



Global Lithium Dynamics: Us-China Geopolitical Competition and Its Implications on Energy Security in South Asian Region

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ABSTRACT:

This paper examines the implications of U.S.–China geopolitical competition over lithium resources for energy security, with a focus on South Asia. Home to nearly 25% of the world's population, South Asia is a developing region facing rising energy demands driven by economic growth. Lithium is a critical resource due to its central role in rechargeable batteries used in electric vehicles, smartphones, laptops, and renewable energy storage systems, supporting the global shift from petroleum to clean energy. The lithium-ion battery market has expanded rapidly, becoming one of the fastest-growing raw material markets worldwide. Reflecting its strategic importance, lithium was declared essential to U.S. economic and national security in 2018, and to the European Union's industrial strategy in 2020. This shift has intensified U.S.–China competition over lithium production, processing, and supply chains, influencing energy security, trade, and pricing dynamics in South Asia. The paper assesses how this rivalry may shape regional development.

KEYWORDS: Lithium Geopolitics, US-China Competition, Energy Security, South Asia, Renewable Energy.

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1. INTRODUCTION

Since the beginning of human history, energy has been essential for humanity. The overall demand for energy has grown because of population growth and modernization. Most countries in South Asia are experiencing serious economic and energy crises, and lithium is crucial for meeting these needs (Ahmed et al., 2016). Figure 1 shows that the share of renewable electricity generation is expected to grow significantly by 2028, with a notable increase in variable renewables such as wind and solar PV, while hydropower remains fairly stable during this period. It underscores the growing importance of sustainable energy sources in combating climate change and ensuring energy security. Keeping in view the importance of this crucial element, the world is moving toward renewables. This shift has heightened US-China geopolitical competition over lithium production and manufacturing, which is also impacting energy security and geopolitical dynamics in South Asia.

Geopolitics is a term surrounded by both the fields of 'geography and politics,' which is a much-debated term among academicians and writers, initially used to refer to the influence of geography on a state's decision-making power in international relations, at first as a deterministic causal relationship between geography and international relations. In general, according to the concept of power and space, geopolitics accentuates the significance of natural resources, supply lines, and strong points.

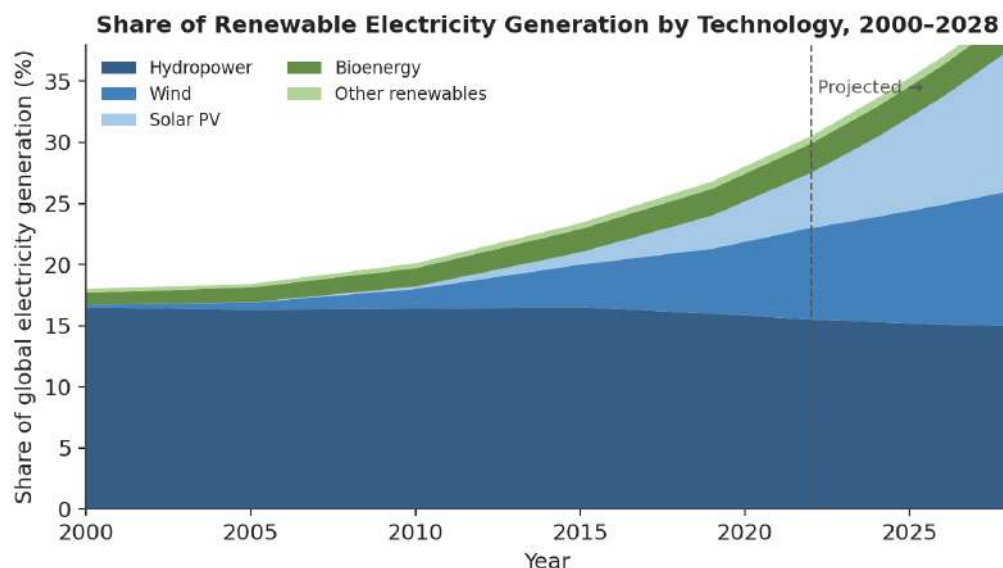


Figure 1: Share of renewable electricity generation by technology, 2000-2028 (IEA, 2023).

The original meaning of the term geopolitics captures the ‘power politics of the state as it relates to geographic space and the environment in which it seeks to achieve its goals,’ reflecting a tight fit between national interest, political power, and strategic geopolitical decision-making (Vakulchuk et al., 2020). Politically, there is a growing consensus among American experts that China is not going to transform into a liberal, pluralist, and democratic society through the liberal democratization strategies of the West (Campbell & Ratner, 2018). As China and Russia have gradually shifted toward exerting their power to advance interests and spread values Washington considers offensive, experts argue that the United States has entered a “new epoch of East-West competition” (Allison, 2020). As a result, Washington policymakers and experts have reached a new consensus regarding China: strategic competition is preferable to cooperation (Shen & Zeng, 2022). There is no doubt that global competition between great powers has returned, and this new round of contest is beginning with unmatched vulnerability. The rivalry between China and the US has increasingly stretched beyond trade to encompass the security of state-of-the-art technologies, regional plans, and two competing development models based on differing norms. Geopolitics and energy are becoming increasingly intertwined, making geo-economics the fundamental arena of great power competition. In addition, the divergent social norms and political systems of the two nations are becoming increasingly apparent, and energy has been extensively politicized as a significant part of great power competition.

Conflict is a contest between people who have opposing wants, ideas, views, values, or ambitions. Although the concepts of competition and conflict are somewhat similar, conflict is not the same as competition; competition includes, regardless of some conflict, a level of normal points, interests, and arrangements within a structure with rules or standards (Mnookin et al., 2004). Competition is a behavior that aims to limit the benefits accessible to others, and in a time of growing global competition, political, economic, and military rivalry are all on the rise (Milner, 1992). This is one of the most challenging, important, and evident facets of the strategic rivalry between the US and China (Center & Bates, 2019).

Compared to the twentieth century, the dynamics and features of this new competition, especially between China and the United States, will be very different. In the past, there was more cooperation and interaction because the economies of the two nations were intertwined (Mattis, 2018). A decline in the long-standing rules-based international order and the rapid separation of the two economies characterize the current era. There are significant ramifications for regional security in South Asia, a region with rapidly increasing energy demands and a desire for improved energy security, since this is not just a contest of economic stakes but a geopolitical maneuver to gain control over strategic commodity supply chains (Pradhan, 2022). Because China and the United States are increasingly determined to gain access to and control over the region's lithium, South Asian nations including Bangladesh, Nepal, India, and Pakistan have emerged as focal points of geopolitical competition (U.S. Geological Survey, 2017).

The world's energy, economic, human capital, and technological dynamics are shifting from unipolar to multipolar. All of these are essential components for using military and economic influence to reshape global affairs. The rush of global powers to secure a heavily populated, resource-rich, and human-capital-rich region such as South Asia is an extension of their broader power projection. This article is aimed at identifying the effect of China US competition in the South Asian region on lithium. It aims at understanding the potential impact of this competition on the energy development of South Asia and its innovation hub and its implications for financial development in the region. The paper also looks at the potential impacts of the new investments by both China and the U.S. on the local physical infrastructure and economy of South Asia in a context of economic opportunities and threats. In addition,

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the paper examines the conflict that comes from this competition and how this competition can put the region's countries on a policy tightrope.

2. PROBLEM STATEMENT

As South Asia increasingly relies on lithium energy, especially from China, and the region's processing capabilities are limited, the region's lithium batteries are beginning to create strategic dependence, which could compromise their economic and political security given the strength of Chinese lithium supply chains. The South Asian nations will have to figure out how to develop economically without relying heavily on outside powers, as the U.S. and China battle it out for ownership of the key minerals. This dependence is analyzed with regards to the consequences of this dependence using geo-economic and dependency theories, showing the threats and opportunities of South Asia in the new global lithium market.

3. RESEARCH OBJECTIVE

This study aims to find out the impacts of South Asian competition over lithium between China and the USA. It also seeks to identify the potential implications of this competition for the development of South Asia as an energy hub, innovation hub and also for financial development in the region.

4. RESEARCH QUESTIONS

- (i) What is the impact of competition between the USA and China with regards to lithium resources on the geopolitical situation and energy supply chain in the South Asian region?
- (ii) What are the implications of South Asian's dependence on lithium imports from the U.S. or China for its economic and development goals?
- (iii) What role does this competition drive in terms of policy changes/shifts in South Asian countries in the interest of wider geopolitical goals?

5. THEORETICAL FRAMEWORK

The lithium race between China and the United States has major implications for the energy security and economic development of South Asia. This is a paper which seeks to examine this complex geopolitical situation, with the following theories being applied as a basis: Geo-Economic Theory and Dependency Theory. These theories offer understanding of the ways in which world powers use economic means to secure strategic superiority and how developing countries become economically subservient to States controlling resources. The theories employed in this study use a holistic approach to understanding how U.S. and Chinese strategic interests affect South Asia's participation in the lithium supply chain.

5.1 *Geo-Economic Theory*

Geo-Economic Theory holds that the use of economic instruments as tools of state power is growing as an alternative to traditional military supremacy. According to the theory, states leverage trade, investment, technology, and financial systems to fulfil their geopolitical goals. In the context of modern conflict, Edward Luttwak (1990) introduced the concept of geo-economics as “the logic of war carried out through other means,” in which economic power functions as a strategic weapon in conflict.

5.2 *Application of Geo-Economic Theory in the South Asian Context*

The United States and China are competing in an economic battle over lithium, which is essential for renewable energy and high-tech sectors. The Belt and Road Initiative (BRI), initiated by China, represents a strategic investment in the South Asian energy sector, and the US is responding by encouraging trade and security alliances. Chinese investment in the infrastructure of lithium-rich regions (e.g., Afghanistan and Pakistan) stands in contrast to U.S. attempts to control lithium supply chains by limiting the transfer of technology and trade. South Asian countries remain technologically reliant on U.S. and Chinese companies for the production of lithium batteries and cannot yet exploit their lithium reserves independently.

5.3 *Dependency Theory*

Dependency Theory describes how economic dependency contributes to underdevelopment in poorer Global South countries. According to the theory, developing countries are locked into an unequal pattern of economic exchange in which they supply raw materials to industrialized countries and receive high-value goods in return, which prevents these countries from developing their own industries and achieving economic independence.

5.4 *Application of Dependency Theory in the South Asian Context*

Economic dependence is increasing as countries in South Asia, particularly Afghanistan, India and Pakistan, purchase raw lithium from other nations and purchase lithium-ion batteries from China and the US. Investments from China (BRI) and the US have economic benefits, but typically come with strings attached to benefit the investor over the host country. The development of lithium-

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processing industries in the South Asian states is challenging, as they have no lithium mining and production capability, which leaves them vulnerable to lithium prices set by the outside world and geopolitical skirmishes between China and the USA.

5.5 Integration of Theories

In terms of economic power, Dependency Theory suggests that South Asian states are structurally dependent on foreign technology, investment and trade, and hence are incapable of exploiting their lithium resources on their own while Geo-Economic Theory explains the mechanism by which China and the US are able to assert their economic power by means of trade policies, infrastructure projects and investment. This paper, based on these theories, evaluates the effect of the foreign competition for lithium on the energy security and economic self-reliance of South Asia and the stability of the region.

6. REVIEW OF LITERATURE

South Asian nations, such as India, Pakistan, Bangladesh, Nepal and Sri Lanka, are emerging as major focus points of geopolitical concern, particularly in the context of China and America's regional competition. The competition has consequences for energy security in the region, particularly in relation to the demand for lithium, a key mineral in EVs and other energy storage devices. The lithium industry is global, with a complex production, processing and utilization framework, with certain regions having a higher share. Eighty percent of the lithium mined is in South America, primarily in Chile, Argentina and Bolivia; and most lithium-ion batteries are produced in Asia, particularly China, Japan and South Korea (Dorn & Peyré, 2020). This means there will be a demand for the transportation of lithium, which is typically done in large quantities and across international borders, to the point of use (Lipman & Maier, 2021). The increasing demand for lithium, most sought after for electric vehicle production, has made the mineral more strategically sensitive; China, for instance, has been very keen on acquiring lithium both domestically and in other parts of the globe (Dorn & Peyré, 2020). As EV demand and lithium-ion batteries (LIBS) continue to grow, the global lithium supply chain is becoming more competitive (Egbue & Long, 2012). The most important products of current international market are lithium hydroxides, lithium-ion batteries, and lithium carbonates, which are produced by Korea, Japan, and USA (Sun et al., 2021). Supply is stretched, and modelling indicates there may be difficulties in the supply chain to satisfy projected levels of demand growth. The key determining factors for EV production are associated with carbonate-based lithium sources, hard-rock lithium sources and general battery production (Calisaya-Azpilcueta et al., 2020). The use and trade of lithium products are extensive, and the U.S., China, European Union, Chile and Australia are all significant, major players in the field of production. It is worth noting that, in some countries, where lithium is a critical import, it is necessary to develop strategies such as forming domestic reserves for lithium recovery in the form of recycling (Sun et al., 2021). The world's largest lithium-ion battery producer, China, has invested heavily in developing its own lithium supply chain, such as investing in lithium mining projects in South America where there is a large share of global lithium reserves (Dyatkin et al., 2020). China is also becoming a major player in lithium (Lipman & Maier, 2021) processing and refinement, with over 70% of the world's lithium-cell manufacturing capacity (Dyatkin et al., 2020). Lately, demand for lithium has grown significantly due to the introduction of other clean storage and renewable energy technologies in the power and transport sectors, stimulated by international agreements like the Paris Agreement, the Kyoto Protocol, and the UN Sustainable Development Goals. In 2019, over 60% of lithium production was used for electric vehicles and energy storage systems, which require lithium-ion batteries. The global lithium market has been estimated at around USD 213 billion in that year and is expected to rise by 20 to 25% until 2025. The strategic value of the resource is of paramount importance as it plays a crucial role in supporting adaptation to environmental changes, climatic stress and the scarcity of fossil fuels and is used in different disciplines (Elsheikh et al., 2019). The current distribution of lithium deposits is highly uneven and with major deposits in Australia and South America, there is considerable competition between China and the United States (Chaubey et al., 2021). There is expected to be a higher demand for lithium than for other major minerals with the growth of clean energy technologies, particularly in the transportation sector as it moves towards electrification (Petavratzi & Josso, 2021). The geopolitics of lithium is a subject that has recently caught the interest of various aspects, but one could question whether lithium has the potential to become even more geopolitically relevant in the future or not (Egbue & Long 2012). If lithium is going to be produced in a particular region, then the consumer countries need to either become self-sufficient in lithium or develop interdependence to ensure access to this valuable material. Lithium is seen as an important strategic mineral in this argument, since most of the known lithium reserves are found in South America or Australia, where there are no vertically integrated supply chains (Kalantzakos, 2020). Lithium is essential for making rechargeable batteries, and China, the world's biggest consumer of lithium, has been trying to buy lithium resources around the world, such as in South America and Australia (Graham et al., 2021). This has led to fears that China's dominance in the lithium market gives it significant leverage over the energy future of the South Asian nations as they increasingly rely on lithium-ion batteries for renewable energy and electric vehicles. However, as of late, the global demand for lithium has exacerbated the geopolitical contest between China and the United States given its importance in rechargeable battery manufacturing (Altiparmak, 2023). World Bank estimates suggest that lithium demand is projected to be up to 5x 2018 production by 2050 (Crawford, 2021).

Figure 2 illustrates how lithium use is distributed among various applications. Battery production, mainly lithium batteries necessary for electric cars and renewable energy storage, uses a significant 65% of lithium. With 18% of the market, ceramics and glass form

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the second-largest category, using lithium to improve material qualities. Smaller shares are allocated to continuous casting mold flux powders and polymer synthesis (3%) and lubricating greases (5%). Usage is low for air treatment (1%) and other miscellaneous applications (5%). This distribution emphasizes the significance of lithium in contemporary technologies, particularly energy storage systems.

Distribution of Global End-Use Markets of Lithium

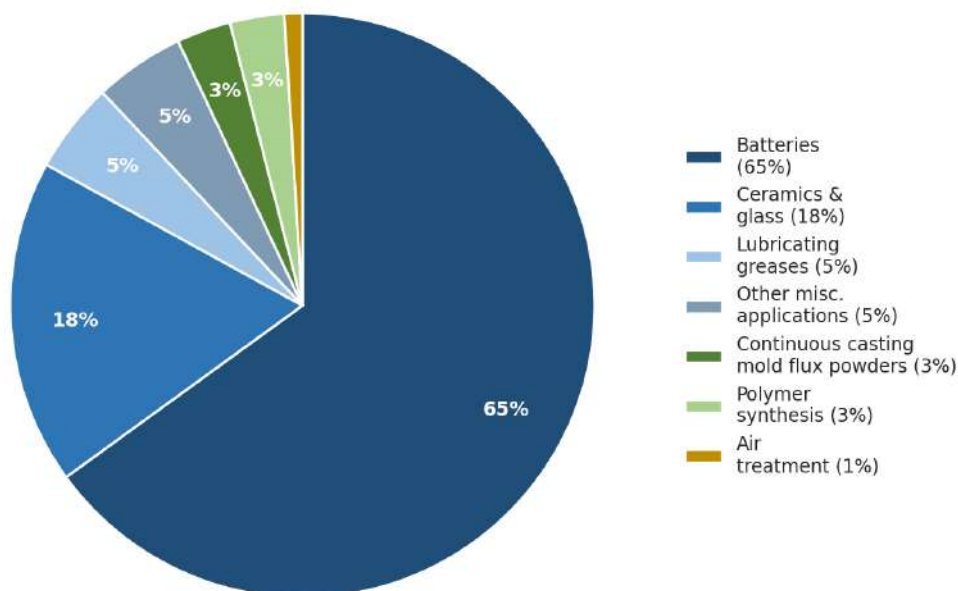


Figure 2: Distribution of global end-use markets of lithium (Sun et al., 2022).

Although lithium geopolitics has been extensively discussed in the literature, a major gap in knowledge remains regarding the geo-economic and geopolitical impacts of the lithium rivalry between China and the USA, especially in South Asia. Although studies have widely examined China's lead in refining lithium and U.S. countermeasures, little has been done to establish how this rivalry has influenced the energy security of South Asia. The region is quite reliant on imported energy, but the potential of lithium in reducing this reliance and supporting the energy transition has not been well studied. Besides, most available analyses emphasize power politics and resource rivalry without applying geo-economic and dependency theory, which could offer better insight into how patterns of lithium trade generate economic dependencies in South Asia — both as sources of vulnerability and as strategic opportunities. Current studies also provide limited insight into South Asia's place within the global lithium supply chain. While attention has been paid to the production and refining of lithium in Australia, South America and China, there have been few studies that look at the role of South Asia as either a consumer, processor or emerging player in this dynamic network. Furthermore, the repercussions of this competition on regional development and the creation of technologies have not been adequately researched. Little is known of whether the South Asian countries, particularly India and Pakistan, will be able to develop and build their own lithium reserves, produce their own batteries and establish electric vehicles industry, or whether they will be increasingly economically dependent on the world's lithium giants. Likewise, there is a lack of empirical evidence of the policy and strategic alliances that South Asian governments have put in place to respond to this evolving geo-economic reality — will the region side by side with the U.S. gain access to new energy trading opportunities under U.S.-China trade agreements, or will it pursue alternative energy trade opportunities? One of the other significant gaps lies in the security implications of a reliance on lithium in South Asia. China is the key player in lithium refining capacity, so the impact of supply-chain risk, economic coercion and vulnerability in the energy transition needs to be explored. If these risks are not properly assessed, then South Asian countries will still be in a tricky situation in the light of growing geopolitical rivalry. This paper is focused on the implications of the U.S.-China lithium competition for the energy security and economic relationship of South Asia through applying geo-economic and dependency theory to provide a comprehensive assessment of the weaknesses and strengths of the South Asian region. This study aims to support the academic community and policy debate on the role of South Asian states in the changing global energy landscape by discussing how they can navigate this competition to achieve economic growth and energy security.

7. IMPORT DEPENDENCY OF SOUTH ASIAN COUNTRIES (2018-2022)

Table 1. Imports of Batteries from China by South Asian Countries in M\$ and K\$ (www.oec.world).

Year	Nepal	Pakistan	India	Maldives	Sri Lanka	Afghanistan	Bangladesh	Bhutan
2022	6.97 M\$	124 M\$	2.08 B\$	2.55 M\$	35.7 M\$	1.05 M\$	89.8 M\$	463 K\$
2021	7.79 M\$	135 M\$	1.26 B\$	1.59 M\$	2.45 M\$	1.14 M\$	122 M\$	36.3 K\$
2020	6.55 M\$	62 M\$	840 M\$	0.659 K\$	2.09 M\$	1.24 M\$	116 M\$	57 K\$
2019	12.4 M\$	74 M\$	903 M\$	808 K\$	1.99 M\$	2.4 M\$	83.6 M\$	285 K\$
2018	8.21 M\$	64 M\$	1.02 B\$	820 K\$	1.63 M\$	3.07 M\$	106 M\$	200 K\$

Table 2. Imports of Batteries from the USA by South Asian Countries in M\$ and K\$ (www.oec.world).

Year	Nepal	Pakistan	India	Maldives	Sri Lanka	Afghanistan	Bangladesh	Bhutan
2022	67.5 K\$	1.11 M\$	19.3 M\$	361 K\$	43.7 K\$	4.61 K\$	0	0
2021	28.1 K\$	439 K\$	17.7 M\$	128 K\$	58.3 K\$	155 K\$	308 K\$	0
2020	37.9 K\$	535 K\$	13.3 M\$	220 K\$	59 K\$	1.88 M\$	0	0
2019	59.9 K\$	984 K\$	13.1 M\$	121 K\$	146 K\$	2.3 M\$	0	0
2018	228 K\$	1.55 M\$	3.75 M\$	131 K\$	134 K\$	3.13 M\$	0	0

The data clearly shows the persistent dominance of China over the USA as a source of battery imports for South Asian countries from 2018–2022, highlighting strong regional import dependency on China. India is the largest importer in both cases, but its imports from China (rising from around \$1.02 billion in 2018 to \$2.08 billion in 2022) dwarf those from the USA, which peak at only \$19.3 million in 2022, showing a massive supply gap. Pakistan, Bangladesh, Sri Lanka, and Nepal follow the same pattern: steady and much higher imports from China compared to relatively small and sometimes inconsistent imports from the USA. Other small economies such as the Maldives, Bhutan, and Afghanistan also rely more on China, with U.S. trade minimal or non-existent in many years. In addition to this trend, China's exports to Pakistan (2021–22) and Sri Lanka (2022) display a significant increase, likely reflecting higher demand for batteries for technological and energy-storage purposes. By comparison, U.S. battery exports are small, with the majority going to India, and sometimes to Pakistan or Afghanistan, though not on a consistent basis, reflecting weaker economic and technological integration in this sector, in which China holds a dominant position.

8. GLOBAL LITHIUM RESOURCES / RESERVES

Table 3. Global lithium resources and reserves (in metric tons) by country (Jaskula, 2021).

Country	Lithium Resources (tons)	Lithium Reserves (tons)
Bolivia	23,000,000	NA
Argentina	22,000,000	1,900,000
United States	NA	1,100,000
Australia	8,700,000	6,200,000
China	6,800,000	3,000,000
Germany	3,800,000	NA
Canada	3,000,000	930,000
Congo	3,000,000	NA
Mexico	1,700,000	NA

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Country	Lithium Resources (tons)	Lithium Reserves (tons)
Czechia	1,300,000	NA
Serbia	1,200,000	NA
Chile	1,100,000	9,300,000
Russia	1,000,000	NA
Peru	1,000,000	NA
Mali	890,000	NA
Brazil	800,000	390,000
Zimbabwe	690,000	310,000
Spain	320,000	NA
Portugal	270,000	60,000
Namibia	230,000	3,600,000
Ghana	200,000	NA
Finland	68,000	NA
Austria	60,000	NA
Kazakhstan	50,000	NA
World total	81,178,000	26,790,000

There is an estimated large reserve of lithium available worldwide that could meet the demand specified in the IEA's sustainable development scenario, and lithium extraction from this reserve would face the same level of challenge as other mineral resources with regard to developing sustainable extraction that does not harm the environment and society. Although the general environmental and social impacts of mining are well understood, the specific environmental and social impacts of scaling up lithium mining are not well understood at the community level, and the geographic concentration of lithium processing in China from hard-rock sources adds to this complexity.

9. EXPECTED WORLDWIDE GROWTH OF LITHIUM EXTRACTION AND PROCESSING

Lithium is an important part of energy storage technologies, including lithium-ion batteries in electric vehicles, renewable energy systems, and portable electronics, and plays a key role in making a country more energy secure. Beyond guaranteeing sufficient and diverse energy resources to meet a nation's energy demands, energy security also requires measures to protect the energy supply from interruption by supply-chain disruptions, geopolitical risks, and other external influences. To reduce vulnerability and ensure the stability of the energy supply, energy security strategies typically involve diversifying energy resources, building redundant energy infrastructure, improving energy efficiency, and developing domestic energy production capabilities. Given these considerations, the demand for lithium is growing globally both to supply national energy needs and to maintain the economy, national security, and welfare of a country or region (Flexer et al., 2018). Currently, China's dominant position in the lithium supply chain poses energy security risks for Europe and North America. Potential solutions include developing more sustainable extraction technologies, improving battery recycling, and exploring alternative battery designs; however, these advancements are unlikely to significantly reduce lithium demand growth before 2030, highlighting the ongoing challenges in balancing sustainability and energy security (Fan et al., 2020).

9.1 Expansion in Lithium Carbonate Demand

By 2020, global demand for lithium, measured in kilotons of lithium carbonate equivalent, was anticipated to reach 429 kt. It is anticipated to grow to more than 2,500 kt if governments implement policies that match the IEA's "sustainable development

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scenario” (Koning et al., 2018). The anticipated rise in demand for lithium carbonate through the end of the decade is depicted in Figure 3. It is anticipated that the global market for plug-in electric vehicles (PEVs) will expand the most; because grid-scale energy storage is not expected to accelerate until after 2030, it has little effect on the 2030 projection.

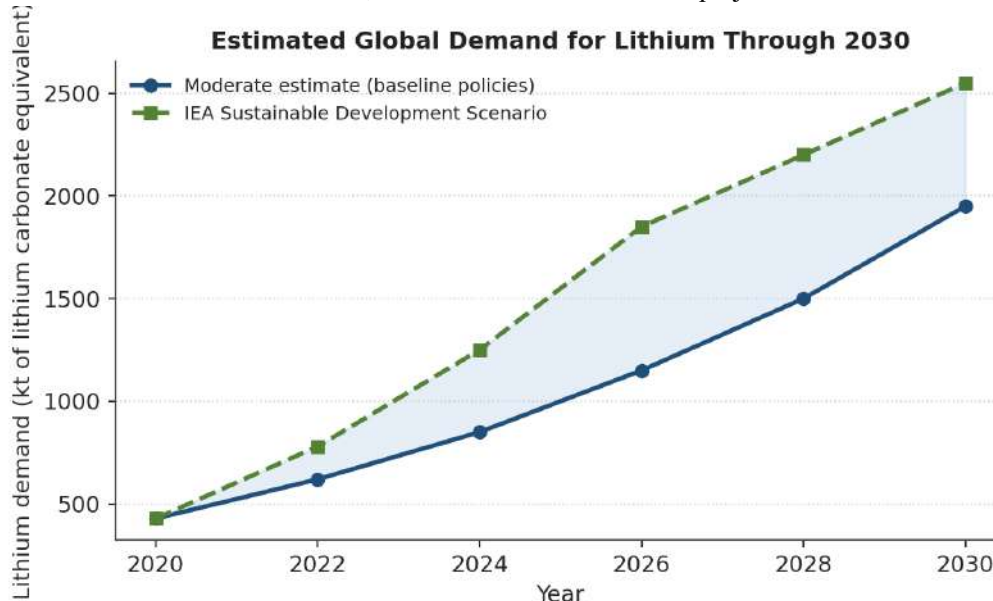


Figure 3: A moderate estimate of the demand for lithium through 2030 in Kt of lithium carbonate equivalent, assuming the IEA's sustainable development scenario is not implemented. Batteries for electric vehicles account for the majority of demand (Gonzales et al., n.d.).

9.2 Average Price of Lithium Carbonate, 2010–2023

The record price for battery-grade lithium carbonate in 2022 was \$37,000 per metric ton. The substantial price hike indicates the surge in demand for lithium carbonate and its relevance in multiple industries, including EV batteries and renewable energy storage solutions. The line chart in Figure 4 illustrates the price of lithium carbonate over the last 12 years, with a notable increase in price the last few years, especially in 2022. The price has increased substantially from 2019 to 2022 as well, and is a clear indicator of the increasing relevance of this commodity, and the challenges of lithium's energy security and technological market.

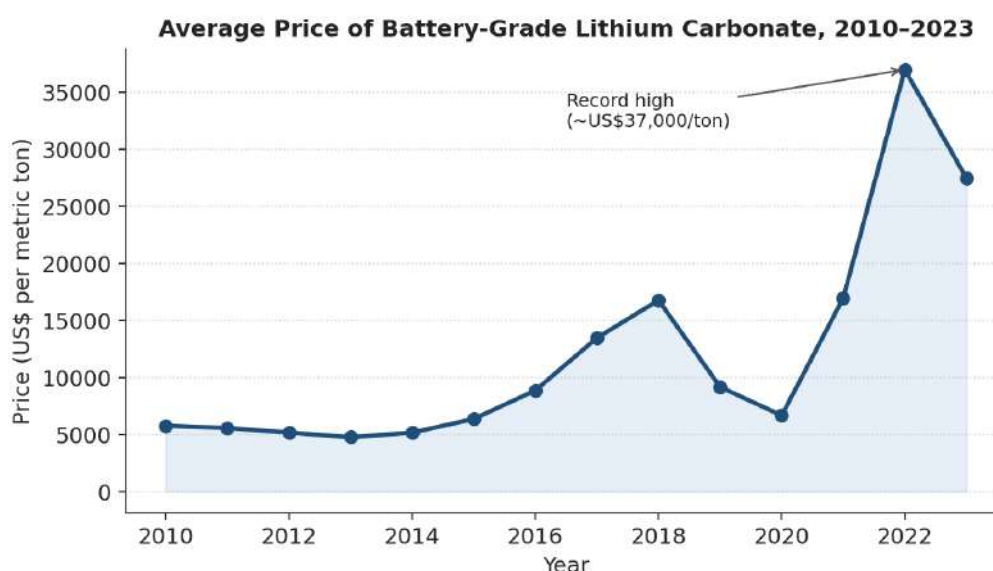


Figure 4: Average price of lithium carbonate, 2010–2023 (in US\$ per metric ton) (Statista, 2024).

10. THE SCRAMBLE FOR ENERGY DOMINANCE

The Chinese and U.S. political leaders both know on a very deep level that technology is a strategic resource. Both sides recognize that the importance of technological leadership can hardly be overemphasized (Altıparmak, 2023).

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10.1 Investment and Policy Initiatives by China and the USA for Renewable Energy

China has made significant investments in renewable energy, with one-third of the world's investment in clean energy and a significant contribution to the overall GDP growth of the country. China has made great strides toward increasing its renewable energy supply, with a dual carbon target of peak carbon emissions before 2030 and carbon neutrality before 2060. In 2023, China installed a substantial amount of solar PV capacity, and saw its wind installations rise by 66% from the previous year. Moreover, the country is also a leader in the world in terms of nuclear power capacity expansion. Industries like solar cells, lithium batteries and EVs are witnessing strong growth, underscoring China's robust position in clean energy innovation and manufacturing, and further expansion is anticipated in 2024. This continuous investments in low-emission power confirm China's support for clean energy development and its commitment to making a cleaner energy future (see Figure 5 for China's energy investment, in billions USD).

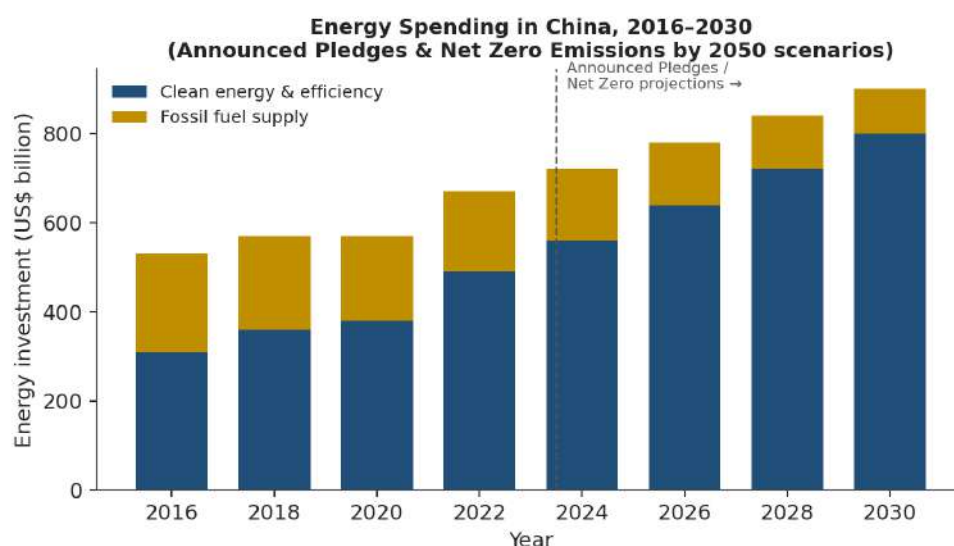


Figure 5: Energy spending in China, 2016–2030, under the Announced Pledges and Net Zero Emissions by 2050 scenarios (IEA, 2024a).

Investment in clean energy has risen substantially in the U.S., surpassing fossil fuel investments in 2020, which totaled \$260 billion, and reach \$280 billion in 2023. The Bipartisan Infrastructure Investment and Jobs Act, \$550 billion, and U.S. Inflation Reduction Act, \$370 billion, are both significant policy measures that have been allocated to clean energy and infrastructure. The investments are fueling clean energy manufacturing growth, grid upgrades, energy efficiency efforts, and workforce development programs. In the face of financing costs and permitting, the United States is showing progress to meet its target of achieving a net-zero emissions economy by 2050 with increasing investments in renewable energy programs (see Figure 6: United States' energy investment, in billions of USD).

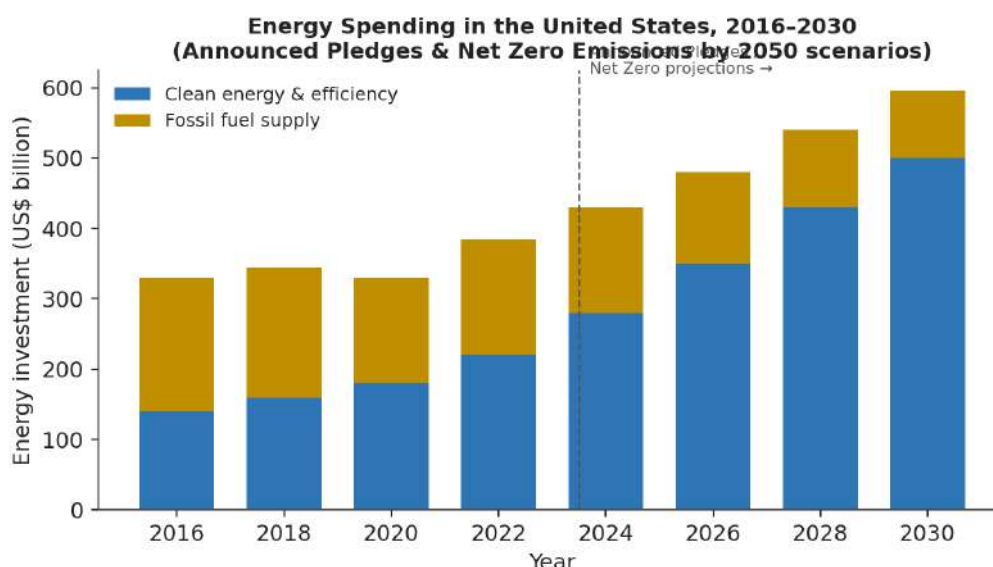


Figure 6: Energy spending in the United States, 2016–2030, under the Announced Pledges and Net Zero Emissions by 2050 scenarios (IEA, 2024b).

11. RENEWABLE ENERGY DEVELOPMENTS ACROSS SOUTH ASIA: TRENDS, TARGETS AND CHALLENGES

11.1 Pakistan

A big energy transition is underway in Pakistan. By 2024 the nation had emerged as a major overseas market for Chinese photovoltaic (PV) companies. According to the China Photovoltaic Industry Association (CPIA), Asia became the largest export market for PV products in the first half of 2024, and Pakistan is the second largest PV module export market after Europe in the first half of 2024. During this time, China exported RMB 1.714 billion in inverters, of which RMB 326 million was exported to Pakistan in August alone, which is an increase of 429.04% from the same time last year. The roofs of houses, offices, mosques and hospitals are often covered by solar panels. The Pakistani government aims to increase the percentage of renewable energy in the country's electric grid to 20% by 2025 and 30% by 2030. According to the IGCEP 2047 report by NEPRA, Pakistan needs an annual installation capacity of 1.65 GW and 1.07 GW for its PV installed capacity to reach 12.8 GW and 26.9 GW by 2030 and 2047 respectively (The Express Tribune, 2024). This trend to import increasing amounts of solar and inverter equipment, like the trend of battery imports (Table 1), represents the same dependency dynamic at the level of the energy transition hardware.

11.2 India

India's medium- and long-term renewable energy targets are ambitious. To combat climate change, Prime Minister Modi presented the “Panchamrit,” or five-point agenda, during his address at the COP26 climate summit in Glasgow in 2021. Reaching 500 GW of non-fossil energy capacity by 2030, achieving net-zero emissions by 2070, reducing total projected carbon emissions by one billion tons between now and 2030, lowering the economy's carbon intensity by 45% by 2030 relative to 2005 levels, and obtaining 50% of energy needs from renewable sources by 2030 are all part of the COP26 targets (International Trade Administration, n.d.). As the region's largest lithium-battery importer from China (Table 1), India's pursuit of these targets will keep it at the center of the US-China lithium competition discussed throughout this paper.

11.3 Afghanistan

In order to achieve the goals of the Renewable Energy Policy (RENAP) for Afghanistan, which calls for the deployment of 4,500–5,000 MW of RE capacity by 2032 and a shift from donor-grant-funded RE projects to a fully private-sector-led industry by the same year, the Renewable Energy Roadmap for Afghanistan (RER2032) offers technology-specific, attainable goals based on RE potential, technology and project prioritization, costs to meet RE generation targets, suitable business models for execution, market development enablers, institutional setup, and capacity-building needs (Asia Pacific Energy Portal, n.d.-a). Afghanistan's largely untapped lithium reserves add a further strategic dimension to its renewable energy planning, since any large-scale mining development would draw it further into the BRI-linked supply chains discussed in Section 12.

11.4 Bangladesh

Over the past 15 years, low-cost Chinese technology has dominated Bangladesh's solar energy sector, driven by the high cost of European imports. Solar power now accounts for 949.65 MW, with over 4.5 million solar home systems (SHS) in operation. China holds a 60% market share in SHS, with its panels being 30–35% cheaper than European options. Key solar parks utilize Chinese manufacturers such as Longi Solar and Sungrow. Experts stress the importance of quality assurance and monitoring, as well as the potential for future joint ventures to diversify the market (The Financial Express, n.d.).

11.5 Sri Lanka

The share of renewable energy (RE) in Sri Lanka's electricity mix increased after the nation achieved its goal of generating at least 10% of its electricity from renewable sources in 2014. Following this, in 2015, the share of fossil fuels in the electricity mix declined while the share of large hydro and renewable energy increased. In order to achieve the goal of 100% renewable electricity generation by 2050, a co-publication of the Asian Development Bank and the United Nations Development Programme outlines scenarios and mechanisms for this transition, highlighting the many technical and financial obstacles Sri Lanka is likely to encounter, including the feasible electricity generation mix and financial interventions needed to meet the target (Asian Development Bank, n.d.-a).

11.6 Bhutan

Bhutan, rich in renewable resources, primarily relies on hydropower, with an installed capacity of 2.33 GW, mostly exported to India. The country is now pursuing its first ground-mounted solar plant, aiming to diversify its energy mix beyond the current 9 MW of non-hydro renewables. The Bhutan Renewable Energy Master Plan estimates potential capacities of 12 GW for solar and 760 MW for wind. However, challenges such as inadequate incentives and regulatory gaps persist. Bhutan's participation in the International Solar Alliance and India's ‘One Sun One World One Grid’ initiative may further facilitate the integration of solar and wind energy into its exports (Observer Research Foundation, n.d.). Bhutan's hydropower-first, solar-second sequencing is a useful counterpoint to the lithium-battery dependency seen elsewhere in the region, and is revisited in the Findings section as a model of more balanced development.

11.7 Maldives

The Government of Maldives and the Asian Development Bank (ADB) signed an agreement for a \$50.5 million renewable energy initiative, the Accelerating Sustainable System Development Using Renewable Energy (ASSURE) Project. Supported by ADB, the project will improve energy security and move the Maldivian power sector toward sustainable renewable energy by using grid-scale energy storage, energy management systems, and upgrades to distribution grids on 20 islands. It will also implement emerging renewable technologies such as ocean-based floating solar panels, wind turbines, and flow batteries, and will support skill development for Maldivian agencies to improve their financial and technological knowledge of renewable energy systems. The financing includes \$41.5 million from the Asian Development Fund, an \$8.5 million concessional loan, and a \$500,000 Climate Change Fund grant, with \$48 million in co-financing from partners including Japan's JFJCM, alongside private-sector investments (Asian Development Bank, n.d.-b).

11.8 Nepal

In order to unite and coordinate policies and programs in the RE sector behind a set of strategic objectives, the Alternative Energy Promotion Center (AEPC) uses the National Renewable Energy Framework (NREF) as an umbrella mechanism. Its objective is to unite the efforts of the Government of Nepal (GoN), development partners (DPs), and other organizations behind a single, overarching vision implemented through an integrated results framework, jointly owned by the GoN and DPs. The RE Framework will engage stakeholders, facilitate fundraising, and coordinate and track the results of various RE projects (Asia Pacific Energy Portal, n.d.-b).

12. RESEARCH METHODOLOGY

This study adopts a qualitative, descriptive-analytical research design grounded in secondary data. It draws on peer-reviewed journal articles, institutional reports (IEA, USGS, ADB, World Bank), and international trade statistics to trace how U.S.-China competition over lithium is shaping energy security outcomes in South Asia.

Trade data presented in Tables 1 and 2 (battery imports by South Asian countries from China and the USA, 2018–2022) were obtained from the Observatory of Economic Complexity (OEC, www.oec.world). Battery imports rather than raw or refined lithium imports, which are not separately and consistently reported for most South Asian economies at the country level are used as a proxy indicator of each country's relative technological and supply-chain dependence on China versus the United States. Reserve and resource figures in Table 3 are drawn from the U.S. Geological Survey's Mineral Commodity Summaries (Jaskula, 2021). Data on renewable energy targets and country-level developments (Section 11) were compiled from government policy documents, multilateral development bank publications, and industry association reports for each of the eight South Asian countries covered in this study.

The analytical approach combines Geo-Economic Theory and Dependency Theory (Section 5) as an interpretive lens through which the trade and investment data are read, rather than as a basis for statistical hypothesis testing. The study is therefore exploratory and interpretive rather than causal or predictive in nature.

12.1 Limitations

Several limitations should be noted. First, battery-import values are an imperfect proxy for lithium dependency, since batteries embed value added from components other than lithium itself, and this study does not have access to disaggregated raw-lithium trade data for most South Asian countries. Second, the country case studies in Section 11 rely on secondary reporting of varying vintage and depth, which limits direct cross-country comparability. Third, as a desk-based study, this paper does not incorporate primary interviews with policymakers or industry actors in the region, which would allow for a richer account of how these dependencies are perceived and managed domestically. These limitations point to clear directions for future research, including firm- or country-level surveys and disaggregated commodity-trade analysis specific to raw and processed lithium.

13. FINDINGS AND ANALYSIS

The findings of the study indicate that Chinese products are key in helping South Asia realize a major transformation in its energy sector by promoting and adopting new energy sources drawn from solar and lithium technologies. The geo-economic and dependency implications are far-reaching, more so in light of the ongoing rivalry and tension between the U.S. and China. Dependency theory indicates that underdevelopment and control by external actors in a major sector of the economy are maintained through dependency on a stronger economy. South Asia's dependency on China with regard to solar and lithium-ion battery technologies makes it susceptible to China's vulnerabilities and strategic influence in the sector. Geo-economic theory places greater emphasis on the use of economic resources to achieve strategic imperatives; China's dominance in lithium gives it a major role in helping shape South Asia's emerging energy sector.

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13.1 Chinese and American Influence on South Asia's Renewable Energy Transition

The growing dependence of the region on Chinese imports of solar and battery technology is indicated by the import data. Among the top three countries that import lithium-ion batteries from China are Bangladesh, Pakistan, and India. India has been the largest market, with lithium-ion battery imports from China valued at \$2.08 billion in 2022. Pakistan imported lithium-ion batteries valued at \$124 million in 2022, and Bangladesh purchased lithium-ion batteries valued at \$89.8 million from China. In contrast, imports of lithium-ion batteries from the U.S. by South Asian countries have remained very small: India recorded imports valued at only \$19.3 million from the United States in 2022, and Pakistan recorded a comparatively small order valued at \$1.11 million. A geo-economic analysis indicates that China pursues a foreign policy in which its superior industrial and technological capabilities are leveraged to forge economic and international alliances that enhance its geopolitical influence. Further, China's entry into South Asia's markets is being facilitated by the Belt and Road Initiative in countries such as Pakistan, through Chinese investment in the development of large-scale renewable energy production in solar parks. As suggested by Dependency Theory, this perpetuates a process of economic subordination by limiting the scope for developing countries to diversify their dependencies away from more developed economies.

13.2 Strategic Implications for Energy Security and Economic Growth

China's control over the lithium supply chain may present serious obstacles for regional energy security, as evidenced by rising demand for lithium batteries in South Asian countries due to the region's growing adoption of electric vehicles (EVs) and integration of renewable energy sources. South Asia's progress toward energy independence may be hampered by supply-chain interruptions, price manipulation, and geopolitical pressure. The US has started advocating for alternative supply chains to offset Beijing's influence after recognizing the strategic disadvantage posed by China's dominance. However, the data show that the low level of U.S. exports to the region indicates that American initiatives to diversify South Asia's energy supply chains remain in their infancy. Afghanistan's largely unexplored lithium reserves, which could reshape the dynamics of regional supply, make it an important player in this equation; China would further solidify its hegemony in the global lithium market if it were to gain a foothold in Afghanistan's lithium mining industry through BRI investments, reducing the diversification options available to South Asian countries. With a goal of 500 GW of non-fossil capacity by 2030, India has started working with the United States and other alternative investors, after recognizing the risks of becoming overly dependent on China, to establish regional facilities for lithium refining in collaboration with the US and Europe. These initiatives, though, remain in their early stages.

13.3 Economic Growth, Innovation, and Environmental Considerations

The results show that, as a result of China's growing dominance over lithium resources and technology, South Asia has the opportunity to establish itself as a center for energy innovation. Higher investment in electric vehicle, lithium battery, and renewable energy devices could boost regional economic growth. This is in line with the geo-economic theory that posits that governments can use economic tools to enhance their international position. South Asia's capacity to participate in the global lithium supply chain could lead to higher energy security, industrial development and employment. But dependency theory warns that if they do not make strategic policy changes, South Asian countries could find themselves in a position where they can only be consumers and not producers of high-value lithium products. There is also a major environmental issue that needs to be addressed with this transition. Technological advances have been shown to promote economic growth and growth too, but with the wrong management they can lead to increased energy use and carbon emissions. A good example of a more balanced development strategy is Bhutan, where sustainability has been a priority, as hydropower projects were developed first and then solar energy (Section 11). Countries in South Asia should adopt policies and regulations that encourage technology transfer, skills training and innovation in the region, while minimizing the environmental footprint of industry growth.

14. CONCLUSION

A new economic and energy order in South Asia is being forged in response to the geopolitical contestation of the lithium resources by China and the USA, which could have significant consequences for international dependence. For this first research question, the result indicates China's dominance of lithium-battery export in South Asia, while South Asian countries are connected to a complicated international lithium supply chain, which affects South Asian energy security and geopolitical alignment. For this first research question, the results show that China dominates the export of lithium-battery across South Asia, and that South Asian countries are part of a complex international lithium supply chain that affect South Asian energy security and geopolitical alignment. As per the second research question, despite the presence of lithium deposits in South Asia, the region has not built its own capacity in the fields of lithium extraction, processing and battery manufacturing, thereby limiting its economic and developmental goals, as predicted by dependency theory. The third research question is answered by geo-economic theory: strategic competition through economic means — from trade to investment to infrastructure investment — is based on economic leverage and thus translates into strategic dominance, such as that of China in the lithium sector and the Belt and Road Initiative (BRI), which has caused governments in South Asia to slowly shift their trade and investment policy. This is also reflected in the import data with the amount of import battery equipment from the US remaining small and the import data from South Asian countries like Bangladesh, India

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and Pakistan from China has gone up many folds. As South Asia is embroiled in great-power competition, the US is attempting to balance China's dominance in trade and technology with alternative partnerships.

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