid in 1976, when Deng Xiaoping broke ranks with Mao's agricultural ambitions to proclaim that, from then on, '**production power lay in the sciences**'. Subsequent leaders have perpetuated and deepened this conviction: in 2006 President Hu Jintao state that '**science and technology**' form the 'central thread in the development strategy of China'; in 2010, the twelfth Five-Year Plan - a road map tracing the key economic strategies for the 2011-2015 period - identified as priorities seven advanced industries and just as many **new-technology horizons**; five years later, **innovation and technological progress** formed the centerpiece of the thirteenth Five-Year Plan (2016-2020). Thus, concepts that were never central to China's history had become mantras of the state'." (Pitron, 2020. p.122)

China in 2050: "strong power" and "global leader"

The 14th 5YP also explicitly emphasizes the desire to become a *self-**reliant technological and manufacturing powerhouse**"* which goes in line with initiatives such as Made in China 2025. (Cooper, 2021, para 5.). Furthermore, there is relative consensus that under Xi Jinping, China's ambition has done nothing but increase, both in tone and in scope. Some of his most recent speeches before the Chinese Communist Party Congress hint at his vision for China. In 2017, he emphasized how the country's development had entered a "new era", using that term 36 times in less than 4 hours. He envisioned China as a "basically" modernized socialist country by 2035, and as a "**strong power" by 2050** (as cited in Shepherd and Qiu, 2017).

In this speech, he laid out the plan to achieve what he calls the "great rejuvenation of the Chinese nation", a concept he had introduced in 2012. In entails a change in approach to foreign policy, from a 'low-profile' attitude to a more assertive behavior. Underlying the approach there is a more comprehensive way of understanding national security, as well as a belief that this is an era of strategic opportunity' for China (Legarda, 2021).

In this sense, the "goal is to restore China to its former status as a global power by 2049. In Beijing's eyes, China is not a rising power, but a returning one. The Western-dominated global order is viewed as a historical anomaly that therefore can – and must – be reversed." (Legarda, 2021. Para 2.). This plan or vision is complex, including important foreign policy and national security targets (such as reunification with Taiwan, for example). However, what seems transparent is that by 2050 China is supposed to be, in Xi Jinping's words: "a global leader in terms of composite national strength and international influence" (as cited in Valchev, 2021, para. 19).

The 2022 speech is equally revealing. Regarding energy specifically, this leader mentioned China's intention to "promote its energy revolution and **engage in global climate governance"** (Erbach & Jochheim, 2022, p.4). Regarding China's power more broadly, he emphasized how China's "international influence, appeal and power to shape the world" had significantly increased in the face of drastic changes in the international arena (as cited in Davidson and Graham-Harrison, 2022).

A desire for international power and geopolitical dominance

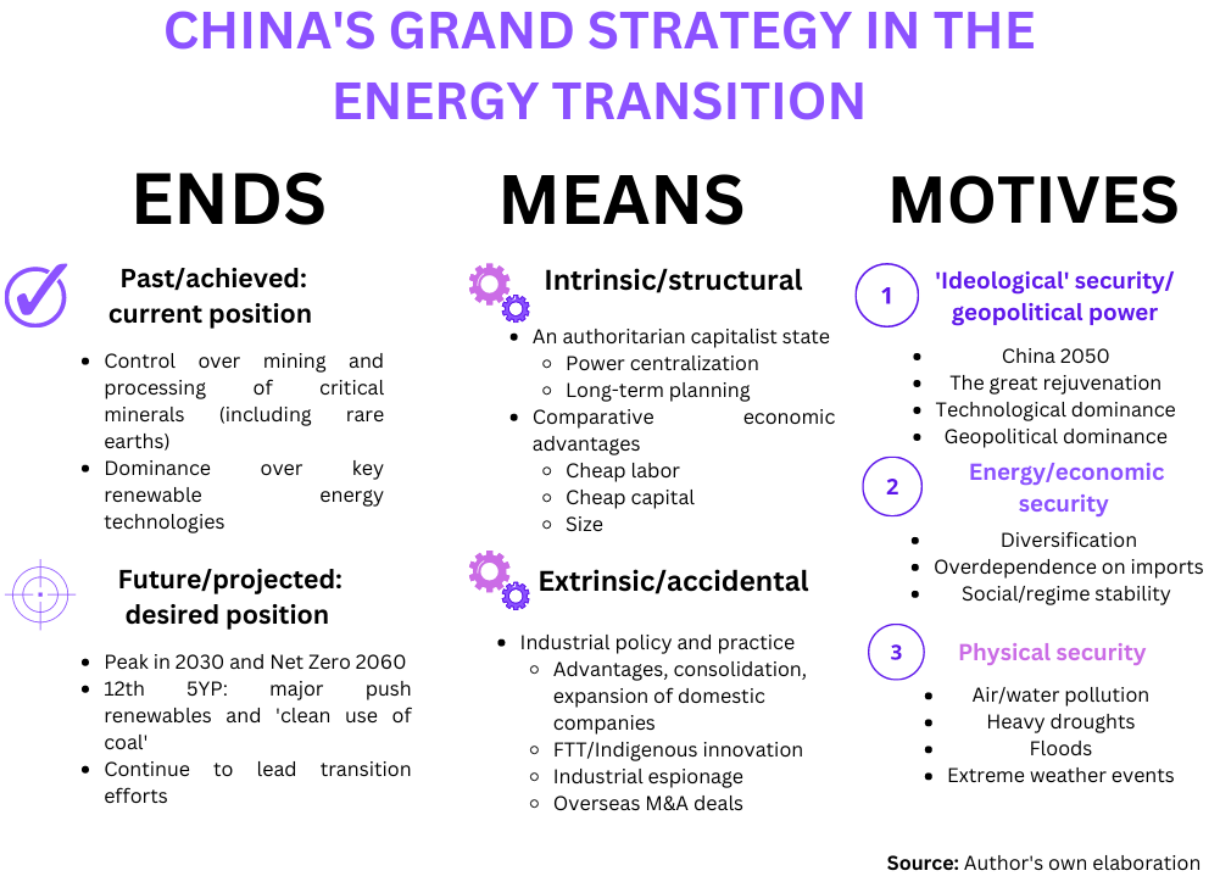
Just as the underlying rationale of energy policy could be understood from the broader perspective of technological superiority, the underlying rationale of technological superiority could be understood from the perspective on international power. In other words, China leads in energy technology because it wants to lead in *all* technology; and China wants to lead in all technology because China wants to be *the* global leader, period. From this point of view, advancing the energy transition is not just seen as a useful way to fight against climate change or ensure energy and economic security, it is also a strategic opportunity to enhance the country's geopolitical positioning[52]. China managed to leverage its geo-economic rise to power by integrating supply chains related to future energy sources, because it "understood already long ago **that it would play a central role in other countries' transitions**. And it is. The European Union, for instance, is 98 percent dependent on China for rare earths. Needless to say, this puts China in a prime position to **redesign the global balance of power."** (Lazard, 2022, 06:02).

Put plainly, you do not invest all of these resources, go out of your way to dominate the materials or the technologies even outside of your territory, and find clever ways to "innovate", just because you care about climate change, or you want to diversify your energy mix. And you do not put yourself at the center of future energy supply chains – ready to weaponize them when necessary - merely because you want to be a tech player. No. All these factors have their own weight. But deep down, looking at discourse and practice, it is fair to say that China's policy towards renewable energies is a reflection of an increasingly assertive power searching for ways to advance its strategic and geopolitical positioning in the world.

Figure 15 summarizes the analysis and discussion.

[52] It should be mentioned that geopolitics are not always part of the official rhetorical discussion in China around energy policy (Freeman, 2018).

Figure 15 – A summary of China's grand strategy in the energy transition
(Source: author's own elaboration)



All in all, China is in a greatly positioned in the energy transition from a geopolitical perspective – this is, from the perspective of "great power competition over access to strategic locations and resources" (Valkukchuk et Al, 2019). For less well-positioned countries, this might mean realistically addressing overdependence risks and diversification opportunities. For China, it means finding ways to keep the technological lead in the face of rising geopolitical tensions with the West in general, and the United States in particular.

Beyond this somewhat "realist" or perhaps more critical approach, it also seems as if China cannot be ignored when it comes to the transformation towards renewable energies. Climate change is, at the end, a global challenge. So even if China's approach can lead to strategic competition or can present a 'national security threat' for dependent countries, it could also be an opportunity for cooperation in this process. In the words of Crow and Saran (2021), "China can be a useful partner in the energy transition, even if it is not the only one" (p.6).

In any case, geopolitics and ideological conceptualizations of China's future power are also a key motive driving renewable energy policy in China. This does not mean that climate change does not matter to the Chinese leadership, or that arguments focused on energy security are not persuasive. It just means that at the core of several lines of policymaking, renewable energy development included, a greater story seems to be in the making. In short, at the deepest level of China's approach one could recognize a broad desire to become and behave as a leading international force – or as *the* leading 21st century global power.

8. CONCLUSIONS

If the fight against climate change was a race, China would surely be one of the leading runners. This global phenomenon is increasingly recognized as one of the humanity's greatest challenges, and it will lead to many extensive transformations. The energy transition, meaning the gradual change from fossil fuels to renewable energy sources, is just one among of the radical changes that have been set into motion. And although virtually every country in the world is involved in this process, there are some countries whose role arguably matters more than others - whether it be because of their contribution to the global share of carbon emissions, the size of their economy, their diplomatic weight or importance, or their efforts in the advancement of renewable technologies. China checks all elements in that list, and probably several more.

This study has aimed at providing a comprehensive account of China's approach to the energy transition, as seen specifically in its renewable energy policies. One of the useful theoretical frameworks to analyze China's approach is provided by Grand Strategy theory. Using this lens allows for the identification of grand plans, principles, or patterns of state behavior (Silove, 2017) on the part of China. Just by seeing this country's current control over several renewable energy supply chains, its past and desired trajectory and the mechanisms it has used to get to where it is, it is possible to see the "grandness" of China's strategy.

It seems to englobe the key characteristics of this concept – the strategy is long-term in scope, extending from several past decades to at least 2050; it is holistic, involving the mobilization of a wide set of national resources; and it is important, given that it pertains to vital interests of the Chinese state, visible at different layers of "security". When it comes to renewable energies, China not only seems to have implemented "a *theory about how to best cause security for itself"* (Posen, 2014 as cited in Friedman Lissner, 2018, p.55), but has gone beyond that. It has put itself at the front and center of one of the greatest geopolitical disruptions of our time.

There are key elements that stand out in the "means" of China's means-end energy chain. Here, the concept of Authoritarian Capitalism can offer valuable insights. China's political system, partly characterized by power centralization and long-term planning; the structural advantages of its economic system, and the combination of policies that have been taken, have all joined to make the perfect national development cocktail. China has then become the prime example of how democracy and economic growth do not necessarily go hand in hand, and how authoritarian

systems can provide a clear strategy, social stability, and national grandeur. The benefits of authoritarianism have already come to the attention of Western policymakers, opaquing the slower, pluralistic, apparently more bureaucratic democracies (Horesh, 2015). In this sense, some of the "advantages" of authoritarian systems seem to come to light in some ways, specially when it comes to physical capital accumulation. However, authoritarian systems tend to have slower rates of human capital accumulation – a key variable explaining innovation, which is crucial to long-term productivity and economic growth (Tavares & Wacziarg, 2000). China has partly escaped that trap by "importing" a lot of its "innovation".

We therefore derive the lesson that although some benefits can be derived from power centralization and long-term planning, political and economic development is ultimately dependent upon a complex set of variables – that go beyond being authoritarian or democratic. China has not succeeded only because it was authoritarian – that would be as ridiculous as saying that the United States became the world's first economic power just because it was a democracy. These elements are important, but they must be seen in conjunction with other economic variables and with the specific set of chosen policies a state develops. China has succeeded because it has used its national resources – political, economic, demographic, diplomatic – to its advantage. It has taken what it is and what it has and has turned its potential into actuality.

And why? Well, again, it is complicated. When it comes to renewable energies in particular, there is not a single reason or level of analysis that can explain the entirety of China's rationale. There is evidence to support that the country has already felt the impact of climate change in its own territory and has real reason to believe that physical security is at stake. There is also wide analytical consensus that given China's energy mix, dependence on imports and strategic vulnerability, it is looking for ways to diversify its sources. In this sense, it is aiming at a more sustainable way to guarantee energy security, economic security, and social stability. Finally, it is also possible to see how China sees climate change as a strategic opportunity to advance its technological development – and with it, its wider position of power in the world. The validity or emphasis on a specific explanation will depend on who we ask, or our own perspective of the world. But the reality is that they are not mutually exclusive, and each adds a different value to the discussion.

One of the great open questions at the end of this journey is well, "why does this matter?" Or put into more sophisticated terms: "What does China's position mean for future energy relations?"; "What are the implications for international security?"; "And for global distribution of power?"; And many other important formulations that policymakers are already facing in designing energy transition policies, and that researchers should furtherly explore. This study is just one among many that has aimed to highlight the importance of the changes we are experiencing, and the specific position taken by this key international actor. Within this context, it is natural to finally wonder whether China must be addressed as a competitor, a threat, or a partner. Once again, there is no single answer. It is probably all three. We will most likely have to compete, fear, and work with China all at the same time. The important thing is that we continue to reflect on this vital subject, maximizing the benefits and minimizing the risks of China's leading position. We could not ignore it, even if we wanted to.

One final correction on a previous statement: if the fight against climate change was a race, China would not be "one of the leading runners"; it would most likely be *the* leading runner, and arguably the winner. So, let us make sure this "victory" benefits us all – not only the planet, but every country in it, and overall global stability for that matter. In other words, let us make sure we all win, too.

9. REFERENCES

Alami, I., Dixon, A. D., De Graaff, N., Gonzalez-Vicente, R., Babic, M., Lee, S., & Melby, I. (2021). Geopolitics and the 'New' State Capitalism. *Geopolitics, 27*(3), 995–1023. https://doi.org/10.1080/14650045.2021.1924943

Ang, Y. Y. (2018, April 16). Autocracy With Chinese Characteristics: Beijing's Behind-the-Scenes Reforms. *Foreign Affairs*. Retrieved April 29, 2023, from https://www.foreignaffairs.com/articles/asia/2018-04-16/autocracy-chinese-characteristics

Bhutada, G. (2021a). Visualizing China's Dominance in Rare Earth Metals. *Elements by Visual Capitalist*. https://elements.visualcapitalist.com/chinas-dominance-in-rare-earth-metals/

Bhutada, G. (2021b). Rare Earth Metals Production is No Longer Monopolized by China. *Elements by Visual Capitalist*. https://elements.visualcapitalist.com/rare-earth-metals-production-not-monopolized-china/

Bordoff, J. (2022, November 9). *PS Events: The Energy Revolution – Session Two: Power Politics* [Video]. YouTube. Retrieved April 24, 2023, from https://www.youtube.com/watch?v=l1GSCVgLJlw

Brown, M., & Singh, P. (2018). China's Technology Transfer Strategy: How Chinese Investments in Emerging Technology Enable A Strategic Competitor to Access the Crown Jewels of U.S. Innovation. In *nationalsecurity.gmu.edu*. Defense Innovation Unit Experimental. Retrieved April 29, 2023, from https://nationalsecurity.gmu.edu/wp-content/uploads/2020/02/DIUX-China-Tech-Transfer-Study-Selected-Readings.pdf

Buchholz, K. (2021, April 21). China Dominates All Steps of Solar Panel Production. *Statista Infographics*. Retrieved April 25, 2023, from https://www.statista.com/chart/24687/solar-panel-global-market-shares-by-production-steps/

Center for Strategic and International Studies (CSIS). (2016, February 15). How Is China's Energy Footprint Changing? *csis.org*. Retrieved April 29, 2023, from https://www.csis.org/analysis/how-chinas-energy-footprint-changing

Chang, F. (2022, March 2). *China's Rare Earth Metals Consolidation and Market Power - Foreign Policy Research Institute*. Foreign Policy Research Institute. Retrieved April 25, 2023, from https://www.fpri.org/article/2022/03/chinas-rare-earth-metals-consolidation-and-market-power/

Chiu, D. (2017). The East Is Green: China's Global Leadership in Renewable Energy. In *Csis.org* (New Perspectives on Foreign Policy, Issue 13, Summer 2017). Center for Strategic and International Studies. Retrieved April 29, 2023, from https://csis-website-prod.s3.amazonaws.com/s3fs-public/171011_chiu_china_Solar.pdf?i70f0uep_pGOS3iWhvwUlBNigJMcYJvX

Church, C., & Crawford, A. (2018). Green Conflict Minerals: The fuels of conflict in the transition to a low-carbon economy. *International Institute for Sustainable Development*. https://www.iisd.org/publications/report/green-conflict-minerals-fuels-conflict-transition-low-carbon-economy

Conte, N. (2022, August 30). *Visualizing China's Dominance in the Solar Panel Supply Chain*. Visual Capitalist. Retrieved April 25, 2023, from https://www.visualcapitalist.com/visualizing-chinas-dominance-in-the-solar-panel-supply-chain/

Cooper, B. (2021, April 1). *China's 14th Five-Year Plan (2021-2025) Report*. Hill+Knowlton Strategies. Retrieved April 29, 2023, from https://www.hkstrategies.com/en/chinas-14th-five-year-plan-2021-2025-report/

Corr, A. (2016, March 16). The Tipping Point Of China's Authoritarian Capitalism. *Forbes*. Retrieved April 29, 2023, from https://www.forbes.com/sites/anderscorr/2016/03/16/the-tipping-point-of-chinas-authoritarian-capitalism/

Crow, A. A., & Saran, S. (2021, December 13). The Geopolitics of Energy Transition: A Guide for Policymakers, Executives, and Investors. *ORF*. Retrieved April 23, 2023, from https://www.orfonline.org/research/the-geopolitics-of-energy-transition/

Davidson, H., & Graham-Harrison, E. (2022, October 16). Xi Jinping's vision for China's next five years: key takeaways from his speech. *The Guardian*. Retrieved April 29, 2023, from https://www.theguardian.com/world/2022/oct/16/xi-jinping-vision-china-next-five-years-key-takeaways-from-speech

Desjardins, J. (2018, May 15). *Copper: Driving the Green Energy Revolution*. Visual Capitalist. Retrieved April 25, 2023, from https://www.visualcapitalist.com/copper-driving-green-energy-revolution/

Erbach, G., & Jochheim, U. (2022). China's climate change policies State of play ahead of COP27. In *europarl.europa.eu*. European Parliamentary Research Service. Retrieved April 29, 2023, from https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/738186/EPRS_BRI(2022)738186_EN.pdf

European Parliament. (2019, October 3). *What is carbon neutrality and how can it be achieved by 2050? | News | European Parliament*. Retrieved April 29, 2023, from

https://www.europarl.europa.eu/news/en/headlines/society/20190926STO62270/what-is-carbon-neutrality-and-how-can-it-be-achieved-by-2050

Fares, R. (2015, March 11). *Renewable Energy Intermittency Explained: Challenges, Solutions, and Opportunities*. Scientific American Blog Network. Retrieved April 29, 2023, from https://blogs.scientificamerican.com/plugged-in/renewable-energy-intermittency-explained-challenges-solutions-and-opportunities/

Finley, M. (2020, June 19). Shock Finding? China Is The World's Biggest Energy Producer. *Forbes*. Retrieved April 25, 2023, from https://www.forbes.com/sites/thebakersinstitute/2020/06/19/todays-quiz-who-is-the-worlds-largest-energy-producer/

Forecasting the Geopolitics of Renewable Energy. (n.d.). Stratfor. https://worldview.stratfor.com/article/how-renewable-energy-will-change-geopolitics

Frankenfield, J. (2022, December 5). *Forced Technology Transfer (FTT)*. Investopedia.com. Retrieved April 29, 2023, from https://www.investopedia.com/forced-technology-transfer-ftt-4687680

Freeman, D. P. (2018). China and Renewables: The Priority of Economics over Geopolitics. In *Lecture notes in energy* (pp. 187–201). Springer International Publishing. https://doi.org/10.1007/978-3-319-67855-9_7

Friedman Lissner, R. (2018). What Is Grand Strategy? Sweeping a Conceptual Minefield. *Texas National Security Review*, *2*(1). https://repositories.lib.utexas.edu/bitstream/handle/2152/73735/TNSR_Vol_2_Issue_1_Lissner.pdf?sequence=2&isAllowed=y

García-Herrero, A., & Ng, G. (2021, March 24). *China's State-Owned Enterprises and Competitive Neutrality*. Retrieved April 29, 2023, from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3793470

Gardiner, B. (2017, May 12). Three Reasons to Believe in China's Renewable Energy Boom. *Science*. Retrieved April 25, 2023, from https://www.nationalgeographic.com/science/article/china-renewables-energy-climate-change-pollution-environment

Gomart, T. (2021). *Guerres invisibles: Nos prochains défis géopolitiques* (2nd ed.). Éditions Tallandier.

Hache, E. (2018). Do renewable energies improve energy security in the long run? *International Economics, 156,* 127–135. https://doi.org/10.1016/j.inteco.2018.01.005

Hafner, M., & Tagliapetra, S. (2020). *The Global Energy Transition: A Review of the Existing Literature*. Retrieved April 29, 2023, from https://www.semanticscholar.org/paper/The-Global-Energy-Transition%3A-A-Review-of-the-Hafner-Tagliapietra/d61bb37355559ef423b55490be7fea10b904f457

Harvey, F., & Carrington, D. (2022, November 7). World is on 'highway to climate hell', UN chief warns at Cop27 summit. *The Guardian*. Retrieved April 24, 2023, from https://www.theguardian.com/environment/2022/nov/07/cop27-climate-summit-un-secretary-general-antonio-guterres

Holden, J., Yao, S., & Li, Y. (2022, November 2). *China – Mining by the numbers, 2022*. S&P Global Market Intelligence. Retrieved April 29, 2023, from https://www.spglobal.com/marketintelligence/en/news-insights/research/china-mining-by-the-numbers-2022

Holzmann, A., & Grünberg, N. (2021, January 7). *"Greening" China: An analysis of Beijing's sustainable development strategies*. Merics. Retrieved April 29, 2023, from https://merics.org/en/report/greening-china-analysis-beijings-sustainable-development-strategies

Horesh, N. (2015, July 20). The West is blind to the appeal of China's model of authoritarian capitalism. *Business Insider*. Retrieved April 29, 2023, from https://www.businessinsider.com/the-west-is-blind-to-the-appeal-of-chinas-model-of-authoritarian-capitalism-2015-7

Hung, S. Y. (Elsie). (2022, April 26). Coal To Power China's Energy Transition. *Forbes*. Retrieved April 29, 2023, from https://www.forbes.com/sites/thebakersinstitute/2022/04/26/coal-to-power-chinas-energy-transition/

Illiberal capitalism. (2008, January 22). *Financial Times*. Retrieved April 24, 2023, from https://www.ft.com/content/f820a134-c509-11dc-811a-0000779fd2ac

International Energy Agency (IEA). (2000, April). *China's Worldwide Quest for Energy Security – Analysis - IEA*. IEA. Retrieved April 29, 2023, from https://www.iea.org/reports/chinas-worldwide-quest-for-energy-security

International Energy Agency (IEA). (2021, June 30). *Hydropower has a crucial role in accelerating clean energy transitions to achieve countries' climate ambitions securely* [Press release]. https://www.iea.org/news/hydropower-has-a-crucial-role-in-accelerating-clean-energy-transitions-to-achieve-countries-climate-ambitions-securely

IRENA. (2019). Global energy transformation: A roadmap to 2050. In *Irena.org*. International Renewable Energy Agency. Retrieved April 29, 2023, from

https://www.irena.org/publications/2019/Apr/Global-energy-transformation-A-roadmap-to-2050-2019Edition

Jigang, W. (2020). China's Industrial Policy: Evolution and Experience. In *Unctad.org*. United Nations Conference on Trade and Development. Retrieved April 29, 2023, from https://unctad.org/system/files/official-document/BRI-Project_RP11_en.pdf

Johansson, B. (2013). Security aspects of future renewable energy systems–A short overview. *Energy*, *61*, 598–605. https://doi.org/10.1016/j.energy.2013.09.023

Kaja, A., Stein, S., & Xiang, T. (2021, April 6). *China's 14th Five-Year Plan (2021-2025): Signposts for Doing Business in China | Global Policy Watch*. Global Policy Watch. Retrieved April 29, 2023, from https://www.globalpolicywatch.com/2021/04/chinas-14th-five-year-plan-2021-2025-signposts-for-doing-business-in-china/

Kennedy, S. (2015, June 17). Made in China 2025. *CSIS.org*. Retrieved April 29, 2023, from https://www.csis.org/analysis/made-china-2025

Khoei, T. T., Slimane, H. O., & Kaabouch, N. (2022). Cyber-Security of Smart Grids: Attacks, Detection, Countermeasure Techniques, and Future Directions. *Communications and Network*, *14*(04), 119–170. https://doi.org/10.4236/cn.2022.144009

Kinderman, D. (2021). Authoritarian Capitalism and Its Impact on Business. In *Proceedings on Symposium on Authoritarianism and Governance*. https://doi.org/10.47816/02.001.23

Lazard, O. (2022). *The blind spots of the green energy transition* [Video]. TED Talks. Retrieved April 25, 2023, from https://www.ted.com/talks/olivia_lazard_the_blind_spots_of_the_green_energy_transition

Legarda, H. (2021, June 15). *China's new international paradigm: security first*. Merics. Retrieved April 29, 2023, from https://merics.org/en/chinas-new-international-paradigm-security-first

Lissner, R. F. (2018). *What Is Grand Strategy? Sweeping a Conceptual Minefield (November 2018)*. Retrieved April 24, 2023, from https://repositories.lib.utexas.edu/handle/2152/73735

Mabuni, B. (2023, March 15). Breaking China's rare earths monopoly. *Asia Times*. Retrieved April 29, 2023, from https://asiatimes.com/2023/03/breaking-chinas-rare-earths-monopoly/

Mallapaty, S. (2021). China creates vast research infrastructure to support ambitious climate goals. *Nature*, *600*(7887), 19–20. https://doi.org/10.1038/d41586-021-03491-6

Meidan, M. (2021). China's emergence as a powerful player in the old and new geopolitics of energy. In *The geopolitics of energy: out with the old, in with the new? Vol. Issue 126* (pp. 12–15). Oxford Institute for Energy Studies. https://www.oxfordenergy.org/wpcms/wp-content/uploads/2021/02/OEF-126.pdf

Mitter, R., & Johnson, E. (2021, May). *What the West Gets Wrong About China*. Harvard Business Review. Retrieved April 29, 2023, from https://hbr.org/2021/05/what-the-west-gets-wrong-about-china

Moore, S., & Melton, M. (2019, April 2). *China's Pivot on Climate Change and National Security*. Lawfare. Retrieved April 29, 2023, from https://www.lawfareblog.com/chinas-pivot-climate-change-and-national-security

Morse, E. (n.d.). *Non-Renewable Energy* (J. Shea, Ed.). Retrieved April 24, 2023, from https://education.nationalgeographic.org/resource/non-renewable-energy/

Moses, M. (2017, December 21). Types and alternative sources of renewable energy. *EDF*. Retrieved April 24, 2023, from https://www.edfenergy.com/energywise/low-carbon-energy

Olano, M. V. (2022, June 24). Chart: China dominates production of minerals needed for clean energy. *Canary Media*. Retrieved April 25, 2023, from https://www.canarymedia.com/articles/clean-energy/chart-china-dominates-production-of-minerals-needed-for-clean-energy

O'Sullivan, M. L., Overland, I., & Sandalow, D. (2017). The Geopolitics of Renewable Energy. *Social Science Research Network*, HKS Working Paper No. RWP17-027. https://doi.org/10.2139/ssrn.2998305

Overland, I. (2015). Future Petroleum Geopolitics: Consequences of Climate Policy and Unconventional Oil and Gas. *Handbook of Clean Energy Systems*, 1–29. https://doi.org/10.1002/9781118991978.hces203

Pitron, G. (2020). *The Rare Metals War: the dark side of clean energy and digital technologies* (B. Jacobsohn, Trans.). Scribe Publications.

Planète Energies. (n.d.). *What Is the Energy Mix?* Retrieved April 24, 2023, from https://www.planete-energies.com/en/media/article/what-energy-mix

Ritchie, H., Roser, M., & Rosado, P. (2022, October 27). *Energy*. Our World in Data. Retrieved April 25, 2023, from https://ourworldindata.org/energy/country/china

Rudd, K. (2022, October 10). The World According to Xi Jinping: What China's Ideologue in Chief Really Believes. *Foreign Affairs*. Retrieved April 29, 2023, from https://www.foreignaffairs.com/china/world-according-xi-jinping-china-ideologue-kevin-rudd

Rumph, M. (2022, August 16). *How Much Power is 1 Gigawatt?* Energy.gov. Retrieved April 29, 2023, from https://www.energy.gov/eere/articles/how-much-power-1-gigawatt

Sallai, D., & Schnyder, G. (2020). What Is "Authoritarian" About Authoritarian Capitalism? The Dual Erosion of the Private–Public Divide in State-Dominated Business Systems. *Business & Society*, *60*(6), 1312–1348. https://doi.org/10.1177/0007650319898475

Sandalow, D. (2020, July). *China's Response to Climate Change: A Study in Contrasts and a Policy at a Crossroads*. Asia Society. Retrieved April 25, 2023, from https://asiasociety.org/policy-institute/chinas-response-climate-change-study-contrasts-and-policy-crossroads

Scholten, D. (2020). *The geopolitics of renewables: New board, new game*. https://www.semanticscholar.org/paper/The-geopolitics-of-renewables%3A-New-board%2C-new-game-Scholten-Bazilian/20cda1b95ee5699486825c238ce20caff0f24e30

Scholten, D., Bazilian, M., Overland, I., & Westphal, K. (2020). The geopolitics of renewables: New board, new game. *Energy Policy*, *138*, 111059. https://doi.org/10.1016/j.enpol.2019.111059

Shepherd, C., & Qiu, S. (2017, October 19). China's Xi lays out vision for "new era" led by "still stronger" Communist Party. *Reuters*. Retrieved April 29, 2023, from https://www.reuters.com/article/us-china-congress-idUSKBN1CM35L

Silove, N. (2017). Beyond the Buzzword: The Three Meanings of "Grand Strategy." *Security Studies*, *27*(1), 27–57. https://doi.org/10.1080/09636412.2017.1360073

Sircar, S. (2021, July 29). Geopolitics of global climate change: Aspects of a Chinese leadership. *ORF*. Retrieved April 29, 2023, from https://www.orfonline.org/expert-speak/geopolitics-of-global-climate-change/

Stegen, K. S. (2015). Heavy rare earths, permanent magnets, and renewable energies: An imminent crisis. *Energy Policy*, *79*, 1–8. https://doi.org/10.1016/j.enpol.2014.12.015

Swanson, A. (2015, March 24). How China used more cement in 3 years than the U.S. did in the entire 20th Century. *Washington Post*. Retrieved April 29, 2023, from https://www.washingtonpost.com/news/wonk/wp/2015/03/24/how-china-used-more-cement-in-3-years-than-the-u-s-did-in-the-entire-20th-century/

Tan, H. (2015, October 1). *What is driving China's investment in renewables?* World Economic Forum. Retrieved April 29, 2023, from https://www.weforum.org/agenda/2015/10/what-is-driving-chinas-investment-in-renewables/

Tavares, J., & Wacziarg, R. (2001). How democracy affects growth. *European Economic Review*, *45*(8), 1341–1378. https://doi.org/10.1016/s0014-2921(00)00093-3

The Editors of Encyclopaedia Britannica. (2009, March 18). *Five-Year Plans | Definition, Economics, Soviet Union, & Facts*. Encyclopedia Britannica. https://www.britannica.com/topic/Five-Year-Plans

Tooze, A. (2020, September 25). Xi Just Radically Changed the Fight Against Climate Change. *Foreign Policy*. Retrieved April 29, 2023, from https://foreignpolicy.com/2020/09/25/xi-china-climate-change-saved-the-world%E2%80%A8/

Turin, D. R. (2010). The Beijing Consensus: China's Alternative Development Model. *Inquiries Journal*, *2*(1). http://www.inquiriesjournal.com/articles/134/the-beijing-consensus-chinas-alternative-development-model

Valchev, I. (2021, April 10). *China's 2049 plan a big challenge before the world*. South Asia Monitor. Retrieved April 29, 2023, from https://www.southasiamonitor.org/china-watch/chinas-2049-plan-big-challenge-world

Valkukchuk, R., Overland, I., & Scholten, D. (2020). Renewable Energy and Geopolitics: A Review. *Renewable and Sustainable Energy Reviews, 122*, 109547. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3565990

Venditti, B. (2021). Visualizing China's Evolving Energy Mix. *Elements by Visual Capitalist*. https://elements.visualcapitalist.com/visualizing-chinas-energy-transition/

Vetter, D. (2022, January 26). China Built More Offshore Wind In 2021 Than Every Other Country Built In 5 Years. *Forbes*. https://www.forbes.com/sites/davidrvetter/2022/01/26/china-built-more-offshore-wind-in-2021-than-every-other-country-built-in-5-years/

Webster, J., & Tobin, W. (2022, November 1). *China's energy security realities and COP27 ambitions*. Atlanticcouncil.org. Retrieved April 29, 2023, from https://www.atlanticcouncil.org/blogs/energysource/chinas-energy-security-realities-and-cop27-ambitions/

Wood, J. (2021, November 15). *Batteries are a key part of the energy transition. Here's why*. World Economic Forum. Retrieved April 24, 2023, from https://www.weforum.org/agenda/2021/09/batteries-lithium-ion-energy-storage-circular-economy/

World Bank Group. (2022). What You Need to Know About Climate Change and Air Pollution. *World Bank*. https://www.worldbank.org/en/news/feature/2022/09/01/what-you-need-to-know-about-climate-change-and-air-pollution

Yifan, J., Baiyu, G., & Geall, S. (2022, June 23). China's Five Year Plan for energy: One eye on security today, one on a low-carbon future. *China Dialogue*. Retrieved April 29, 2023,

from https://chinadialogue.net/en/climate/chinas-five-year-plan-for-energy-one-eye-on-security-today-one-on-a-low-carbon-future/

Zhang, K. (2021). Bringing the Economy Back In Economic Development and China's Grand Strategy. *Journal of Indo-pacific Affairs*. https://media.defense.gov/2022/Jan/05/2002917948/-1/-1/1/JIPA%20-%20ZHANG%20-%20JAN%2022.PDF

10.APPENDICES/NOTES

STATE OF THE ART: GEOPOLITICS OF THE ENERGY TRANSITION

1. **Disastrous consequences of climate change** include the melting of the ice caps and the rising of global water levels, extreme weather events, droughts and desertification, ocean acidification, declining biodiversity, and so forth. Most of these consequences are related in one way or another to other characteristics of the energy system aside from burning fossil fuels, that entail an unsustainable model of economic growth. Climate change has already proven to be a disrupting force for human and animal security, as seen for example in more destructive and deadly floods, drought-related famine or mass migrations. Most experts agree that the current energy model will not only exacerbate the security risks for human beings or countries but will endanger planetary security.

2. **Within the debate on new interdependencies,** one side remarks the potential for electricity cut-offs as a geopolitical weapon, and the other points out how rerouting, decentralization and regionalization of energy systems make that scenario largely improbable, or at least more rare than other types of energy embargoes. In the end, the authors suggest that the predictions of different camps are hard to reconcile since they rest on divergent underlying assumptions about the evolution of the transition and geopolitics in general (Valkukchuk et Al, 2020). Additionally, it should be mentioned that **cyberattacks are not unique to future energy infrastructure, such as smart grids**, but rather it includes everything that is digitalized. There is not something intrinsic to the energy transition or renewable energy infrastructure that makes it more prone for cyberattacks (Valkukchuk et Al, 2020), even though the consequences of attacking energy infrastructure can at times be more serious than other types of infrastructure, given its transversal nature.

3. **Some authors think the distinction between winners and losers is less clear-cut**. For example, O'Sullivan et Al (2017), imply that fossil fuel importers lose along exporters. They found in a quantitative study that China and the US will lose more geopolitically precisely because of their excessive dependence on fossil fuels. The idea that seems to be behind is that the more of your system that you have to change or to transform, the more costly the energy transition is for you.

4. This report was born out of a joint effort between the German Federal Office, the Ministry of Foreign Affairs of Norway and the IRENA, who supported a great international initiative during the period between 2016-2017, creating the Global Commission of the Geopolitics of Energy Transformation under IRENA in 2018, charged with creating a report on the topic. The commission counted with some of the most prominent academics and renowned energy experts, giving the report an important level of credibility. It was published in 2019, and it sparked an even greater interest in the field, which has received an even greater attention in very recent years (Valkukchuk et al., 2019).

5. **Even if supply cuts on critical minerals** (used in some renewable energy technologies such as solar panels and wind turbines) could be compared to oil embargoes, for instance, this might not be an accurate analogy, since some minerals can be recycled, new alternatives for them can be found, or they might have to be imported only once, for example (Scholten et Al, 2020). How new energy risks assimilate or differ from traditional ones will be explained further in the discussion.

6. **The reason why Scholten et Al (2020) are relatively skeptical** of the perhaps exaggerated focus on raw materials (critical minerals), is that they remark how many of these materials can potentially be recycled, how new substitute materials might be developed, how new deposits might be found, and how, in contrast to fossil fuels that demand periodic and limited consumption, these materials could arguably have to be imported only "once" for the initial renewable energy infrastructure. This is also remarked in the IRENA (2019) report, but Scholten et Al (2020) explore it in more detail.

ANALYSIS AND DISCUSSION

THE ENDS

1. **This is a huge problem for the energy transition, in general**. The reality is that renewable energies require an important amount of minerals whose extraction from the ground is "anything but clean" (Pitron, 2020. Pg. 52.) Mining, as currently practiced, is an inherently dirty operation, making this industry the second most polluting in the world (Pitron 2020, pg. 33). This is part of the reason why many Western countries, while claiming environmental values, have practically "de-localised" pollution to China and

other poor countries "willing to sacrifice their environment for financial gain" (Pitron, 2020, pg 59.).

2. **In October 2021, the Chinese central government released two documents** that for the first time laid out how China may achieve the biggest goals it set in 2019 – achieving net zero by 2060 and getting emissions to peak in 2030. These two documents are a "working guidance" to outline a path for researchers, and "a 2030 action plan" to sketch out how to achieve carbon goals. This second document includes a set of technical methods than can be part of the equation to do so: low-carbon technologies such as hydrogen fuel and batteries, and carbon capture and sequestration technologies are included; but also, market-based mechanisms such as carbon taxes and emissions trading schemes; and even modelling techniques that can help industries and local governments when implementing the policies (Mallapatty, 2021).
3. **It is also the first time the outline for energy policy** (furtherly developed in an attached document to the general FYP) is referred to as [the plan towards a] "modern energy system" instead of "energy development plans". This may reflect a change in thinking, aiming at a system that can adapt to current challenges, such as the energy transition (Yifan et Al, 2022).
4. Within the line of thinking that **China falls short of what is needed to reach its targets**, experts point out, for example, that the country has not yet set any absolute target on emissions, which is key to limit the amount of carbon dioxide we can expect it to produce. Other experts consider that "*what China should do is not what China can deliver"* (Mallapatty, 2021 p.20) saying that even if its goals are not as ambitious as what would be needed, they are realistic. What seems clear is that China's pledges have global ramifications, leading some researchers to declare that "*when China moves a little to the left or to the right, up or down, the whole world feels it* (Mallapatty, 2021 p.20).

THE MEANS

1. In conferences on rare earths all over the world**, the question around China's manipulation of rare earth prices always came up.** The day after 2010 embargo, rare earth prices hit sky-rocketing levels before taking a nosedive, with no apparent economic logic, given that supply and demand had remained unchanged. Several experts expressed

their conviction and anger at the prospect of Beijing's price manipulation: "The Chinese do absolutely whatever they want on the rare-earths market (…)". It created the impression that they could decide to stockpile just as easily as they [could] decide to slash prices for no apparent reason, giving non-Chinese mining companies a headache when trying to plan a long-term strategy: "How can they escape bankruptcy when mineral prices are five to ten times lower than forecasted?" (Pitron, 2020, p. 170).

2. It should be mentioned that this does not mean all of China's current technological development is due entirely or completely to foreign expertise or technology. It just means that a great part of the underlying structure has been based on this strategy of acquiring know-how and technology, learning and then creating. This might be a perfectly legitimate objective. Whether the means to achieve it are legitimate is a different discussion.