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HOR KA WAI CHRISTOPHER

«Foreign relations of Kazakhstan in the context of renewable energy»

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Domestic scientific consultant:
Doctor of Historical Sciences, Professor
Kukeyeva F.T.

Foreign scientific consultant:
Doctor of Economics, Professor
The Hong Kong Polytechnic University
Director of the “Belt and Road” Centre
Xu Xinpeng
(Hong Kong, China)

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Normative References

This dissertation incorporates references to the following established norms:

National legistlations and the presidential decrees:

1. Law of the Republic of Kazakhstan on Support for the Use of Renewable Energy Sources No. 165 IV, dated July 4, 2009 (with changes and additions as of July 3, 2022).
2. Concept for the Transition of the Republic of Kazakhstan to a "Green Economy" until 2050, Presidential Executive Decree of the Republic of Kazakhstan No. 577, dated May 30, 2013.
3. Concept of the Development of the Fuel-Energy Complex of the Republic of Kazakhstan by 2030, approved by the Decree of the President of the Republic of Kazakhstan No. 724, dated June 28, 2014.
4. New Rules for Determining Fixed Tariffs and Marginal Auction Prices, Government Resolution of the Republic of Kazakhstan No. 925, dated December 29, 2017.
5. Concept of the Foreign Policy of the Republic of Kazakhstan for 2020-2030, approved by the Decree of the President of the Republic of Kazakhstan No. 280, dated March 6, 2020.
6. National Development Project "Green Kazakhstan," approved on October 12, 2021 by Government of the Republic of Kazakhstan and signed on October 13, 2021 by the Decree of the President of the Republic of Kazakhstan.
7. Regional Green Agenda Program for Central Asia, adopted on July 21, 2022 by the Heads of State of Central Asia.
8. Strategy on Achieving Carbon Neutrality until 2060, approved by the Decree of the President of the Republic of Kazakhstan No. 121, dated February 2, 2023.

Multilateral agreements:

1. Central Asian Nuclear-Weapon-Free Zone Treaty, signed on September 8, 2006, by the Heads of States of Central Asia and ratified on March 21, 2009.
2. Treaty on the Eurasian Economic Union, signed on May 29, 2014, by the Republic of Kazakhstan and ratified on January 1, 2015.
3. Joint Declaration on New Stage of Comprehensive Strategic Partnership Between the People's Republic of China and the Republic of Kazakhstan, signed on August 31, 2015, by the Heads of States of the two countries.
4. Paris Climate Agreement, signed on August 2, 2016, by the Republic of Kazakhstan and ratified on December 6, 2016.
5. Roadmap for the Development of Regional Cooperation for 2022-2024, adopted on July 21, 2022 by the Heads of States of Central Asia.

Glossary

In this dissertation, the following terms are used with their corresponding definitions.

Term	Definition
Carbon neutrality	This refers to the idea of achieving net-zero greenhouse gas emissions by balancing emissions with their removal, often through carbon offsetting, or by eliminating emissions from society through the transition to a post-carbon economy.
Central Asia Power System (CAPS)	A unified electricity grid consists of the power networks of present-day Uzbekistan, southern Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan, which was created under the auspices of the Soviet Union in the 1970s to ensure consumers' energy supply through a jointly operated regional generation and transmission network, taking into consideration the region's uneven distribution of energy resources.
Central Asia-South Asia Power Transmission Project (CASA-1000)	A cross-border electricity transmission project that interconnects hydroelectric power available in Kyrgyzstan and Tajikistan with electricity-deficient Afghanistan and Pakistan in the Indian subcontinent, with an original project closing date scheduled to be March 2023 but extended to December 31, 2025 due to ongoing turmoil in Afghanistan and the suspension of funding by the World Bank.
Critical raw materials	The essential elements listed by the European Commission are not only "critical" for producing a broad range of goods and technologies but also for the sustainable functioning of the European economy, given the region's high import dependence and the lack of viable substitutes.
Energy security	A concept that is generally synonymous with the uninterrupted availability of energy sources at an affordable price, but dimensions such as environmental sustainability, social acceptability, technology development and regulatory stability are increasingly embedded.
Environment, social and governance (ESG)	A subset of non-financial performance indicators that refer to an organisation's shift in operating principles to do more than mere profit-making but

	also actively strive to contribute positively to the environment and social causes and to conduct themselves responsibly, in which transparency and accountability play a vital role.
Multi-vector foreign policy	A foreign policy approach that has been used by Central Asian countries in response to the intense geopolitical pluralism in a region where the presence of multiple competing external powerful countries is found, by which leverage is gained by Central Asian countries through "playing" these power forces against one another while developing friendly and predictable ties with all.
Petroleum	A complex mixture of hydrocarbons that exists on Earth in liquid, gaseous or solid form, whose production, consumption and transportation are of vital importance to international relations.
Rare earth elements	A set of seventeen metallic elements known as lanthanides on the periodic table that play a progressive role in the clean and renewable energy movement and are necessary components of a wide range of applications, especially high-tech consumer products, such as cellular telephones, computer hard drives, electric and hybrid vehicles, and flat-screen monitors and televisions.
Rents	They refer to real, pure profit captured by exploiting natural resources, which exhibit a significant positive effect on economic growth while potentially resulting in corruption-prone institutions and poor governance.
Renewable energy	An energy type whose sources are continually replenished due to natural processes, including the energy of sunlight, wind energy, hydrodynamic energy of water, geothermal energy (such as the heat of the ground, groundwater, rivers and basins) and anthropogenic sources of primary energy (in the form of biomass, biogas and other fuels derived from organic waste) that could be used for the production of electric and/or thermal energy, as described in Article 1 of Kazakhstan's Law on Support for the Use of Renewable Energy Sources in 2009.

Abbreviations

Abbreviation	Definition
^{o}C	Degrees Celsius
5G	Fifth-generation technology standard for broadband cellular networks
ANEEL	Agência Nacional de Energia Elétrica (National Electric Energy Agency of Brazil)
AI	Artificial Intelligent
ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
AIFC	Astana International Financial Centre
AIFC-GFC	The AIFC's Green Finance Centre
AIX	Astana International Exchange
BRI	Belt and Road Initiative
BRICS	An intergovernmental organisation initially comprising Brazil, Russia, India, China, South Africa
CAPS	Central Asia Power System
CAREC	Central Asia Regional Economic Cooperation Program
CAREM	Central Asia Regional Electricity Market
CASA-1000	Central Asia-South Asia Power Transmission Project
CIS	Commonwealth of Independent States
CNPE	Conselho Nacional de Política Energética (National Council for Energy Policy of Brazil)
COP	The United Nations Climate Change Conference of the Parties
COVID-19	Coronavirus disease 2019
CPC	Caspian Pipeline Consortium
CSTO	Collective Security Treaty Organization
EAEU	Eurasian Economic Union
EBRD	European Bank for Reconstruction and Development
ECO	Economic Cooperation Organization
ETS	Emissions trading systems or schemes
ESG	Environment, social and governance
FDI	Foreign direct investment
G20	Group of Twenty
GCC	Gulf Cooperation Council
GDP	Gross domestic product
GHG	Greenhouse gas
GW	Gigawatt
HCI	Human Capital Index
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change

IRENA	International Renewable Energy Agency
JSC	Joint stock company
KEGOC	Kazakhstan's Electricity Grid Operating Company
KOREM	Kazakhstan Electricity and Power Market Operator
KW	Kilowatt
kWh	Kilowatt-hours
LEU	Low-enriched uranium
MENA	Middle East and North Africa
MERCOSUR	Mercado Común del Sur (Common Market of the South)
MME	Ministério de Minas e Energia (Ministry of Mines and Energy of Brazil)
MMR	Mixed methods research
MW	Megawatt
NATO	North Atlantic Treaty Organisation
NDCs	Nationally determined contributions
OECD	Organization for Economic Cooperation and Development
OPEC	Organization of the Petroleum Exporting Countries
OPEC+	An alliance of petroleum exporting countries including OPEC and ten non-OPEC countries
PDEE	Plano Decenal de Expansão de Energia (Ten Year Energy Expansion Plan of Brazil)
PROINFA	Programa de Incentivo às Fontes Alternativas de Energia Elétrica (Incentive Program for Alternative Sources of Electric Energy of Brazil)
R/P	Reserves-to-production
RECAI	Renewable Energy Country Attractiveness Index
REN21	Renewable Energy Policy Network for the Twenty-first Century
SCO	Shanghai Cooperation Organisation
UHV	Ultra-high voltage
UNASUR	Unión de Naciones Suramericanas (Union of South American Nations)
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USD	United States Dollars
WEF	World Economic Forum
WTO	World Trade Organization
WWF	World Wildlife Fund

Introduction

Relevance of the dissertation. The importance of energy in industrial processes, modern economies and daily activities could hardly be overstated. Fossil fuels, including coal, oil and natural gas, continue to account for the majority of total energy consumption. However, their finite nature and uneven distribution across the world have given rise to oligopolistic markets, where producers hold considerable market power and consumers secure access to indispensible resources. The major oil-producing countries in the Persian Gulf, shaped by global dependence on hydrocarbon-based products, have relied on the United States as a guarantor of global energy flows since World War Two. The oil crisis of the 1970s further brought the politics of energy to the forefront of international relations studies, leading scholars worldwide to analyse a highly globalised fossil fuel market and its implications for energy supply chains and international relations. A radical change in this longstanding pattern of interdependence, which seeks to ensure energy security, only began to emerge in 1990 when the Intergovernmental Panel on Climate Change (IPCC) presented scientific evidence that the extraction, distribution and burning of fossil fuels were significant contributing factors to many of the planet's environmental, ecological and climate problems. The consequences, including the depletion of sea ice, accelerated sea-level rise, and more frequent and severe heatwaves, are projected to alter weather patterns and impact various sectors of the economy. The 2015 Paris Climate Agreement marked a milestone in global efforts to mitigate climate change. This document serves as the inaugural comprehensive climate agreement, requiring participating countries to submit their own nationally determined contributions (NDCs) to curtail the rise in the global average temperature below two degrees Celsius (°C). To accomplish the Agreement's central goals, the deployment of renewable energy, along with energy efficiency and significant changes in global energy markets, has been regarded as urgent and essential to reduce one major source of the problem, namely energy-related carbon emissions.

The Republic of Kazakhstan, a key player in fossil fuel production in Central Asia, is not shielded from the effects of the global shift towards renewable energy. According to Article 1 of Kazakhstan's Law on Support for the Use of Renewable Energy Sources No. 165-IV, which was issued in 2009, renewable energy refers to various forms of energy that come from sources or processes that are constantly replenished, including but not limited to hydropower, solar and wind energy. Since 2012, efforts have been made to promote renewable energy technologies, encourage sustainable practices and support the shift towards a low-carbon economy through initiatives like the "Kazakhstan 2050 Strategy" and associated legislative structures and auction systems. In the early 2020s, the Republic's inquiry into the potential for developing green hydrogen facilities and nuclear power plants demonstrated its commitment to energy diversification and decarbonisation.

Throughout history, certain authors have analysed the potential for conflicts in Central Asia over resources. Simultaneously, the Central Asian region also offers a plethora of underexplored territory when considering the geopolitical and socio-economic consequences of the emergence of renewable energy as a dominant force in

global energy dynamics. As renewable energy reshapes global energy supply and value chains, the relevance of this dissertation to the field of international relations lies in its contribution to the existing literature on global energy dynamics, focusing on the intersection of Kazakhstan's dual role as a petroleum producer and a newcomer to the renewable energy transition, its foreign policy formulation and its contribution to global energy security.

The research question was formulated on the basis of gaps in existing knowledge and recent literature on renewable energy development and subsequent changes in Kazakhstan's foreign policy orientation. Specifically, the dissertation author attempted to address the contradiction regarding the continual dominance of fossil fuels in ensuring energy security and the advocacy for the essentiality of renewable energy deployment to promote multilateral cooperation. The primary research question guiding this dissertation was, "how can Kazakhstan enhance its diplomatic capacity and global presence in the upcoming energy order in which renewable energy is prioritised?" To answer this question sufficiently, the dissertation author focused on three interrelated aspects: 1) the internal and external conditions necessary for renewable energy to become a foreign policy instrument; 2) the impact of renewable energy on Kazakhstan's approach to foreign affairs; and 3) diplomatic strategies for maintaining the Republic's relevance to global energy security.

A **hypothesis** was proposed based on this foundation: Kazakhstan's efforts to embrace renewable energy can serve as a strategic pivot to enhance its diplomatic influence and secure its relevance in an evolving energy landscape.

The aim of the dissertation is to bridge the gaps in current knowledge and recent literature concerning renewable energy development by analysing Kazakhstan's foreign policy in the context of discernible trends in the global energy landscape, taking into account the Republic's internal and external conditions and its pivotal contributions to global energy security.

The following **tasks** were identified to address the aim of the dissertation, answer the research question and test the hypothesis:

- conduct a survey of international relations theories to theoretically understand and analyse Kazakhstan's foreign energy policy;
- conduct a case study on an anchor country that has features comparable to Kazakhstan but is ahead in renewable energy adoption, to identify the theoretical composition of its foreign energy policy, as well as specific internal and external conditions, for developing renewable energy-oriented foreign affairs strategies;
- conduct a correlation analysis using relevant global statistical data to assess the intensity and trend of the relationship between renewable energy adoption and diplomatic capacity;
- review the key milestones in Kazakhstan's journey towards becoming an energy state;
- conduct model-based forecasting to project the trajectory of Kazakhstan's foreign energy policy with reference to the knowledge acquired from the aforementioned tasks;
- determine the implications of renewable energy on Kazakhstan's multi-vector foreign policy in theoretical and practical terms;

- determine the implications of renewable energy on Kazakhstan's contribution to global energy security in theoretical and practical terms;

- speculate on the unique opportunities, challenges and recommendations for Kazakhstan's foreign energy relations in terms of policy resonance and action alignment with partner countries in light of global aspirations for carbon neutrality.

The subject of the dissertation is Kazakhstan's global presence through foreign affairs strategies centered on renewable energy, with a specific emphasis on the internal and external factors that are essential for turning renewable energy into a foreign policy instrument amidst changes in the global energy landscape.

The object of the dissertation is the nexus of renewable energy and Kazakhstan's foreign energy policy.

Methodology. This dissertation employs a five-phase mixed methods research (MMR) methodology, which begins with a survey of international relations theories, a case study on an anchor country and a correlation analysis for the purpose of model building via triangulation. This is followed by model-based forecasting, which leads to recommendations for mandatory actions for Kazakhstan to assert its global presence in a post-petroleum world. Apparently, the four types of data analysis, namely descriptive, diagnostic, predictive and prescriptive, are also incorporated in this research design to provide hints at each of the research methodologies that address what happened (descriptive), why something happened in the past (diagnostic), what could happen next (predictive), and what should happen in the future (prescriptive).

In the first phase, at the descriptive level, a survey of international relations theories is conducted to explore the theoretical composition of Kazakhstan's foreign policy and the role of energy in its formulation since independence. Geo-related factors, neorealism, neoliberalism and constructivism are referred to, taking into account Kazakhstan's natural resources and strategic location, security concerns, strategies for desirable outcomes and state-building vision with respect to external actors and changes in the global energy landscape.

In the second phase, at the diagnostic level, a case study is conducted on an anchor country to identify a set of internal and external conditions, referred to as indicators, that move renewable energy towards a central position in foreign policy-making. Using the software programme MAXQDA specifically for qualitative analyses, key features of this anchor country's renewable energy transition are codified to help identify indicators for renewable energy to become a foreign policy instrument.

In the third phase, also at the diagnostic level, a correlation analysis is performed on two variables in the form of two sets of relevant data to determine whether a country's diplomatic capacity is affected by responsive action taken according to changes in the energy landscape. In this dissertation, the Energy Architecture Performance Index developed by the World Economic Forum and the Global Sustainable Competitiveness Index developed by SolAbility Sustainable Intelligence are selected for correlation analysis to represent renewable energy transition and diplomatic capacity, respectively. Besides using Pearson's *r* formula to calculate correlation strength, the data trends, clusters and patterns resulting from plotting one

index on the x-axis and the other on the y-axis conjointly provide a glimpse of the energy order of the future.

In the fourth phase, at the predictive level, model-based forecasting is used to forecast Kazakhstan's foreign relations in the context of renewable energy. Building on the knowledge acquired from the descriptive and diagnostic analysis together with a review of Kazakhstan's milestones in state-building, Kazakhstan's energy development and associated domestic and foreign policy are analysed against each indicator while considering international relations theories, the anchor country's renewable energy transition pathways and the essences of the forthcoming energy order. A forecast is then made to specify the required policy revision and feasible greenfield development for the benefit of the Republic's diplomatic capacity and global presence in the coming decades.

In the final phase, at the prescriptive level, the theoretical and practical implications of renewable energy on Kazakhstan's multi-vector foreign policy and its contribution to global energy security are examined and summarised. Taking into account the knowledge acquired from the descriptive, diagnostic and predictive analysis, recommendations within the framework of Kazakhstan's Concept of the Foreign Policy for 2020-2030 were prescribed for the Republic to take advantage of opportunities to boost its diplomatic capacity and global presence while resolving relevant challenges amidst global renewable energy transition and carbon neutrality.

The chronological scope of the dissertation covers two timelines: 1) Brazil's journey from the 1970s oil crisis to 2023; and 2) Kazakhstan's trajectory from independence to 2023. The reason for a longer timeline for Brazil is to illustrate the country's milestones in reducing its petroleum reliance by developing alternative energy resources to meet its energy needs. For Kazakhstan, 1991 was the year when the Republic gained independence and began asserting its global presence through petroleum exports. For both countries, 2023 was significant as the year denoted a transition in Brazi's presidency and the ratification of Kazakhstan's Strategy on Achieving Carbon Neutrality until 2060. Although deviations caused by economic and political volatilities can not be ruled out, Kazakhstan's current efforts in pursuing a new level of "economisation" of foreign policy, accelerating the adoption of renewable energy technologies and exploring diverse cooperative strategies in renewable energy transition signal a proactive stance towards a decarbonised future dominated by non-carbon-emitting energy.

Reference foundation of the dissertation. A wide range of sources can be classified into five groups. These sources were used to obtain data that specifically addressed the research question. The diversity of sources allows for a multi-faceted exploration of the research question.

The first group of sources is comprised of governmental documents, including legislation, as well as policy-related information, press releases and publications issued by state agencies. These materials offer authentic, reliable data and a historical account of decisions and changes. For this dissertation, Kazakhstan's legislation [1-11], coupled with communication issued by the Official website of the President of the Republic of Kazakhstan [12-17], the Official Information Source of the Prime Minister

of the Republic of Kazakhstan [18-31] and various ministries [32-35] are of utmost importance. This dissertation also references similar materials issued in Brazil [36-41], China [42-43], India, [44-49], Pakistan [50], Russia [51], Turkey [52-54], Turkmenistan [55], Uzbekistan [56-57], the United Arab Emirates [58-59], the United Kingdom [60-61] and the United States [62-66]. The availability of these materials online as public information facilitated data collection, enabling the dissertation author to understand Kazakhstan's potential and aspirations in global energy security, as well as those of other countries in comparable circumstances.

The second group of sources consists of intergovernmental documents, including international agreements, multilateral policy-related information, press releases and publications issued by agencies of various intergovernmental organisations. Materials issued by the Euasian Economic Union [67], the European Union [68-70], the Organization of Turkic States [71], the World Trade Organization [72] and the United Nations [73-74] offer corresponding and supplementary perspectives on the policy measures undertaken by their member countries with Kazakhstan. The availability of these materials online as public information facilitated data collection, enabling the dissertation author to understand Kazakhstan's interactions with other international actors in the renewable energy supply and value chains.

The third group of sources is represented by speeches and addresses by various heads of states. These materials provide insights into the direction of policies, historical context and political rhetoric, while also acting as a measure of public sentiment and documentation of a country's position on global issues. For this dissertation, while the speeches and State of Nation Addresses of Kazakhstan's founding president Nursultan Nazarbayev [75-77] and current president Kassym-Jomart Tokayev [78-90] play a significant role in unveiling the Republic's strategy towards achieving renewable energy transition, carbon neutrality and other related national targets, the speeches delivered by the heads of states of Brazil [91], China [92], Russia [93] and the United States [94-95] offer a comprehensive global outlook and additional insights that significantly impact Kazakhstan's development trajectories. The availability of this group of materials online as public information made data collection convenient, enabling the dissertation author to discover the underlying rationale behind Kazakhstan's multi-vectoral approach to foreign affairs, efforts to protect national sovereignty and attempts to be a responsible participant in the international community.

The fourth group of sources consists of statistical data and maps produced by state and non-state agencies, which provide quantitative evidence, reveal trends, enable comparisons and facilitate predictive modelling. These materials are essential tools for policy-making, geographical analysis, data visualisation, hypothesis testing, demographic studies and epidemiological research. The Bureau of National Statistics of Kazakhstan, Kazakhstan Electricity Grid Operating Company (KEGOC), the International Energy Agency (IEA) and the World Bank are among the prominent providers of this category of materials, along with various entities that offer open access to statistical data and maps. For this dissertation, statistical data and maps with respect to economic performance [96-100], energy profile [101-106], environmental and natural resources [107-114], human capital [115-118], greenhouse gas (GHG)

emissions [119-120] and the renewable energy industry [121-122] are of particular importance. The availability of this group of materials online as public information simplified data collection, enabling the dissertation author to analyse them and obtain a comprehensive understanding of their interrelationships and impacts.

The fifth group of sources is represented by industry reports and significant press releases from the public and private sectors. These sources cover a wide array of topics, including economic performance [123-140], energy economics [141-152], energy infrastructure [153-170], human capital [171-173], renewable energy development [174-194], sustainable development [195-216] and the technology industry [217-219]. These materials play a crucial role in this dissertation by providing valuable insights into industry trends and policy understanding and serve as a reliable source of data complementary to statistics and maps. Prominent suppliers within this category of resources consist of the Asian Development Bank (ADB), the International Renewable Energy Agency (IRENA), the Organisation for Economic Co-operation and Development (OECD), the Organization of the Petroleum Exporting Countries (OPEC), the United Nations, the United States Agency for International Development (USAID), the World Economic Forum (WEF), among others. The availability of this group of materials online as public information facilitated a broad and comprehensive understanding of the renewable energy sector, enabling the dissertation author to conduct knowledge-based analysis.

Extent of scientific elaboration of the research question. Although renewable energy represents a novel subject of research in international relations studies, various aspects of foreign policy-making in association with energy have been explored by historians, political scientists, economists and analysts worldwide. Given the extent of scientific elaboration applied to the research question, a multi-country approach was applied in this dissertation, which involved conducting a survey of historiographies from the following origins:

Western historiography. The significance of American and European historiography in this dissertation lies in its systematic presentation of the interplay among key concepts such as energy, geo-related factors, security, economics, technology, civil society and environmental concerns, deepening the dissertation author's comprehension of the underlying theoretcial frameworks that define the intricacies and nuances of international energy politics.

Halford Mackinder's Heartland theory offers a framework for understanding the strategic importance of energy-rich regions like the Middle East and Central Asia [220], while Nicholas Spykman's Rimland theory resonates with the increasing interdependence between producers and consumers, highlighting the pivotal role of maritime chokepoints in determining global energy security [221]. Mohrez Mahmoud El Hussini examined the energy strategy of the United States during the Cold War era and suggested that geo-related factors played an influential role in foreign policy-making [222]. John J. Mearsheimer discussed how states use energy resources as tools of geopolitical strategy, emphasising the necessity for states to prioritise securing stable and reliable energy supplies to maintain national security and economic stability [223].

Neorealist scholars such as Stephen Walt and Kenneth Waltz argued that energy security is a critical aspect of national security, prompting states to strive for energy dominance, either through control over energy resources or technological superiority in energy production [224, 225]. Zbigniew Brzezinski's perspective on the technotronic era and post-Cold War power dynamics likewise emphasises the influence of technological advancements and resource demands on international energy dynamics [226-228]. Özgür Özdamar reinforced these perspectives by exploring the impact of energy security on foreign policy decisions, highlighting how shifts in energy production and consumption affect the global balance of power [229].

Joseph S. Nye, Robert O. Keohane and Lisa L. Martin, Paul Pierson, Keohane and Nye, and Andrew Moravcsik offered a neoliberal theoretical framework by acknowledging the influence of international institutions [230-232], soft power [233] and intergovernmental bargaining [234] on shaping state energy policies, including but not limited to, energy security. In their 1977 book, Keohane and Nye particularly aruged that market mechanisms, characterised by complex interdependence among states and non-state actors in the form of energy trade, play a crucial role in shaping international energy relations [233].

Constructivist scholars such as Alexander Wendt and Peter J. Katzenstein viewed energy security as a notion shaped by the identities and interests of states beyond a purely materialist perspective [235-237], which is consistent with the study of Martha Finnemore and Kathryn Sikkink that emphasises the role of ideational factors as key determinants in shaping the objectives of purposeful actors [238]. Charles Tripps and Anne Pitcher, Mary H. Moran and Michael Johnston specifically addressed the influence of natural resource wealth on the effective yet informal patterns of behaviour exhibited by the ruling elite in the Arab Middle East and Africa, particularly in shaping their reliance on clientelism and rent-seeking practices, when engaging with foreign trading partners. They argued that natural resource wealth can lead to a system in which these ruling elites selectively distribute benefits to loyal supporters to reinforce their own position [239, 240]. Amanda Machin applied constructivism to analyse the association between proposed energy policies and energy nationalism amidst the European Union's vulnerability to external energy sources and the rise of populism. Her findings indicate that the origins of European energy nationalism can be attributed to the prevalence of energy independence, national imaginaries and anthropocentric dualism in political and social discourses [241]. Hannah K. Patenaude and Emma Frances Bloomfield asserted that the growing norms of global sustainable development have prompted many countries and corporations to share a common objective of reducing reliance on fossil fuels, thereby heightening the potential for international collaborative endeavours [242]. Their hypothesis aligned with the research conducted by Juan Carlos Ríos-Fernández, Juan Manuel González-Caballín, Andrés Meana-Fernández and Antonio José Gutiérrez-Trashorras on supermarkets across the twenty-seven member countries of the European Union, which demonstrated that a mutual interest in environmental and energy benefits among these companies drives their collective implementation of energy improvements and utilisation of residual energy [243].

With respect to renewable energy, the report produced by Mycle Schneider acknowledged that wind and solar combined outperformed nuclear globally for the first time in 2021, and in 2022 they generated 28 percent more electricity than nuclear power plants, signifying the significant contribution of renewable energy to global energy security [244]. The studies of Kelly Levin and David Rich, as well as that of Takeshi Kuramochi, Leonardo Nascimento, Mia Moisio, et al., assessed international and national strategies for mitigating GHG emissions, focusing on the adoption of renewable energy technologies by various countries and the implementation of relevant governmental policies [245, 246]. While Daniel Scholten, Emre Hatipoglu, Saleh Al Muhanna and Brian Efird investigated the geopolitics of renewable energy and its impact on international relations [247, 248], Scholten, David Criekemans and Thijs Van de Graaf redefined the characteristics of great power rivalry amidst renewable energy transition [249]. The outcomes of their investigation are consistent with the research conducted by Carlos Pestana Barros, Luis A. Gil-Alana and James E. Payne, as well as that of Suyog Chaudhari, Erik Brown, Raul Quispe-Abad, Emilio Moran, Norbert Müller and Yadu Pokhrel, which highlighted the contest for substantial investments in infrastructure [250, 251]. Their findings also resonate with the research of Gran Andrea Blengini, Cynthia El Latunussa, Umberto Eynard, et al., Dolf Gielen and Martina Lyons, along with those of Petra Zapp, Andrea Schreiber, Josefine Marx and Wilhelm Kuckshinrichs, which examined the competition for critical raw materials and rare earth elements [252-254]. Furthermore, their observations correspond to the scholarly work of Heymi Bahar and Jehan Sauvage, Arman Aghahosseini, Dmitrii Bogdanov, Larissa S.N.S. Barbosa and Christian Breyer, Kathleen J. Hancock, Stefano Palestini and Kacper Szulecki, Corey Johnson and Stacy D. VanDeveer, which focused on the emergence of new forms of energy dependency and interdependency between countries [255-258]. As hydrogen is considered paramount to effectively combat energy, food and environmental crises, Ulrich Koegler, James Thomas and Susie Almasi examined the production of green hydrogen within the Gulf Cooperation Council (GCC) as a case study. Their report presents the intricate dynamics of the discussion of foreign relations in the context of renewable energy, proposing that success in the upcoming green hydrogen market will ultimately be determined by the efficiency and effectiveness of the supply chain [259].

Regarding the impacts of renewable energy on policy-making and societal welfare, Hugo Lucas, Rabia Ferroukhi and Diala Hawila commented that renewable energy auctions have emerged as a widely utilised policy tool for promoting low-carbon electricity generation since the 2000s, having benefitted from the rapidly decreasing costs of renewable energy technologies, the increased number of project developers, their international exposure and expertise, and the considerable policy-design experience accumulated over time [260]. Mark Coeckelbergh and Henrik Skaug Sætra predicted that the intersection of innovative energy sources and enabling technology, notably the integration of artificial intelligence (AI), will impact various aspects of democratic governance [261]. Frédéric Docquier raised concerns about developing countries' inability to adopt new energy technologies due to the migration of highly educated individuals from developing to developed countries, commonly referred to as "brain

drain" [262]. Such concerns were also reflected in the studies of Rafael Alvarado, Qiushi Deng, Brayan Tillaguango, Priscila Méndez, Diana Bravo, José Chamba, María Alvarado-Lopez and Munir Ahmad when human capital – such as education and health – was found to play a decisive role in decreasing the consumption of non-renewable energy and promoting the transition to a more sustainable energy matrix in developed economies [263]. Henrik Kock and Cathrine Reineholm conducted twelve qualitative case studies on organisational change competence at different levels (micro, meso and macro) in Sweden, observing that learning opportunities in change processes is one of the critical factors in minimising change resistance among both leadership groups and members when faced with transformation initiatives. This observation implies that renewable energy transition, as well as any sustainable development initiative, is most effectively carried out in parallel with the cultivation of human capital [264]. Mariaelena Murphy and Corina Pacher, through their case study of a start-up in the raw materials sector within the East-Southeast Europe region, suggested that talent retention and attraction, also known as "brain circulation," are essential to counteract the brain-drain phenomenon. According to them, such efforts are essential for facilitating productivity gains, technological advancements and sustainable growth [265].

Human capital development aside, Andreas Goldthau and Benjamin K. Sovacool argued that energy scholarship must incorporate social justice principles to facilitate the building of a post-petroleum future [266]. Their publication prompted a discussion of "energy justice" and "energy domocracy" within the framework of renewable energy transition and energy interrelations between producers, consumers and energy transit, spearheaded by Darren McCauley, Raphael J. Heffron, Hannes Stephan and Kirsten Jenkins [267], Nicholas Sakellariou [268], Eleni K. Stigka, John A. Paravantis and Giouli K. Mihalakakou [269], James Angel [270], Kirsten E. H. Jenkins [271], Jennie C. Stephens [272], Kacper Szulecki and Indra Overland [273], Kirsten E. H. Jenkins, Jennie C. Stephens, Tony G. Reames and Diana Hernández [274], Dirk Eidemüller [275], Rimel I. Mehleb, Giorgos Kallis and Christos Zografos [276], and Bettina K. Arkhurst, Wendy Hawthorne, Isa Ferrall-Wolf, Katherine Fu and Kate Anderson [277]. Goldthau and Kirsten Westphal acknowledged the significant disparities in energy politics between the Global North and Global South, arguing that many countries in the Global South remain heavily reliant on traditional sources and less efficient technologies because of economic constraints or specialisation in energy-intensive sectors [278].

Concerning Kazakhstan's domestic and foreign energy policies, Tamara Makarenko, Katherine Hardin and Nicola P. Contessi highlighted Kazakhstan's strategic cultivation of strong energy ties with major powers – Russia, China, the United States and the European Union – primarily to secure export routes and access new markets in a multi-vectoral format [279-281]. Edward Schatz, Carol S. Leonard and Sebastien Peyrouse explored the impacts of neopatrimonial practices on Kazakhstan's political system, underscoring the role of energy rents [282-284]. Balazs Egert and Morena Skalamera Groce examined the implications of the "Dutch Disease" phenomenon, which may arise from an overdependence on resource exports, and its potential to jeopardise Kazakhstan's social order and regime stability [285, 286].

Richard Pomfret, Roy Allison, Caroline Erin Elkin, Anatole Boute and Mirjana Radovanović, Sanja Filipović and Andrea Andrejević Panić argued that economic diversification and sustainable development in Kazakhstan are faced with challenges prompted by ageing infrastructure, which perpetuates the Republic's dependence on oil rents and impedes its connectivity with other Central Asian countries [287-291]. Martin Russell expressed optimism that China's infrastructure effort, in conjunction with the European Union's support for educational exchanges and a rule-based approach to ensure a level playing field for all stakeholders, can improve connectivity between Central Asia and the global community [292]. Roman Vakulchuk and Overland acknowledged the infrastructural challenges faced by Central Asia but suggested that the region's abundant critical raw materials could enable it to play a pivotal role in the global clean energy transition [293]. Thorleikur Jóhannesson, Guðni Axelsson, Steinunn Hauksdóttir, Carine Chatenay, Davíð Örn Benediktsson and Tobias B. Weisenberger assessed potential utilisation of geothermal resources in Kazakhstan and provided a set of recommendations on next steps for possible deployment in the Republic [294]. Mircea Ardelean, Philip Minnebo and Hana Gerbelová, taking into account the shift in energy dynamics between Central Asia and the great powers in the context of renewable energy, forecast potential electricity linkages between Central Asia and Europe, which imply a decline in pipeline diplomacy and a rise in the geopolitics of low-carbon electricity [295].

In summary, Western scholars play a crucial role in advancing the field of energy research. However, the Euro-Americancentric perspective in Western historiography has been subject to frequent criticism as this narrow focus has led to the marginalisation of non-Western cultures and the disregard of diverse experiences.

Brazilian historiography. The relevance of Brazilian historiography in this dissertation is underscored through key themes such as energy diplomacy at the intra- and extra-regional levels, as well as the diversification of energy portfolios.

At the intra-regional level, within the framework of the Common Market of the South (MERCOSUR), Laura Gomez-Mera, Thauan dos Santos, Melisa Deciancio and Cintia Quiliconi extensively examined the efforts undertaken by Brazil, Argentina and Paraguay to synchronise energy policies, encourage the development of cross-border energy infrastructure projects and facilitate the exchange of energy commodities. Their respective studies revealed that progress in this domain has been uneven across the parties invovled, with various political, economic and technical challenges hindering the realisation of a fully integrated regional energy market [296-298]. Juan Roberto Paredes conducted a detailed analysis of the seasonality and variability of renewable energy resources, as well as possible complementarities between solar, wind and hydroelectric power in Central and South American countries. He argued that energy integration is a suitable strategy for these countries and urged policy-makers and energy planners to find ways to dismantle some regulatory and interconnection barriers to unlock this potential [299].

At the extra-regional level, on the economic front, Elizabeth Alice Clements and Bernardo Mançano Fernandes addressed Brazilian businesses' interest in securing access to Africa's vast natural resources through investments [300]. Politically, Stavros

Afionis, Lindsay C. Stringer, Nicola Favretto, Julia Tomei and Marcos S. Buckeridge examined the role of Brazil in the global biofuels arena, focusing on Brazil's use of biofuels as a means to augment its international influence and establish itself as a dominant force within the Global South [301]. Strategically, Lídia Cabral, Alex Shankland, Arilson Favareto and Alcides Costa Vaz argued that Brazil has viewed Africa as a key partner in the South Atlantic to expand its foreign affairs strategies beyond MERCOSUR and South America [302]. A study undetaken by Pedro Henrique Batista Barbosa focused on China's presence in the Brazilian electricity sector, seeking to identify participating Chinese corporations, describe their activities and analyse the extent to which Brazil and China have inserted themselves into each other's global energy strategies. His findings forecast an expansion of Chinese electricity companies' investments and assets in Brazil in the coming years based on the complementary nature of the two countries, which will generate mutual benefits [303].

In the context of domestic renewable energy development, a study led by Deborah Werner and Lira Luz Benites Lazaro recognised Brazil's progress in renewable energy, including hydroelectric power, wind, solar and green hydrogen production, but underscored the significant challenges in scaling up these technologies, including technical constraints, regulatory hurdles and the need for substantial investments [304]. Stephanie Jamison and Roberto Bocca outlined three fundamental pillars for propelling Brazil's energy transition agenda, namely the modernisation of the energy market, integration of technology and digitalization, and promotion of innovative financing mechanisms [305].

In summary, Brazilian historiography presents an alternative perspective to Western narratives, without dismissing Western contributions in terms of theory-building and practical applications. Nevertheless, nationalistic biases and elite narratives highlight the importance of adopting a diverse, inclusive and critical research approach to international energy relations.

Chinese historiography. Chinese historiography is crucial to this dissertation because it offers a perspective on the profound interest of China in Central Asia. Sun Zhuangzhi's research in 2001 sheds light on the significance of China's involvement in Central Asia amidst the United States' War on Terror [306], while Liao Xuanli affirmed the lasting mutual benefits that stem from the Sino-Kazakh energy diplomacy through bilateral crude oil trading, especially after the completion of the China-Kazakhstan oil pipeline in 2006 [307]. Lu Na-Xi, Huang Meng-Fang and Lu Shan-Bing examined China's collaborations with Russia and Central Asian countries respectively, recognising Russia's position as a security provider in Central Asia and its significant energy investments in the region. Taking into account the launch of China's Belt and Road Initiative (一带一路, BRI) in 2012, which reached the post-Soviet space through investments and infrastructure projects, they suggested a mechanism to align the BRI with the Russia-led Eurasian Economic Union (EAEU), facilitated by the Shanghai Cooperation Organisation (SCO) [308]. Wang Jian, Ren Lin, Wu Hongying, Liu Zhongmin and Xu Xiuli addressed China's role in the changing international order, underscoring the challenges and opportunities that China faces as

a result of intensified great power competition not only in Central Asia but throughout the entire Global South [309].

Regarding China's efforts to transition towards a more sustainable energy sector, a study by Guoyang Wu, Ping Ju, Xinli Song, Chenglong Xie and Wuzhi Zhong highlighted the proficiency of Chinese experts in coordinating and interacting between low-emissions nuclear power plants, electricity grids and protection systems in light of the growing electrification trend aimed at mitigating greenhouse gas (GHG) emissions [310]. In terms of promoting mutual sustainable growth through cross-boundary electricity grid interconnection, Chunyi Huang, Chengmin Wang, Heng Li, Jing Luo, Weiqing Sun and Xizhou Du examined the feasibility of building a power grid interconnection among Xinjiang, Pakistan and five Central Asian countries [311], while Xiaomeng Lei, Dawei Wang and Wei Wang speculated about the prospect of a Kazakhstan-China-Republic of Korea electric interconnection [312]. Youyi Zhang examined China's third-party market cooperation (第三方市场合作) under BRI and noted that Chinese renewable energy projects not only offer essential infrastructure and energy stability to recipient countries but also serve as a platform for collaboration between investors and project developers from China and Western multinational corporations [313]. The research conducted by Haili Xue, Xiao Lan, Qin Zhang, Haoguang Liang and Zixiao He raises questions regarding the green development level for participating countries in the BRI, despite the influx of foreign direct investment (FDI) from China [314].

Despite worsening economic downturn since the coronavirus disease 2019 (COVID-19) pandemic, Zhang Shiguo's research report in 2021 highlighted the intricate nature of China's energy transition, which is marked by challenges stemming from the country's rapid economic growth, reliance on coal and environmental concerns associated with its overseas petroleum extraction and mining [315]. While Boya Sun, Wenzhong Zhu, Nafeesa Mughal, Tolassa Temesgen Hordofa, Rinat Zhanbayev and Iskandar Muda underscored the importance of achieving sustainable economic growth through strategic investments in the human capital index and a focus on research and development in the field of renewable energy [316], a subsequent study by Jianmin Wang, Lixiang Wang and Han Wan verified that the process of decarbonising China's economy has resulted in varying degrees of gross domestic product (GDP) decline [317]. Zhangqi Zhong, Zhifang Guo, and Jianwu Zhang conducted a study to address the problem of GHG emissions by examining how engagement in global value chains influences the transfer of carbon emissions via trade [318].

In summary, Chinese historiography and Chinese academics provide a Sinocentric perspective for the dissertation author to understand the complexities related to China's energy diplomacy with specific post-Soviet countries and renewable energy transition. However, this perspective does not fully account for the diverse experiences, perspectives and historical narratives within the post-Soviet space.

Russian historiography. The importance of Russian historiography in this dissertation stems from the intertwined histories and shared Soviet pasts of Russia and the post-Soviet Central Asia. Lev Gumilev's "Eurasianism," which views Russia as a Eurasian civilisational state destined to unite the region [319], is one of the earliest and

most prominent perspectives that have contributed to the understanding of the intellectual discourse on Eurasian identity and Russia's role in Eurasian geopolitics. Angelina A. Kolomeytseva and Maria A. Maksakova explored the significance of energy and related potentials in realising the vision of a unified Eurasia. They asserted that Russia's strategic control over vast energy reserves, especially natural gas, has empowered it to use these resources to form alliances, exert regional influence and enhance the competitiveness of member countries of the EAEU in global markets [320]. The study undertaken by Yuliya A. Davydova, Ekaterina V. Kargapolova, Marina A. Simonenko and Andrey A. Lezhebokov on the Caspian region underscored the importance of pipeline infrastructure for promoting cooperation between Russia and Kazakhstan for mutual benefits and security in the Caspian macro region [321]. Lyudmila Chudinova and Sergei Podkovalnikov's studied the vast and interconnected electricity grid, which was established during the Soviet era across multiple countries, likewise validated the efficiency of electric power integration between Russia and Central Asia in the long term. The potential for constructing new interconnections with neighbouring regions beyond the post-Soviet sphere was also explored by these researchers [322]. Alexander Libman and Evgeny Vinokurov portrayed such development of regional cooperation policies between Russia, Central Asian countries and the wider post-Soviet space as an illustration of "Holding-Together Regionalism," a concept that refers to the initial composition of countries participating in a regional agreement and the establishment of borders that participants perceive as natural and reasonable. Yet, they are aware of the tendency of these countries to lean towards different extra-regional poles of influence, such as Turkey, the European Union, China, Romania and so on. [323].

Thus, in his examination of Russian foreign policy with countries within the post-Soviet space, Alexander Nikitin highlighted the controversy surrounding Eurasian regional integration. He posited that the collapse of the Soviet Union marked the beginning of a new era defined by geopolitical pluralism [324]. Konstantin Kurilev, Denis Degterev, Daria Stanis and Nadezda Smolik observed the emergence of competition, economic disparities and political tensions among the newly sovereign countries within the post-Soviet space, arguing that these were signs of the EAEU's dysfunction and a direct outcome of geopolitical pluralism [325]. Kristina Zemskova investigated how the initiative of a common energy market among the EAEU member countries can play its role in the process of Eurasian integration [326]. Taking into account the Western sanctions on Russia following its annexation of Crimea in 2014, Tatyana I. Pototskaya examined the potential implications for Russia's pipeline infrastructure in the fragmented post-Soviet space, highlighting the risks confronted by Russia in terms of its continental exports via pipelines as opposed to the prospects offered by maritime exports [327]. Sergey Zhiltsov examined the feasibility of installing a submarine pipeline in the Caspian Sea to explore alternative export pathways but acknowledged the obstacles posed by the Convention on the Legal Status of the Caspian Sea [328]. Mikhail Krutikhin, along with European energy scholar Indra Overland, addressed Russia's international political isolation and its cooperation with OPEC, acknowledging that the creation of OPEC+ in 2016, including Azerbaijan, Kazakhstan

and seven other petroleum-exporting countries, showcases Russia's recognition of shifting dynamics in the global energy market and its determination to protect its energy interests through collaborative efforts, particularly concerning oil market psychology and foreign policy side-benefits, to uphold the country's influence on the global stage [329]. Despite the continuation of the Russo-Ukrainian conflict since 2022 and the impact of intensified Western sanctions on Russian energy exports, Igor R. Tomberg noted that Russia's interactions with Central Asian countries remain positive, reflecting a deep-rooted interdependence that has endured for many years [330].

In summary, Russian historiography makes a significant contribution to understanding the geopolitical dynamics across Eurasia and beyond. However, besides being Russocentric, Russian historiography has been criticised for marginalising the experiences and perspectives of Central Asia.

Central Asian historiography. Central Asian historiography is crucial to this dissertation because it sheds light on the transition of the Central Asian region from a fragment of the Soviet bloc to a collection of sovereign states navigating post-Soviet economic and political challenges.

Vafo Niyatbekov and Khurshed Dodikhudoev, two academics from Tajikistan, extensively analysed the drawbacks faced by Tajikistan following post-Soviet independence when Central Asian countries encountered challenges in their pursuit of sovereignty. Their analysis presented a pessimistic viewpoint, highlighting the disparities in resource distribution, particularly in water resources among the Central Asian countries, the economic imbalances across the region and the lack of political will among leaders to address these issues [331]. Mirzokhid Rakhimov, from Uzbekistan, presented his narrative on the failure of Central Asian countries to maintain a high level of Soviet-era interdependency within the region and promote Central Asian regionalism since the collapse of the Soviet Union, emphasising the significant role that the West, Russia and China play in assimilating the remaining potential for regional cooperation in Central Asia due to their geostrategic competition in the region [332]. However, Farkhod Tolipov, from Uzbekistan, asserted a hopeful perspective on Central Asia since China launched the BRI in 2013. Tolipov's optimism was driven by the potential advancements facilitated by the BRI, which seeks to promote region-building and cooperation among Central Asian countries [333]. Tolipov also conceptualised the identity "Central Asia Five," underlining the importance of Central Asia's essential unity as a group of five countries progressing together [334].

In terms of intra- and extra-regional energy relations, Farkhod Aminjonov, from Uzbekistan, addressed the impacts of export diversification policies on the trade of Kazakhstan's oil and Turkmenistan's natural gas in the context of intra-regional energy security. He highlighted these countries' lack of consideration of energy demand at both intra-regional and even domestic levels, particularly in comparison to their energy ties with Russia, China, the United States, the European Union and India, as well as the lavish incentives that come with these connections [335]. Aminjonov also examined the adverse impacts of individual countries' self-reliant and self-controlled approaches to energy policy, particularly in terms of electricity distribution, during the early years of independence, implying that the full resumption of the Soviet-built

Central Asia Power System (CAPS) could result in shared benefits across the entire Central Asian region [336]. The Eurasian Development Bank report published in 2021 by Evgeny Vinokurov, Arman Ahunbaev, Nursultan Usmanov, Taras Tsukarev and Tulegen Sarsembekov examined the investment landscape within the water and energy sectors of Central Asia, which underscored the prevailing trend where energy initiatives are prioritised over water management and supply projects. Furthermore, the majority of these initiatives were primarily designed to fulfil the demands of national economies, often neglecting regional considerations [337]. Abdurashid Mirzayev, Head of National Dispatching Center in Uzbekistan, produced a presentation in 2023 that underscored the latest development of CAPS and the associated challenges but nonetheless empahsised that joint electricity supply to the Central Asian economies is a more economically feasible option than independent electricity supply by each country separately [338].

As the world grapples with climate change and renewable energy transition, Alina Abylkasymova, Bahtiyor Eshchanov and Farkhod Aminjonov from Uzbekistan, together with Daniyar Moldokanov from Kyrgyzstan, worked alongside European researchers Indra Overland and Roman Vakulchuk to investigate the wind energy potential of the five Central Asian countries and presented the theoretical wind power supply capacity in the region. The promising figures obtained from their study led to the anticipation that renewable energy transition in Central Asia is likely to accelerate, driven by the dual imperatives of energy security and sustainable development [339]. Regarding the construction of nuclear power facilities in Central Asia, a debate emerged when uncertainties were raised during a 2021 expert conference, in which Petr Svoyik from Kazakhstan, Marat Musuraliev from Kyrgyzstan, Khamidzhon Arifov from Tajikistan and Abdulla Abdukadirov from Uzbekistan participated. The discussion focused on the efficacy of nuclear energy as a solution to the growing energy deficit in the region. These experts asserted that Central Asian countries must increase their own national electricity generation capacities through conventional and alternative energy sources, and restore the CAPS [340].

In summary, experts from Central Asia have conveyed a narrative of resilience, adaptation and ambition in fostering intra- and extra-regional energy relations to stimulate development in the Central Asian region. However, regional generalisations often result in oversimplifications and inaccuracies when the unique circumstances of a particular country are not taken into account. The lack of perspectives from scholars of Kazakhstan in this section can be attributed to the fact that Kazakhstan, as the most energy-intensive economy per capita and the most developed country in the region, distinguishes itself from the overall Central Asian historiography.

Kazakhstan's historiography. Kazakhstan's historiography is fundamental in this dissertation as it establishes the groundwork for forecasting future prospects and challenges in the Republic's pursuit of global presence and diplomatic capacity. According to Yermukhamet Yertisbayev, a former adviser to Nazarbayev, Kazakhstan's multi-vector foreign policy and energy strategy were intertwined and formulated in accordance with the Republic's geographical location and the emergence of geo-economic and geopolitical realities in global politics following the end of the

Cold War. His observation reveals that Kazakhstan's foreign energy strategy has been characterised by a pragmatic approach that prioritises the maintenance of balanced relationships with multiple great powers and developed countries to safeguard national security and boost economic performance over adherence to specific ideologies [341]. Madali Naymanbayev, Zhazira Baltabekova and Nina Lokhova conducted a study on Kazakhstan's resource diplomacy, specifically examining how partnerships with extra-regional entities influence the production of rare earth elements in the Republic. By identifying key areas where technological advancements could be achieved through collaborations with partners from more developed countries, these findings aligned with Yertisbayev's insights on the crucial role of Kazakhstan's pragmatic foreign policy approach in maximising the potential of the Republic's resource-driven economy [342]. A research undertaken by Leila Delovarova, Biybinaz Almanova and Moldir Kiikbay further elaborates on the importance of the emergence of well-compensated employment opportunities, the enhancement of skills among the workforce and the transfer of advanced technologies in Kazakhstan's interactions with advanced European and Asian countries specialising in high-tech industries, renewable energy technologies and nuclear power facilities. Rather than warning of the potential ideological disruptions caused by international exposure, their findings recognised that these interactions are particularly essential for young specialists in Kazakhstan to increase their competitiveness and form communities of professionals from various industries for the modernisation of the Republic [343].

Amidst the positive economic relationships established with advanced extra-regional entities, Leila Delovarova, Nuriddin Sultanmuratov and Adilbek Yermekbayev explored the pivotal role of economics in fostering collaboration among the five Central Asian countries to address shared challenges within the Central Asian region, implying the continual relevance of their interdependencies in electricity and water management, geographical proximity, shared Soviet history and interconnected infrastructures if given favourable economic conditions [344]. Considering the emerging geo-economic and geopolitical landscape, Fatima Kukeyeva, Kuralay Baizakova, Karlygash Userova and Meruret Usen recognised the necessity of applying adjustment to Kazakhstan's multi-vector foreign policy to safeguard national interests amidst the increasingly intricate global realities, constant turbulence and the transformation of modern international relations. However, their perspective on the Central Asian vector was predominantly pessimistic due to the lack of self-sufficiency in terms of both economic and military capabilities among the countries in the region [345].

In terms of energy development, Serik Orazgaliyev investigated the cooperation between Kazakhstan's National Company KazMunayGas and multinational enterprises to drive the Republic's progress in operations, which included not only upstream crude production and exports but also downstream activities, such as crude processing and refining [346]. Togzhan Kassenova examined Kazakhstan's nuclear sector and the prospect of introducing nuclear energy into the Republic's energy matrix, covering issues ranging from energy security and economic growth to environmental stewardship and geopolitical sway [347]. Aisultan Alimkhan, Adilkhan Makhambayev and Ikechi A. Ukaegbu examined how global trends and future developments of

"Industry 4.0" and "Energy 4.0" will impact Kazakhstan's energy sector [348]. Yerkebulan Mukhambet, Dhawal Shah, Galina Tatkeyeva and Yerbol Sarbassov specifically explored the potential of utilising biomass wastes in small communities as part of the circular economy model in Kazakhstan [349]. It is also noteworthy that Kazakhstan possesses a substantial reserve of untapped geothermal energy, as indicated by a study by Zhanatgul Kaliakhmetovna Suleimenova, N. Shakerkhan and N. Ashimov [350]. In his research, Dulat Kazhkenovich Kalitov extensively analysed the distinct qualities of geothermal waters in the Almatinskaya Oblast [351]. Galiya Movkebayeva, Aliya Aktymbayeva, Nurken Baikadamov, Kamar Beketova, Marija Troyanskaya, Sholpan Smagulova, Aizhan Imangaliyeva, together with Russian researcher Yuliya Tyurina, conducted a comparative assessment of Kazakhstan's energy sector development and forecast the energy demand and the associated environmental impact in terms of economic growth up to 2040. While arguing that Kazakhstan could meet the 2040 target to improve energy efficiency, energy technology and service sector, the findings of their research illustrated that emissions are on an upward trajectory across the emissions-intensive sectors [352].

On this basis, despite the Republic's bold aspirations to reach carbon neutrality by 2060, Saule Akhmetkaliyeva's research on wind and solar energy revealed that the Republic's progress in implementing renewable energy technologies as a substitute for fossil fuels remains inadequate [353, 354]. In their study, Galiya Movkebayeva, Zhibek Bimagambetova and Marat Karatayev likewise stressed the importance of extensive government involvement as a fundamental requirement for the advancement of renewable energy technologies [355]. To enhance the development of human capital and pave the way for long-term sustainable growth, Aktoty Aitzhanova, Anastassiya Iskaliyeva, Venkataraman Krishnaswamy, Dmitry Makauskas, Hossein Razavi, Ahmad Reza Sartip and Aida Urazaliyeva proposed that governmental bodies should be encouraged to strategically harness oil wealth to create opportunities for Kazakhstan to expand its investments in renewable energy technologies [356].

Last but not least, it is crucial to take into account the research articles of Ka Wai Chrsitopher Hor, the dissertation author. Hor's research was distinguished by its originality, as he applied Brazil as a case study to explore the renewable energy transition in Kazakhstan [357], while also addressing the trends and challenges associated with conventional energy, renewable energy and Kazakhstan's multi-vector foreign policy [358-361].

In summary, the academic community in Kazakhstan offers a wealth of valuable insights that allow the dissertation author to explore the complexities inherent in the Republic's foreign energy policy from a local perspective. Nevertheless, the impact of renewable energy on Kazakhstan's diplomatic capacity and global presence have not been the subject of extensive discourse.

Scientific novelty of the research. In today's intricate energy scenario, with innovative technologies challenging the status quo, uncertainties arise over the once assured global presence of petrostates in powering the international system. Thus, the novelty of this dissertation lies in the use of a MMR methodology that, for the first time, combines international relations theories, a case study on Brazil and global data to

construct a forecasting model to scrutinise Kazakhstan's foreign relations in the context of renewable energy. In Kazakhstan's historiography, for the first time, a set of indicators identified through a case study on Brazil was used to examine how various significant, yet typical, internal and external factors would configure the Republic's approach to renewable energy transition and associated diplomatic activities. The dissertation author has pioneered novel pathways that facilitate a greater comprehension of the formulation of renewable energy-oriented foreign affairs strategies.

Amidst growing tripolarity in international relations and the global shift towards low-carbon energy, the dissertation author also adopted a novel approach to recognising the Central Asian vector and "second-tier" countries in Kazakhstan's multi-vector foreign policy, advocating an optimistic prospect that seeks to consolidate, rather than disperse, the respective energy interests of the great powers and other partner countries in accordance with emerging patterns of interdependence that foster energy security and carbon neutrality. Along with an identity re-invention, a form of "hybrid diplomacy," which combines elements of petroleum politics and renewable energy-focused foreign affairs strategies, was conceptualised for the first time as a viable strategy for Kazakhstan to address various energy challenges at the national, regional and international levels while ensuring its continued importance in global energy security.

Being aware of how renewable energy transition is much more than a mere substitution of energy technologies, the dissertation author was the first to incorporate concepts such as energy democracy, technocracy and social justice into the discussion of international energy relations. These concepts help explain the high latency found in Kazakhstan as well as many other petrostates in terms of policy resonance and action alignment with countries at the forefront of renewable energy transition, thereby contributing new insights into the dynamics of foreign relations in the context of renewable energy beyond the usual extent.

Points to defend. Following an in-depth analysis of the trajectory of Kazakhstan's foreign energy policy in the context of renewable energy, these points are to be defended:

1. While geo-related factors are influential to a country's foreign energy policy, diplomatic capacity and global presence in the post-petroleum world are linked less with neorealism's self-help and power struggles among states but rather with a framework of interdependence. This approach prioritises collaborative efforts between partner countries to attain both energy security and carbon neutrality, drawing upon principles of neoliberalism and constructivism. No single international relations theory dominates the landscape.

2. The case study on Brazil provides empirical evidence that enriches the understanding of a country's transition towards integrating renewable energy as a strategic element of its foreign policy. The identification of a collection of indicators in Brazil underscores some of the most fundamental but general internal and external conditions that can propel renewable energy to a central position in foreign policy-making in Kazakhstan and other countries.

3. Quantitative research utilising global datasets provides evidence for the intensity and trend of the association between diplomatic capacity and the uptake of

renewable energy, suggesting that countries that prioritise and promote renewable energy projects are more prone to develop sustainable and mutually beneficial interstate relations. This finding is closely linked to the case study on Brazil, where the positive correlation is consistent with Brazil's cross-border energy infrastructure projects with multiple neighbouring countries to attain mutual benefits.

4. Kazakhstan's multi-vector foreign policy serves as a strategic framework that enables the Republic to navigate the complexities of a changing energy landscape while safeguarding its interests. By maintaining a pragmatic stance through balancing its energy interests among the great powers and many "second-tier" countries, Kazakhstan develops a diversified portfolio of energy partners, which not only allows for the ongoing development of its fossil fuel reserves but also promotes investments in renewable energy projects. This dual approach fosters the adoption of a hybrid diplomatic model that integrates both petroleum politics and renewable energy-oriented foreign affairs strategies.

5. Renewable energy adoption transcends mere energy technology substitution. Kazakhstan's renewable energy transition signifies substantial changes to the political, societal and economic systems that have long been characterised by wealth concentration and dependence on fossil fuel rents. The absence of energy democracy and social justice into the foreign policy-formulation may complicate the Republic's efforts to enhance policy resonance and action alignment with the frontrunners in renewable energy transition.

1 Renewable Energy and Foreign Affairs

Although renewable energy does not involve as many grand diplomatic actions as fossil fuels, it has been an ascending priority for domestic and foreign policy worldwide over the last decade. This chapter explores the role of energy in shaping a country's foreign affairs strategies, focusing on international relations theories and their practical applications in Kazakhstan. Through a comprehensive analysis of Brazil as a case study, valuable insights into the country's energy diplomacy are further uncovered. Moreover, a correlation analysis using relevant quantitative data is conducted to shed light on emerging trends, clusters and patterns in the global energy landscape that Kazakhstan and the rest of the world are currently navigating.

1.1 Methodology and Theories

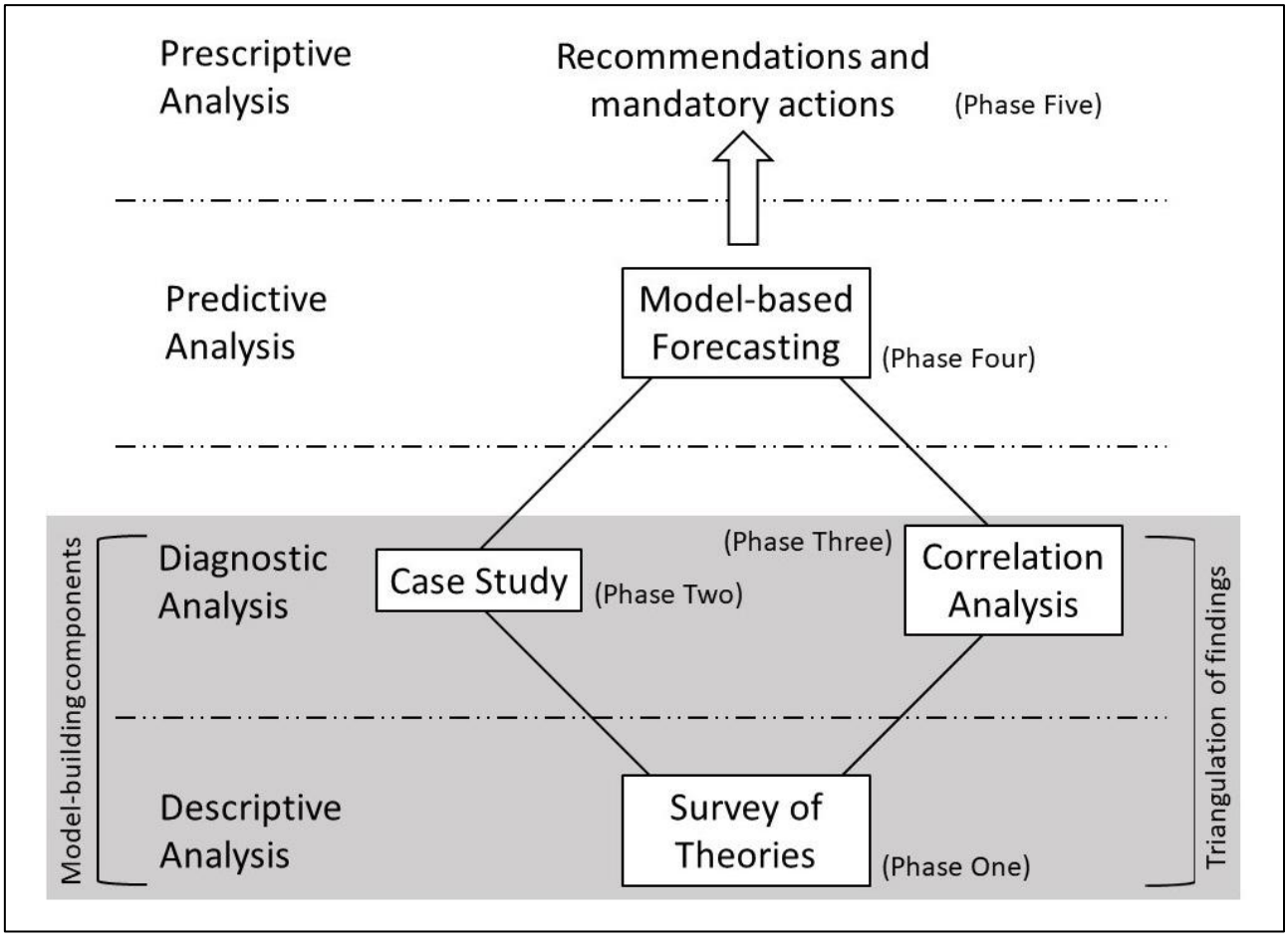
1.1.1 Mixed methods research (MMR) methodology

Scientific research is a systematic quest for knowledge. Positivism and interpretivism are two extreme mutually exclusive research philosophical paradigms of nature and sources of knowledge. The former regards the world as largely objective and measurable in terms of the use of numbers. The latter asserts that the world is largely subjective and that numeric measurement is not always possible or desirable; hence, words can indicate nuances more accurately [362]. The dilemma of choosing between these alternatives, or between quantitative and qualitative research methods, has traditionally been a central aspect of paradigm debate. This divide has paved the way for a third approach that is pragmatic. In the sphere of research philosophy, pragmatism acknowledges the presence of diverse methods for interpreting the world and conducting research. Consequently, by incorporating both positivist and interpretivist stances into a single research study, a more extensive comprehension of social realities can be attained, aligning with the specific nature of the research question. Within the pragmatist paradigm, theories and practices are comprehensively explored, encompassing both quantitative and qualitative research perspectives. This approach capitalises on the unique strengths of different research designs guided by the principle that "where natural science encounters limitations, social science flourishes, and vice versa [363]." In the field of research methodology, the mixed methods research (MMR) approach is closely aligned with a pragmatist worldview that emphasises the practicality of various methods. By integrating quantitative and qualitative strategies in data collection and analysis, MMR enhances the credibility and validity of research findings [364]. Although the title of this dissertation asserts that this is a case-based research, as renewable energy transition continues to unfold across the globe, the MMR methodology is deemed appropriate to provide an evidence-based and data-driven approach to address the multi-layered impacts of renewable energy on Kazakhstan's foreign affairs strategies.

The primary focus of case-based research lies in the analysis of cases shaped by interdependencies among various factors. This approach identifies the effects that emerge from the entirety of these interactions rather than attributing them solely to the

dominant or independent contribution of a single variable or a limited number of variables. Given that Kazakhstan is considered a newcomer to renewable energy, the essence of the research presented in this dissertation is exploratory based on the Republic's national capabilities and ambition to become a key element of global energy security. The primary methodology employed in this study is qualitative data analysis, which involves conducting a survey of relevant international relations theories and a case study on an anchor country. This approach is used to identify the underlying causal process. To gain a holistic understanding of the global landscape of petroleum dependence, energy transition and diplomatic capacity, quantitative analysis in the form of correlation analysis is conducted. This quantitative analysis, combined with qualitative data analysis, enables triangulation and facilitates the development of realistic and credible model-based forecasts. These forecasts are tailored to address the aim of the dissertation and the primary research question. Thus, the research design in this dissertation includes five phases, as illustrated in Figure 1. Apparently, the four types of data analysis, namely descriptive, diagnostic, predictive and prescriptive, are also incorporated to provide hints at each of the research methodologies that address what happened (descriptive), why something happened in the past (diagnostic), what could happen next (predictive), and what should happen in the future (prescriptive).

Figure 1 – Research design: a mixed method research methodology



In the first phase, at the descriptive level, a survey of international relations theories is conducted to explore the theoretical composition of Kazakhstan's foreign policy and the role of energy in its formulation since independence. Although the sphere of theories is characterised by perpetual emergence and competition among various perspectives, the use of theories in research yields numerous benefits. First, theories provide the underlying logic for understanding the occurrence of natural or social phenomena by elucidating the key drivers and outcomes of a targeted phenomenon, as well as the underlying processes responsible for generating that phenomenon. Second, theories assist researchers in making sense of their findings by enabling the synthesis of prior empirical evidence within a theoretical framework and resolving conflicting results by identifying contingent factors that influence the relationship between two constructs in different studies. Furthermore, theories offer valuable guidance for future research by facilitating the identification of abstract concepts and relationships that merit further investigation. Lastly, theories contribute to the accumulation of knowledge by bridging gaps between existing theories and allowing for the re-evaluation of established theories from a fresh perspective.

Despite these benefits, it is important to acknowledge that theories have their own constraints. As simplified interpretations of reality, theories may not always offer sufficient explanations for phenomena under investigation because they rely on a restricted range of constructs and relationships. Theories are intended to provide concise and parsimonious explanations, whereas actual reality may be considerably more intricate. Additionally, theories can restrict researchers' perspectives and hinder their ability to recognise crucial concepts that fall outside the scope of the theory. Therefore, to obtain a coherent, systematic and logical comprehension of Kazakhstan's foreign affairs strategies in association with energy, a survey of the most relevant international relations theories, including geo-related factors, neorealism, neoliberalism and constructivism, is essential but not exclusive. The survey should also take into account Kazakhstan's natural resources and strategic location, security concerns, strategies for desirable outcomes and state-building vision with respect to external actors and changes in the global energy landscape.

In the second phase, at the diagnostic level, a case study is conducted on an anchor country to identify a set of internal and external conditions, referred to as indicators, that move renewable energy to a central position in foreign policy-making. Within the various subfields of international relations, case studies are frequently used to gain insights and understanding. This is because each individual "case" offers several observations on intervening variables, which in turn enables the application of various qualitative measures to assess different aspects of independent and dependent variables. On this basis, a case study can be defined as a well-defined aspect of a historical happening that a researcher selects for analysis that does not necessarily suffer from indeterminacy.

For an accurate and realistic forecast of Kazakhstan's foreign relations in the context of renewable energy, it is crucial to conduct a case study on a significant petroleum-exporting country that shares similar attributes with Kazakhstan but has made substantial progress in transitioning to renewable energy. This anchor country

ought to provide valuable insights into the practical boundaries and limitations of the forecast and outline the expected range of acceptable actions associated with renewable energy transition [366]. According to the 2023 data, as shown in Table 1, three of the top fifteen crude oil exporting countries are considered highly developed in terms of renewable energy adoption: Norway, Brazil and Canada [106]. Among them, Norway and Canada belong to the Global North, whereas Brazil belongs to the Global South. With renewable energy accounting for 50.33 percent of Brazil's primary energy supply compared to Kazakhstan's 4.52 percent [122], the former is an obvious choice to be the anchor to help speculate how the latter would proceed towards deep decarbonisation and large-scale renewable energy adoption. Through a case study on Brazil's energy security strategy since the oil crisis in the 1970s, assisted by the software programme MAXQDA distributed by VERBI Software GmbH specifically for qualitative analyses, a set of internal and external conditions that reflect Brazil's renewable energy development and its engagement with other countries are identified as indicators that aid in forecasting Kazakhstan's prospect of using renewable energy as a foreign policy instrument.

Table 1 – Renewable energy deployment in the top crude oil exporting countries

	Share of global crude oil exports (2023) [106]	Share of renewable energy in primary energy supply (2023) [122]
Saudi Arabia	16.3%	-
Russia	9.1%	6.31%
United States	9.1%	11.66%
United Arab Emirates	8.6%	9.93%
Canada	7.7%	26.26%
Iraq	7.7%	-
Norway	3.9%	72.09%
Nigeria	3.8%	-
Kuwait	3.3%	3.86%
Brazil	3.3%	50.33%
Kazakhstan	3.3%	4.52%
Angola	2.5%	-
Libya	2.4%	-
Oman	2.3%	-
Mexico	2.1%	8.61%

To visualise the theoretical composition of Brazil's foreign policy and the level of importance of each indicator, relevant qualitative data is quantified through the use of the estimated ratio score. According to *The Mathematics of Collective Action* by James S. Coleman, assigning estimated ratio scores helps illustrate the direction of interests in international politics [365]. Because this dissertation is fundamentally a piece of qualitative research, estimation is made without considering any effect size

along with its confidence interval. By relying on the dissertation author's reasoned evaluation of the data, each international relations theory is assigned a ratio score between 0 and 1. This score indicates the theory's relative importance compared to other theories, with the sum score being 1. Likewise, a separate set of estimated ratio scores on a scale of 0 to 1 is assigned to quantify the level of importance of each indicator in Brazil's renewable energy-oriented foreign affairs strategies. These scores are assigned based on the indicator's relative significance compared to other indicators, ensuring that the total score equals 1. With a list of indicators identified at the end of this phase, the characteristics of Brazil's renewable energy-oriented foreign affairs strategies are expressed numerically, as presented in Section 1.2.6 (see Table 4 and 5).

In the third phase, also at the diagnostic level, a correlation analysis is performed on two variables in the form of two sets of relevant data to determine if a country's diplomatic capacity is affected by its responsive action according to changes in the energy landscape. Correlation analysis is a statistical technique that provides numerous benefits because it enables the simultaneous analysis of data from multiple subjects. In addition, it can be employed to examine the interrelationships between different variables. Equation 1, known as Pearson's *r* formula, is used to calculate the Pearson Correlation Coefficient *r*, where *x* and *y* are variables to be tested for correlation, and *n* is the sample size. Developed by Karl Pearson, an English mathematician and biostatistician, Equation (1) can be interpreted as a measure of the correlation between two objects possessing paired attributes. This equation calculates the sum of the products of the differences between the attributes and their respective object means, and then divides this sum by the product of the squared differences from the object means. In this dissertation, *x* represents a country's capability to shift away from petroleum dependence and *y* represents its sustainable diplomatic capacity.

$$r_{xy} = \frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i-\bar{x})^2}\sqrt{\sum_{i=1}^{n}(y_i-\bar{y})^2}} \qquad \text{Equation (1)}$$

To quantify these items, the Energy Architecture Performance Index developed by the WEF and the Global Sustainable Competitiveness Index by SolAbility Sustainable Intelligence are used as proxies. The Energy Architecture Performance Index – known as the System Performance Imperatives since 2018 – considers eighteen indicators that cover uses of low-carbon energy, diversification of energy supply and energy security of a country [159]. The Global Sustainable Competitiveness Index assesses a country's capacity to create and maintain inclusive prosperity while safeguarding its ability to sustain or enhance current levels of wealth. This evaluation is based on five key areas of progress: 1) natural capital; 2) resource efficiency and intensity; 3) intellectual capital; 4) governance efficiency; and 5) social cohesion [129]. The availability of a range of data across over one hundred countries between 2014 and 2023 helps verify the strength of the association between the independent variables (*x*) and dependent variables (*y*) over the years, determining whether renewable energy plays a significant role in prompting sustainable and mutually beneficial interstate

relations. The Pearson Correlation Coefficient serves as a descriptive statistic, offering a succinct overview of the properties exhibited by a particular data set. In particular, it elucidates the intensity and directionality of the linear connection between two quantitative variables. As the association between the two variables becomes more robust, the Pearson Correlation Coefficient *r* tends to approach either +1 or -1, contingent upon whether the relationship is positive or negative. Although interpretations of the strength of association vary between disciplines, Table 2 lists the correlation strength related to *r* [362]. It is worth noting that correlation is a measure of a linear relationship; thus a zero value is not indicative of the absence of a relationship but could imply the existence of a quadratic or any other higher degree relationship between the data points [367]. By loading Analysis ToolPak in Microsoft Excel, *r* could be calculated using the quantitative data collected. In addition, an understanding can be derived from the graphs plotted in accordance with the data sets, providing a visual representation of the emerging energy order in terms of the trends, clusters and patterns. However, it is imperative to differentiate between correlations and causations. Correlations merely indicate relationships between variables and should not be interpreted as cause-effect connections. In essence, correlations are contingent on the specific circumstances where which they are observed.

Table 2 – Pearson Correlation Coefficients related to the correlation strength [362]

Value of Pearson Correlation Coefficients *r*	Interpretation
0.90 to 1.00	Very strong correlation
0.70 to 0.89	Strong correlation
0.40 to 0.69	Moderate correlation
0.10 to 0.39	Weak correlation
0.00 to 0.09	Negligible correlation

In the fourth phase, at the predictive level, model-based forecasting is used to forecast Kazakhstan's foreign relations in the context of renewable energy. Forecasting in the field of international relations presents a unique set of challenges because of the multitude of variables involved, the unknown magnitudes of these variables and the unpredictable influence of random factors or external shocks. The intricacies associated with forecasting are further complicated by uncertainties surrounding future international dynamics. A vivid demonstration of this occurred in 1980 when esteemed economist Paul Samuelson, hails from the United States and is a recipient of the Nobel Prize, predicted a consistent growth trajectory for the Soviet economy. Samuelson considered the potential for the Soviet Union to outpace the United States. However, these projections were consigned to the annals of history as the Soviet Union experienced a collapse in 1991. The repercussions of this collapse left an indelible mark on the global stage, yet only a select few experts had the prescience to predict its imminent arrival. It has been argued that the forecasting of political events has been a subject of debate because of two main challenges. First, the accuracy of the predictions relies heavily on the reliability of the information used in the forecast. Second, a model

that effectively captures an expected event characterised by a structural break may not be suitable for scenarios in which routine changes are anticipated. However, the importance of international relations forecasting lies in its ability to achieve various objectives. These objectives include gaining insights into the unknown, exerting control over future outcomes, comprehending the overall dynamics of a system to better understand current conditions and preparing for the immediate future. In this regard, retrospective forecasting plays a crucial role in the studies of international relations. By drawing upon established theories, experiences from other countries and statistical data, retrospective forecasting can provide valuable insights. The past serves as a valuable laboratory of experiences and data, facilitating reflective examinations and blueprints for the future [366].

Although the historical events of specific countries may not directly shape the future of other countries, it is crucial to acknowledge that at one point in time, what is now regarded as the past may actually be the future. As the current renewable energy transition is characterised by nonhomogeneous progress across the globe, the gaps between the frontrunners and laggards reflect their differences in tackling key barriers, encompassing a variety of challenges such as technology and financial risks in nascent markets, as well as the complexities involved in integrating a significant amount of variable renewable energy into markets with existing infrastructure. Therefore, the significance of retrospective forecasting in this dissertation cannot be overstated, as it allows for the examination of lessons learned from a pioneering country, such as Brazil, which serves as a guiding light for newcomers, such as Kazakhstan, regarding potential changes in the specifications of the new energy order. Going beyond the boundaries of a conventional case study, the effects of renewable energy on Kazakhstan's foreign relations are explored using a model that incorporates components, criteria and patterns derived from international relations theories, a case study on Brazil and a correlation analysis of relevant world data.

To visualise the theoretical composition of Kazakhstan's current foreign policy and the level of importance of each indicator, qualitative data on Kazakhstan is quantified using the estimated ratio score. This helps differentiate the Republic's renewable energy-oriented foreign affairs strategies from those of Brazil, thereby identifying the two countries' relative competence and incompetence in this domain. Section 2.2.9 provides a numerical representation of Kazakhstan's renewable energy-oriented foreign affairs strategies (see Table 7 and Table 8).

In the final phase, at the prescriptive level, the theoretical and practical implications of renewable energy on Kazakhstan's multi-vector foreign policy and its contribution to global energy security are examined and summarised. Taking into account the knowledge acquired from the descriptive, diagnostic and predictive analysis, recommendations within the framework of Kazakhstan's Concept of the Foreign Policy for 2020-2030 were prescribed for the Republic to take advantage of opportunities to boost its diplomatic capacity and global presence while resolving relevant challenges amidst global renewable energy transition and carbon neutrality.

1.1.2 Survey of international relations theories

International relations theories offer diverse viewpoints and methodologies for understanding, examining and forecasting the choices made by states and non-state entities in their interactions. To understand the motives and aims that underlie Kazakhstan's foreign policy choices when faced with a rapid increase of renewable energy in global electricity production to 2.5 times its 2023 level by 2030 [184], a survey of international relations theories helps unveil the rationale behind the efforts of founding president Nursultan Nazarbayev (1991-2019) to build a "bridge between Asia and Europe," as well as the ongoing efforts of current president Kassym-Jomart Tokayev (2019-) to enhance the Republic's global presence in association through its multi-vector foreign policy.

Geo-related factors

As the world's largest landlocked country by land size, Kazakhstan shares borders with Russia, China, Kyrgyzstan, Uzbekistan and Turkmenistan and adjoins a large part of the Caspian Sea. Due to its very favourable geographical position, which translates into a diverse geological composition, apart from large fossil fuel reserves, Kazakhstan has more than eighty elements of the periodic table, including ferrous and non-ferrous metals, which can be found on its territory. The geologically diverse terrain of Kazakhstan exhibits a distinct pattern of primary resource nodes. In the northern part of the Republic, aluminium, iron and gold are primarily sourced. Moving towards the east, polymetallic ore mining takes the centre stage. Central Kazakhstan is known for its significant copper and manganese deposits. In the southern part of the Republic, a unique infrastructure for uranium mining has been established, while also serving as a supplier of phosphate materials. Lastly, western Kazakhstan offers a substantial supply of oil and natural gas resources, potassium and boron salts, and high-quality chromites [110]. Geologically and economically speaking, the North Caspian Basin, which spans across Kazakhstan and Russia, is home to a singular petroleum system that holds great significance. The estimated discovered reserves are approximately 19.7 billion barrels of oil and natural gas liquids and 157 trillion cubic feet of natural gas. The supergiant Tengiz and Karachaganak fields in Kazakhstan and Russia's Astrakhan field hold a substantial share of these reserves [107]. Notably, the Kashagan field, an expansive offshore oil reserve located in the Kazakhstan zone of the Caspian Sea, is expected to have a considerable impact on the Republic's future oil production, ranking fifth globally in terms of its size [109]. Thus the Republic's resources and mining industries undoubtedly have a direct impact on its engagement in foreign affairs because it exports approximately 89 percent of its mineral products, among which oil and natural gas commodities provide the most production value [102]. In addition, due to its location at the crossroads of different civilisations and the ancient Silk Road, in terms of cross-border mobility, Kazakhstan plays a crucial role in connecting East Asia, the Caucasus, the Middle East, South Asia and Europe. Alone or combined, these geo-

related factors create unique development opportunities and foreign affairs strategies for Kazakhstan to assert its global presence.

Geo-relate factors provide a framework for understanding the resurgence and implications of contemporary great powers' involvement in Kazakhstan and Central Asia as a whole. Since the early twentieth century, a continuous and enduring theoretical framework has been established that offers valuable insights into contemporary dynamics. This theoretical underpinning can be traced back to 1904, when Halford Mackinder, a renowned British geographer, first proposed the "Heartland" theory in response to geopolitical competition, referred to as the "Great Game," between the Russian and British empires in Afghanistan and adjacent areas, known as "the pivot area," for world domination [220]. The theory was subsequently developed in response to significant global events, culminating in its final formulation in 1943. This formulation identified the northern-central core of Eurasia as the prospective geographical foundation for a world empire, encompassing Central Asia and substantial portions of Iran and Russia. In Mackinder's view, political geography and geopolitics are based on physical geography. His ideas and concepts provide a geo-historical perspective on events.

Nicholas Spykman, like Mackinder, recognised the paramount importance of geography in shaping foreign policy, emphasising its enduring nature. However, Spykman argued that the Heartland was just a geographic space open to cultural and civilisational impulses from the Rimland, a strip of coastal land that encircles Eurasia. His perspective implies that Mackinder's pivot does not possess an independent historical role, whereas the Rimland holds paramount importance in terms of global dominance. This assertion was substantiated by highlighting the maritime power's capacity to forge a web of alliances encircling the Rimland, effectively denying the Heartland access to the sea [221]. In a broad sense, both Mackinder's Heartland and Spykman's Rimland theory guided the United States' Cold War decision-making, with military strategies in compliance with their concepts – the ideas of nuclear deterrence and the policy of containment – adopted to counter the Soviet Union [222].

After the Cold War, the geopolitics of Eurasia have increased their noteworthiness due to the emergence of new ethnic conflicts and the presence of abundant petroleum resources in the post-Soviet space. In agreement with Mackinder's theory, Zbigniew Brzezinski of the United States stated in his 1997 book *The Grand Chessboard* that "Eurasia is ... the chessboard on which the struggle for global primacy continues to be played." Kazakhstan was portrayed as a shield for other Central Asian countries in relation to Russia, implying that Russia's influence in post-Soviet Central Asia would not be effectively asserted unless this geographic shield was first penetrated. Moreover, Brzezinski identified the cluster of Central Asia, the Caucasus and the surrounding areas as the "Eurasian Balkans," predicting that it would be a centre of major crises in the future due to its proximity to its most immediate and powerful neighbours, namely Russia, Turkey, Iran and China, and its enormous concentration of petroleum reserves and important minerals [228]. Such an anticipated struggle for control over oil and natural gas resources, infrastructure and geopolitical influence in post-Soviet Central Asia and the Caucasus has been referred to as the "New Great Game," a unique

scenario in which political and economic interests collide in a complex chessboard composed of powerful external actors [279]. To prevent potential challengers to American interests from emerging in the post-Soviet space, Brzezinski urged the policy-makers of the United States to take up Britain's role in Mackinder's hypothesis and called for the maintenance of "geopolitical pluralism," which was marked by the fragmentation of nation-state sovereignty within the borders of the Commonwealth of Independent States (CIS), while creating strategic challenges for Russia to implement its own strategic tasks within the post-Soviet space [227]. Following the September 11 attacks in 2001, the repositioning of Central Asia from the periphery to the core of the United States' strategic interests, primarily due to its proximity to Afghanistan, appeared to have solidified the inevitability of the great powers' involvement and intricately entangled the geopolitical dynamics in the region.

While the logic of Brzezinski's academic work was in line with the United States' hegemonic position in conflict-prone Eurasia, the integration of the Eurasian space based on the concept of the great Russian "super-ethnos" to accomplish ethnic consolidation for the Eurasian culture was advocated by the work of Soviet and Russian historian Lev Gumilev. Gumilev's ideas of Eurasianism, as conveyed in his book *Ethnogenesis and the Biosphere* (*Этногенез и биосфера Земли)*, challenged conventional nation-state boundaries and transcended geopolitical interests by presenting a vision of interconnectedness, where the vitality of ethnic groups contributed to the resilience of the entire Eurasian biosphere [319]. The formation of the Russia-led Eurasian Economic Union (EAEU), which unites Russia with former Soviet countries in Central Asia, the Caucasus and Eastern Europe, can be understood within this framework. Beyond Gumilev's theory of "passionarity," which is reflective of his conviction of the biological nature of the ethnos, the EAEU mechanism empowers Russia to strategically align with other petrostates in the post-Soviet era, thereby reinvigorating its historical sphere of influence and advancing its foreign policy objectives [324]. Leveraging its abundant energy resources, Russia employs coercive tactics against European and Asian countries heavily reliant on its exports of crude oil, natural gas and petroleum products. This calculated approach solidifies Russia's position as a dominant player in the global energy market. In fact, the exclusive emphasis placed on oil and natural gas in the sphere of energy geopolitics can be ascribed to the distinctive geographical and technical characteristics associated with these energy systems. These characteristics have played a significant role in shaping the current dynamics of interstate energy relations [247]. With Russian foreign policy increasingly integrated with energy strategy under current president Vladimir Putin (2000-2008, 2012-), Russia has resurged as a new type of energy state poised to mitigate the growing infiltration of the United States in some former Soviet republics. In search of an intracontinental transport corridor other than through the Suez Canal and around the Cape of Good Hope, in 2007, Russia and Kazakhstan began to consider building the Eurasia Canal for large cargo vessels and oil tankers to sail between the Caspian Sea and the Sea of Azov. The idea has since attracted attention from multiple countries in the Black Sea and Central Asia, as well as Iran and China, because of its potential to connect the energy-rich Caspian Sea basin and Gulf region with European and Asian markets. If built, the Eurasia Canal offers immense

potential for Russia and Kazakhstan to capitalise on their geographic position while reinforcing Russia's position as a guarantor of stability for many countries in Eurasia. Even with a certain level of tension in Kazakhstan-Russia relations reported since Russia's invasion of Ukraine in 2022, Kazakhstan maintains its rather accommodating stance towards Russia's concerns over security, status and power with respect to the geographical pivot of Central Asia [330].

It is undeniable that Brzezinski's geopolitical pluralism has posed challenges to the progress of integration among the newly independent states, raising uncertainties regarding Gumilev's vision for Russia as a system-forming element in the post-Soviet space [325]. Nevertheless, China's ascent as the foremost energy consumer globally since 2019, coupled with its position as the second-largest economy in the world since 2010, has empowered it to establish itself as a dynamic participant in Central Asia, taking the position of the region's key trading partner, largest de facto lender and source of development financing. It has been argued that China's vision of "building a community of a shared future for humanity (构建人类命运共同体)" through its global infrastructure development strategy, known as the Belt and Road Initiative (BRI), launched in 2013, was not rooted in the country's aspiration to accumulate more wealth and power; nor was it a geopolitical scheme to carve out a Chinese sphere of influence. On the contrary, it represents humanity's relentless pursuit of common interests and universal values [315], in which the pioneering concept of the "third-party market cooperation" model has been promoted to establish a link between China's manufacturing capabilities and advanced countries as well as global financial institutions, namely, third parties, in the developing world to serve the interests of all participating parties [313]. Such multibillion-dollar geo-economic thrust has already turned Central Asia into a transport and logistics hub with an infrastructure network of roads, rail and oil and natural gas pipelines stretching across the Eurasian supercontinent. Since the Eurasia Canal remains at the conceptual stage as of 2023, the development of land transport corridors through China and Pakistan provides Central Asia with a vital link to ocean shipping, serving to overcome the region's landlocked geography.

It is worth noting that Central Asia's increased access to the global supply chain through improved infrastructure for better connectivity has given the countries therein opportunities to be integrated into the global value chains and transition from mere suppliers of natural resources and raw materials to manufacturers of goods and services. This is a crucial step for them to achieve economic diversification and a low-carbon economy in accordance with their nationally determined contributions (NDCs) under the Paris Climate Agreement.

Against the backdrop of these vested features, Kazakhstan has been implementing a multi-vector foreign policy since gaining independence in 1991, characterised by constant rebalancing among the United States, Russia, China and other influential actors, including the European Union. Yermukhamet Yertisbayev, a former adviser to Nazarbayev, posited that Kazakhstan's multi-vector foreign policy is not solely a subjective desire or a mere "doctrine" of Nazarbayev. Instead, it appears to be shaped by the geographical location of the newly independent state and the emergence of post-Cold War geo-economic and geopolitical realities in global politics, particularly in

Central Asia [341]. Regular adjustments are essential to address the challenges and capitalise on the increasing array of prospects that arise along the borders of the Republic [345]. Consequently, the competition among the great powers and their shared objective of addressing energy security issues have resulted in significant influxes of foreign direct investment (FDI) into the infrastructure responsible for transporting Kazakhstan's petroleum to global energy markets. This infrastructure includes pipelines, tankers and railways, which facilitate exports in multiple directions. As a result, Kazakhstan witnessed a notable increase in its global energy market share and enhanced its presence in the international arena. This growth is reflected in the Republic's gross domestic product (GDP), which has surged from USD$20 billion in 1992 to USD$225.5 billion in 2022 [100].

There is little doubt that Kazakhstan's increasing global presence as a key element of global energy security appears to be due to Central Asia's geopolitical destiny as the world's pivot of energy resources. However, beyond the scope of geo-related factors, state security, complex interdependence and the ruling elite's distinctive state-building visions are other key elements that contribute to understanding the Republic's foreign affairs strategies.

Neorealism

Kazakhstan had inherited from the Soviet Union the fourth largest nuclear arsenal in the world, which would have provided the Republic with absolute deterrence capacity. Given the sense of external vulnerability and unclear fate of conventional forces stationed within Kazakhstan's territories after independence, the possession of nuclear weapons presented an attractive opportunity for Kazakhstan to leverage against any security threats in the early 1990s. However, the ruling elite of the Republic chose to relinquish their nuclear capabilities to Russia. Such a resolution to the nuclear dilemma confuses neorealist logic.

Neorealism, also known as structural realism, primarily examines the systemic level of an international system rather than individual units within it. This analytical approach prioritises structural factors and assigns lesser significance to local and individual-level factors in terms of causal priority. From its origins in Niccolò Machiavelli and Thomas Hobbes to Hans Morgenthau and classical realism, neorealism has become popular within the field of international relations. As described by Kenneth Waltz and John Mearsheimer, neorealism argues that the international system operates in an anarchic manner, lacking any hierarchical structure among states and a central authority. In the absence of a governing body to safeguard their interests, states resort to the strategy of "self-help" by amassing power to secure their survival within the tumultuous global order. The process of power accumulation leads to a sense of insecurity among other states, prompting them to enhance their own capabilities. This results in relative gains, where one state's gain is perceived as another state's loss, creating a competitive "win-lose" or "zero-sum" environment. Properly understood, neorealism contends that states should pursue internal balancing strategies where feasible and external balancing strategies where necessary. Alternatively, a weaker

state may adopt a bandwagoning strategy to align itself with a hegemon. This strategy occurs when the weaker state determines that the advantages of opposing a stronger power are outweighed by the costs. To differentiate between these concepts of alliance building, external balancing refers to the act of forming alliances with others to counter a prevailing threat, while bandwagoning refers to the act of aligning with the very source of danger [224]. Such a materialist understanding of structures implies that capabilities are the ultimate basis for state security, and the distribution of capabilities under anarchy is of paramount importance [225].

Against the backdrop of the Soviet legacy and the current Russia-Central Asia subsystem, Kazakhstan's foreign policy formulation could be analysed through neorealism. In particular, Russia sought to channel regional policies through the CIS during the early 1990s and proceeded to create several other economic and security organisations that offered ready avenues for bandwagoning, including the CIS Free Trade Area, the Collective Security Treaty Organization (CSTO) and the EAEU. Access to Russia's extensive pipeline network has also been considered strategic for increasing Kazakhstan's petroleum exports and driving the Republic's economy forward. Above all economic and cultural ties, Russia's superior military power has undoubtedly been a crucial component of Kazakhstan's post-independence security strategy. It is noteworthy that, despite the obvious strength of these connections, Kazakhstan's chief foreign policy objective has been to increase and maintain its own sovereignty and influence, which requires increasing autonomy from Russia and, in some cases, policies that cause annoyance to Russia. For instance, the "Latinisation" of the Kazakh language since 2017, the denunciation of Russia as a problematic "outside mentor" in a 2018 summit of all Central Asian countries and the refusal to recognise Russia-backed breakaway territories of Ukraine in 2022. More importantly, Kazakhstan has pursued external balancing of its foreign policy agenda by seeking closer cooperation with its Central Asian neighbours since 2017. As stated in the Republic's Concept of the Foreign Policy for 2020-2030, "Kazakhstan needs to consolidate its status as a responsible participant in the world community, a key contributor to the system of geopolitical and geo-economic coordinates of the Eurasian continent, and a leading state in the Central Asian region [9]."

Despite Kazakhstan's efforts in internal and external balancing, the Republic does not appear to be overturning the asymmetric balance in the Russia-Central Asia subsystem and leading other Central Asian countries out of Russia's shadow. The imbalance of power still overwhelmingly favours Russia, let alone the likelihood of a Russian intervention if instability occurs in the Central Asian region, as exemplified through joint military drills between Russia, Uzbekistan and Tajikistan in the summer of 2021 during a "deteriorating" situation in neighbouring Afghanistan and the first ever peacekeeping mission for the CSTO collective contingent in Kazakhstan in January 2022. However, Kazakhstan's foreign policy approach has been characterised by a combination of balancing actions and bandwagoning with multiple great powers, including Russia, simultaneously. This strategy appears to deviate from the predictions of neorealism. Specifically, the Republic's multi-vector foreign policy has showcased a unique form of relational power, enabling a weaker state to address the challenges of

dependence while engaging in an asymmetrical relationship [281]. By using the great power competition between Russia, the United States and China, Kazakhstan has managed to reap the benefits of the region's challenging geopolitics, protecting itself from being a client state of the hegemons while extracting increased benefits, assistance and better contractual terms from them to serve its interests.

Although a neorealist approach to foreign affairs undermines the multiplicity of variables that explain a state's foreign policy formulation, it has exerted a dominant influence on the theoretical framework in the sphere of energy research, with its primary focus being the role of state actors and their interests in the context of energy security. It is noteworthy that the neorealist perspective emphasises that states are not solely focused on attaining relative gains; they also harbour concerns about the potential loss of their position vis-à-vis other states in the international system [223]. Given the competitive nature of energy supply, it is imperative to employ profound strategic analysis and military capabilities to safeguard energy imports and secure control over finite energy reserves. When announcing his ambitious Kazakhstan 2050 Strategy in 2012, Nazarbayev's decree that "Kazakhstan is one of the key elements of global energy security" [76] was reflective of the Republic's strategic focus on making petroleum exports as a foreign policy instrument and strengthening its competitiveness in global energy markets.

Being the largest consumer of primary energy in the world by far, China has long wanted to improve its energy security by diversifying its energy matrix, energy suppliers and transportation routes, and Kazakhstan provided one of the most convenient solutions. Some studies have asserted that China's energy investment has been regarded as a challenge to the interests of Russia and the United States in Central Asia, but little evidence has been found to support the claim of the "China Threat" on the basis that China does not seek hegemony, does not face practical threats from any Central Asian countries, works well with Russia and is still a developing country [307]. By entering into an energy cooperation agreement with China, Kazakhstan has effectively obtained the required FDI to develop new pipelines and infrastructure, thereby diminishing Russia's control over its vital energy exports. Furthermore, given the turbulent relations and public disputes between Russia and Kazakhstan since the start of the war in Ukraine in 2022, the potential construction of the Trans-Caspian Gas Pipeline would grant Kazakhstan access to the European market via Azerbaijan and Turkey. Despite Russia's opposition to this development and citing a violation of the 2018 Convention on the Legal Status of the Caspian Sea [328], Kazakhstan has successfully maintained its sovereignty over its petroleum industry. By strategically engaging with multiple major powers, Kazakhstan has ensured that no single foreign entity holds undue influence over its energy resources. Such an approach to foreign energy relations – using petroleum to engage multiple great powers to neutralise multiple potential external threats – cannot be fully explained through a neorealist framework.

While fossil fuel demand has been growing for two hundred years, the use of petroleum as a foreign policy instrument might be about to enter a structural decline. With climate change mitigation increasingly embedded in the energy landscape, the development of a decarbonisation pathway for the global energy system is already

underway. Neorealists have the option of either perceiving nuclear energy as a favourable route for energy security and national capability building or turning innovative solutions that facilitate the production, transmission, distribution and usage of renewable energy into assets of strategic significance. In either case, the new energy order is anticipated to take the form of competition between the great powers in terms of market shares in energy generation technologies and control over the supply and value chains of low-carbon energy [249]. Kazakhstan's lack of self-help capabilities to adapt to a new type of technology-based energy diplomacy might prompt it to develop actionable foreign policy solutions that are not entirely based on neorealism.

Neoliberalism

Scrutinising Kazakhstan's interaction with foreign countries during the past thirty years, the Republic's aim to build an image of a responsible and constructive actor in international society has been prominently manifested. Besides actively participating in international cooperation and reaching out extensively, it is worth noting that Kazakhstan applied for accession to the World Trade Organization (WTO) in 1995 and formally became a member in 2015. This membership not only preserves Kazakhstan's individuality as a sovereign state but also implies the necessity for the Republic to obey rules and guidelines for the benefit of both parties, making neoliberalism relevant in the theoretical composition of Kazakhstan's multi-vector foreign policy.

Neoliberalism, alternatively referred to as neoliberal institutionalism, emerged during the 1970s as a response to traditional international relations theory. This theory places greater emphasis on the overall benefits that a state can derive from a particular policy than by focusing on relative gains. Neoliberalism challenges the notion that policy-makers primarily seek "win-win" situations in which all parties involved benefit rather than perceiving agreements as "zero-sum" games. By integrating elements of power politics and economic liberalism, Robert Keohane and Joseph Nye attempted to address the following question: can international cooperation continue to develop and prosper in the absence of hegemonic power? While sharing neorealism's belief that states prioritise their own interests, they adopted a significantly more positive outlook on the potential for cooperation. Neoliberalism asserts that institutions play a crucial role in facilitating cooperation among states because they serve as a coordinating mechanism by ensuring a fair distribution of information among potential collaborators. This, in turn, helps minimise the costs associated with monitoring individual compliance and enables states to effectively impose sanctions on non-compliance [231]. The recognition of non-state actors, non-military sources of influence, interdependence, international institutions and cooperation outweighs the emphasis placed by neorealism on states, military power, self-sufficiency, conflict and the absence of a central authority.

To illustrate that states are completely linked together in various aspects of their national resources, Keohane and Nye introduced the notion of "complex interdependence" as a fundamental element of the neoliberal perspective [233]. Energy interdependence plays a crucial role in ensuring energy security for all states. Non-state institutions, such as the Organization of the Petroleum Exporting Countries (OPEC) and

multinational oil companies, dominate interactions in liberal market economies [329]. This blends global fossil fuel resources with the economies of producing, consuming and transiting countries. Discussions about ecological interdependence, renewable energy transition and energy electrification have intensified in the international community due to the threat of climate change. The United Nations Climate Change Conferences, held annually within the framework of the United Nations Framework Convention on Climate Change (UNFCCC) since 1995, reflect the orthodoxy of neoliberalism. During these conferences, participating countries seek common ground to reduce GHG emissions by considering market mechanisms as a means of governing human interference with the climate system. The surge in renewable energy development and growth of renewable energy markets worldwide can be attributed to various factors, including state policies, intergovernmental collaboration, and international advocacy. The implementation of neoliberal principles, along with the increasing adoption of the United Nations' Sustainable Development Goals and the Paris Climate Agreement, has further contributed to this global transformation.

In recognition of the importance of neoliberal internationalism, Kazakhstan has been strategically aligning itself with the great powers and other extra-regional actors to secure mutual benefits, according to its multi-vector foreign policy. The establishment of the Conference on Interaction and Confidence-Building Measures in Asia in 1992, which has been the sole international platform for stable dialogue on Asian security issues since 1999, and the construction of the Caspian Pipeline Consortium (CPC) pipeline system in 2001, which symbolises the growing Eurasian economic interdependence between Kazakhstan and Russia [321, 327], are two examples. However, understanding intra-regional relations among the five post-Soviet Central Asian countries within the framework of neoliberal regionalism is difficult because of the intricate effects induced by geopolitical pluralism. Despite Nazarbayev's efforts to establish the Central Asian Union in the early 1990s, the period from 1994 to 2005 was marked by ineffective implementation. Internal disparities among Central Asian countries, their susceptibility to external influence, rivalry between Kazakhstan and Uzbekistan, coupled with the latter's diminishing interest in intra-regional cooperation, posed significant challenges. Faced with Turkmenistan's permanent neutrality status, Kyrgyzstan and Tajikistan felt overlooked because of their relatively smaller size compared to their larger neighbouring countries [331, 332]. As a result, not only did the endeavour to achieve shared customs, anti-dumping measures, tax policies and currency convertibility become increasingly unattainable between Central Asian countries, but the task of maintaining the Soviet-established interdependence framework, particularly in the domains of water and energy, which were established before 1991, proved to be arduous among them. Simultaneously, the organisation underwent a change in nomenclature, transitioning from the Central Asian Union to the Central Asian Economic Community, and eventually rebranding itself as the Central Asian Cooperation Organization.

The period from 2005 to 2016 represented a period of fragmentation when regional cooperation in Central Asia expanded to include overlapping regional organisations promoted by international organisations or countries from neighbouring regions. The

Central Asian Cooperation Organization was disbanded following its integration into the Russia-dominated EAEU, which evolved from the Eurasian Economic Community with Armenia, Belarus, Kazakhstan, Kyrgyzstan and Russia as its current member countries. It is considered the first successful example of regional economic integration between countries from the former Soviet Union, described as "Holding-Together Regionalism" – integration of countries originally part of a single political entity [323]. China's rise as a dominant economic force since the 2000s has also profoundly impacted Central Asian countries, highlighting the necessity for China to establish strategic partnerships with the region through a model of good-neighbourliness and friendship on a multilateral basis [306]. In addition to the Shanghai Cooperation Organisation (SCO), which evolved from the Shanghai Five in 1996 with China, India, Iran, Kazakhstan, Kyrgyzstan, Pakistan, Russia, Tajikistan and Uzbekistan as current member countries, China's BRI, initiated in 2013, has played a crucial role in fostering region-building within Central Asia. Through the establishment of new economic and infrastructure linkages, the five Central Asian countries became intricately connected to China's sphere of influence [333]. Although Kazakhstan's autonomy and independence appear to have been compromised due to the significant military and economic asymmetry between itself and some of these powerful extra-regional partners, their shared interests in stability and common understanding of security have made large-scale armed conflicts and prolonged unrest in Central Asia inconceivable. As of 2023, despite Russia's invasion of Ukraine and the irregular border clashes between Kyrgyzstan and Tajikistan, the collective aspiration of all involved countries to collaborate to enhance regional security, foster economic growth, maintain political stability and promote prosperity has reduced the occurrence of a New Great Game [330].

This favourable condition for cooperation indeed reignites the practices of neoliberal regionalism between Kazakhstan and the other four Central Asian countries. The Central Asia Power System (CAPS), also known as the Unified Energy System of Central Asia, is of utmost importance for the region to effectively meet its rapid economic growth and surging electricity demand. Created in the 1970s with the purpose of ensuring consumers' electricity supply through a regional network that collaborated to produce and distribute energy from the various sources available in Central Asia [290, 340], the function of the CAPS witnessed a sharp decrease when Central Asian countries independently took charge of energy decision-making after the disintegration of the Soviet Union. However, following the dealth of Islam Karimov, the enduring autocratic leader of Uzbekistan, in 2016, discussions about the CAPS' full resumption since 2017 have attracted not only intra- but also extra-regional interests. The European Union [295], the United States [209], China [308, 311, 312] and Russia [322] have all unveiled their visions for the region to become an energy cluster that enhances energy security and facilitates low-carbon transition within and outside the Central Asian region. On this basis, the CAPS represents a neoliberal platform that manages energy relationships and fosters the distribution of energy-related collective goods among the five Central Asian countries after years of limited cooperation, enabling the region to gain significance as an energy cluster.

Kazakhstan's participation in the CAPS can be seen as a strategy to manage its relationships with the great powers and promote mutually beneficial interactions in the region. The desired outcome is an increase in cooperative interactions among the five Central Asian countries, which demonstrates three key attributes of complex interdependence: 1) the existence of numerous channels linking societies; 2) the absence of a hierarchical structure in addressing issues; and 3) the minimal role of the military force [233]. These attributes lay the foundation for further development in the region, whether or not integration is involved. It is important to recognise that the concept of interdependence is deeply ingrained in traditional integration theories. These theories emphasise the importance of intra-regional economic interdependence in regional integration projects. Neofunctionalism, for example, suggests that interdependence facilitates the transfer of regional integration from one sector to another and eventually into the political domain [230]. On the other hand, liberal intergovernmentalism argues that the outcomes of treaty negotiations in regional integration projects can be explained by asymmetric economic interdependence [234]. Institutionalists contend that interdependence and transnational exchange require the establishment of regional institutions and mechanisms that ensure stability through positive feedback [232]. In essence, all of these integration theories are based on the economic rationale of intra-regional trade and investment, with the aim of eliminating barriers to trade and investment within the region while promoting economic growth and prosperity. However, these integration theories have limitations because they focus primarily on the European example, rendering them questionable for direct application to regions like Central Asia, where the structural prerequisites for regional integration differ [238].

A fully operational CAPS would exemplify neoliberal energy regionalism. This mode of regional integration adds an energy dimension to the existing economic and security interdependence among the five Central Asian countries. It takes into account the spatial and material conditions of the Central Asian region, such as its energy infrastructure and resources [257]. In the modern era, multiple cases can be observed in which countries are interconnected through various regional institutions, markets, infrastructure and politics, all of which revolve around energy-related matters. Notable examples include the Association of Southeast Asian Nations, the European Union, the Southern African Development Community, the Economic Community of West African States, the United States-Mexico-Canada Agreement, the Common Market of the South (MERCOSUR) and the EAEU. These intergovernmental organisations have implemented formal agreements and established dedicated institutions to address energy-related issues. They cover various energy sources, including renewable, nuclear and fossil fuel sources. Moreover, these organisations oversee the management and regulation of pipelines and electricity grids. From a neoliberal perspective, the relationship between energy interdependence and regionalism can be assumed to be positive. However, it is crucial to consider key factors such as regional rivalry, regional hegemonism, regional identity and the significance of political and institutional non-state actors. These factors directly affect the regional governance of energy resources. For Central Asia, where regional integration has failed in the past, neoliberal energy regionalism has been proposed as a solution to help the five countries overcome their

energy deficits and serve as the first step towards region-based order-making and order-maintenance. One proposal is to establish a United Central Asian Energy and Water Committee, in which national representatives are mandated by parliaments or governments with high authority. This cooperative effort would help restore the CAPS, especially when accompanied by an increase in installed capacities across the five Central Asian countries. It would also require improved political interaction, a legal framework and a favourable investment climate [340].

It is worth noting that the rise of Shavkat Mirziyoyev as President of Uzbekistan in 2016 after almost twenty-seven years of rule under Karimov marked a significant change in Central Asian intra-regional relations. This implies the decisive role played by the ruling elite in both domestic and foreign affairs in Central Asian countries. To understand Kazakhstan's foreign affairs strategies since independence, Nazarbayev's unique state-building vision and the characteristics of his regime cannot be overlooked, which at times were deemed to include practices and considerations beyond geo-related factors, neorealism and neoliberalism.

Constructivism

Constructivism emerged in the mid-1990s as a challenge to neorealist and neoliberal theoretical paradigms, responding to international changes where economic restructuring, technological advancements, and globalisation shifted global power from Western to Eastern countries. This shift coincides with the recognition that state sovereignty has been undermined by the importance of scientific knowledge. As a social theory, constructivism proposes that human interaction is primarily influenced by ideational factors, particularly inter-subjective beliefs. Collective beliefs play a crucial role in shaping the identities and interests of actors [238]. One notable contribution of constructivism to the study of international relations is its recognition that a state's identity profoundly impacts its interests, preferences and behaviours. This understanding allows for a more nuanced analysis of international relations dynamics. Alexander Wendt and Peter Katzenstein emphasised the role of identity in shaping interests and state policy. Wendt argued that identities serve as the foundation for interests [235], whereas Katzenstein viewed identity as varying across different countries [237]. These perspectives highlight the limitations of neorealism and neoliberalism, which fail to acknowledge the human traits of states such as intentionality, rationality and interests.

The state-building endeavours of Nazarbayev in Kazakhstan can be attributed to constructivism, which highlights the significance of actors, particularly those in positions of power such as the ruling elite and influential citizens. These actors consistently influence and occasionally alter the fundamental dynamics of international relations through their actions and interactions. Nazarbayev served as the president of Kazakhstan from April 1990 for almost three decades before his resignation in March 2019. Despite mounting pressure to establish the Kazakh nation-state, a dominant theme that influenced Central Asia in the 1990s, he considered it arduous to build and promote common state identities to reinforce social cohesion. With history offering

resources to construct state identity based on the Eurasian notion of multi-ethnic identity, Nazarbayev often explicitly defined Kazakhstan as a Eurasian state, which is neither eastern nor western, nor Islamic nor Christian; rather, the state should be a bridge between both. In Nazarbayev's words, Kazakhstan as a Eurasian state seeks "mutually advantageous" and "good neighbourly relations of confidence on the whole of the Eurasian continent [75]," and this has been the foundation of the regime's construction of a multi-vector foreign policy.

Nazarbayev's foreign policy approach, characterised by its multi-vectoral nature, enabled Kazakhstan to navigate the formation of a post-Cold War geopolitical order. He believed in a statehood free from negative associations with nuclear weapons, emphasised diversity and freedom of language, culture and ethnicity. Unlike Gumilev's Eurasianism, Nazarbayev prioritised a peaceful and harmonious Kazakhstan with a balanced foreign policy. Through skilful navigation of international politics and strategic balancing of the great powers' interests, Kazakhstan achieved economic growth and increased global presence within thirty years. This success can be attributed to the Republic's proficiency in leveraging competition among competitors while safeguarding its own national interests.

Kazakhstan's Eurasian policy has multi-faceted intentions. Externally, it seeks to strengthen diplomatic ties with Russia and other Central Asian countries, emphasising Eurasian solidarity. Simultaneously, it balances relations with Asia and Europe, serving as a bridge between the two continents. Furthermore, Kazakhstan seeks to establish itself as a beacon of peace, stability and neutrality. On this basis, a component of the Republic's domestic policy is to foster a prosperous and harmonious society that embraces its multi-ethnic and multi-national composition. However, the core aspect of constructivism that international relations are socially constructed leaves room for speculation if, following independence, the Republic's ruling elite have selected specific elements from the rich heritage of Eurasianism and treated the state as their own patrimony to serve their preferred political and personal goals. The presence of concentric circles within the ruling elite, including the president, his family, oligarchs and technocrats, who were united by familial or clan ties and/or their background in the Soviet-era bureaucracy or security services, retained not only elements of Soviet-style authoritarianism but also exhibited neopatrimonial characteristics.

Neopatrimonialism is defined as a fused, hybrid system in which traditional practices – including patronage, clientelism, nepotism, rent-seeking and corruption – occur in the context of a modern state characterised by formal impersonal democratic institutions and a clear separation between the public and private sectors [240]. Countries burdened by neopatrimonialism face significant challenges when transitioning to a rule-based system similar to that observed in the West because this transformation necessitates either a political rupture to dismantle the control of the patrimonial elite over the economy or an economic shift to introduce new influential actors capable of supplanting the elite and rewriting political and economic regulations. Analysts argue that the political dynamics in Kazakhstan are heavily influenced by the three hordes, known as "zhuz" in the Kazakh language. These hordes, which traditionally operated as flexible tribal confederations based on territorial principles, significantly shaped the

Republic's political life [282-284]. It is noteworthy that Kazakhstan's independence did not result from a nationalist struggle but rather from the fall of the Soviet Union. Thus, instead of replacing the original ruling elite in the Soviet times, the ruling elite in the previous system continued to build the new system. In addition, unlike most of the independent states that emerged from decolonisation, the social movements and capacity to mobilise the people were weak in post-Soviet Kazakhstan.

Regarding engagement in foreign affairs, one of the most obvious results of neopatrimonialism is the very limited success of coordinated multilateralism in the Central Asian region since the 1990s. Equally overwhelmed with neopatrimonial practices, concerns arose among the post-Soviet Central Asian countries and Kazakhstan regarding the establishment of effective mechanisms for intra-regional collaboration. These countries appeared to be wary that such structures could mirror regional intervention frameworks, thereby challenging their political authority. Similar concerns were expressed by leading countries in the Middle East [239]. This fear undermined the formation of an integrated economic, political and security system at the intra-regional level, despite collective incentives. On the other hand, since regime security is of paramount importance for neopatrimonial rulers, bandwagoning behaviours towards Russia have been the norm because they accept Russia's residual position. Through the pursuit of collective political solidarity with Russia as a means of "protective integration," they have attempted to erect a barrier against international political processes or agendas perceived as posing a political challenge to incumbent regimes and their leaders [288].

Many Russian petroleum companies, such as Lukoil, Gazprom and Rosneft, have heavily invested in Kazakhstan. As a resource-rich country, the neopatrimonial nature of the Kazakhstan regime has demonstrated a tendency to wager on the exploitation of resources for export. This resulted in an increased risk of "Dutch disease," a syndrome of over-reliance on oil and natural gas [285]. The ruling elite's focus on the lucrative exploitation of raw materials and neglect of other domains of innovation and cutting-edge technology was exemplified in Nazarbayev's Strategy Kazakhstan 2030, announced in 1997. The programme aimed at promoting resource nationalism by claiming that oil extraction was "the very key of gold that would enable us to open the door to welfare and independence" [75]. However, Kazakhstan's optimistic outlook was shattered by the domestic banking crisis in 2007 and the subsequent global financial crisis in 2008. These crises revealed the detrimental consequences of the Republic's excessive dependence on mineral exports. As a result, Kazakhstan was compelled to adopt a more proactive economic diversification stance. To attract FDI from various countries to fulfil the economic and political objectives of the Republic, the ruling elite recognised the necessity for Kazakhstan to shift towards a new identity as a green economy. This shift was indicated by the introduction of the Kazakhstan 2050 Strategy by Nazarbayev in 2012, which marked a significant step towards adopting the United Nations Environment Programme's green economy principles. Consequently, this transition has sparked discussions on how to effectively balance economic growth with environmental sustainability [76].

It has been argued that developing a green economy requires investment in innovative projects and specialised education programmes for the population, especially the younger generation. This approach can help cultivate "green" minds and improve environmental literacy. This may explain why Nazarbayev's third term as president (2006-2011) focused on using natural resources to advance progressive reforms in education. In addition to the Bolashak International Scholarship, established in 1993 to support high-performing Kazakhstan students studying postgraduate degrees overseas, Nazarbayev created new universities, introduced privatisation in higher education, promoted English in the curriculum and initiated a transition to the Latin alphabet for the Kazakh language. Through active public diplomacy and education exchanges with Western countries, Russia and China, Nazarbayev demonstrated his determination as a reformer and moderniser, bringing Kazakhstan into the twenty-first century and contributing to the development of human capital in line with the Kazakhstan 2050 Strategy. By adopting progressive educational practices, in 2022 Kazakhstan was ranked thirtieth globally out of one hundred seventy-seven countries in terms of educational attainment [115]. This has laid the foundation for sustainable human, social and economic knowledge-based development in the Republic.

China's expanding economic influence has also emerged as a significant prospect for Kazakhstan since the mid-2000s, and the impact of China's BRI on the Republic cannot be underestimated, particularly in terms of renewable energy development. By leveraging the BRI, Kazakhstan has been able to develop ambitious plans to enhance the use of wind and solar power for electricity generation. Moreover, this strategic approach has effectively mitigated the risks associated with the "Dutch disease" and has facilitated economic diversification, ultimately leading to a greener and more sustainable future. Recognising how a country's global development, status, reputation and international capabilities are largely determined by its contribution to global decarbonisation, in 2021 Tokayev took measures to hasten the pace towards renewable energy sources by tuning up Nazarbayev's target from a 10 percent share of electricity generation to a 15 percent share by 2030 [13]. European extractive companies, such as France's Total and Italy's Eni, were also persuaded to transform their activities towards green technologies in Kazakhstan [12, 199]. According to constructivism, Tokayev's display of ambition to decarbonise Kazakhstan's energy system can be interpreted as an attempt to re-invent a new identity for the Republic to simultaneously become a fossil fuel producer and a green advocate, producing new stimulus to develop foreign affairs strategies with respect to intra- and extra-regional relations, including but not limited to petroleum diplomacy.

Following the unrest in Kazakhstan in early January 2022 and the limited involvement of the CSTO in restoring order, Tokayev pledged to build a "New Kazakhstan" and to combat corruption, nepotism, and monopolies in politics and the economy [82]. With the threat of Russia's expansionism following its invasion of Ukraine, Tokayev demonstrated his political will to strengthen regional cooperation in Central Asia. At the fourth Consultative Summit of the Leaders of Central Asian States in July 2022, Tokayev's proposal to adopt the concept of interaction between Central Asian countries within multilateral formats received approval from the other four

presidents. This move can be considered an attempt to counter external shocks through external balancing, while elements of neoliberalism can also be observed in other agreements ratified by the five countries. These agreements include a roadmap for regional cooperation from 2022 to 2024 and a document titled the Regional Green Agenda Program for Central Asia [84]. Kazakhstan's re-invention of its identity, reflected in Tokayev's efforts to revise the Kazakhstan 2050 Strategy and adapt to geopolitical, economic and technological shifts [82], demonstrates how constructivism influences the Republic's foreign policy.

In summary, the analysis of Kazakhstan's foreign energy policy illustrates the intricate relationship among geo-related factors, neorealism, neoliberalism and constructivism, which together form a framework characterised by their differing degrees of theoretical and practical relevance. Neoliberalism might be regarded as the principal theory when considering the motivations and goals behind Kazakhstan's engagement with specific state and non-state actors, but the Republic's lack of success in fostering intra-regional cooperation with other Central Asian countries reveals significant underlying issues associated with geography, history, security and identity re-invention.

1.2 Case Study of Brazil

Brazil is the ninth-largest economy in the world and the largest energy consumer and petroleum producer in South America. To explore the key characteristics, meanings and implications of renewable energy with respect to a country's engagement in foreign affairs, it is essential to switch the study focus from Kazakhstan to a country with comparable petroleum-exporting capability while being more advanced in renewable energy adoption.

1.2.1 History and milestones

One of the largest discoveries in the past three decades, the oil and natural gas reserves in the pre-salt layer off Brazil's coast in 2006 ushered in a new era of energy production and marked a significant change for the country's petroleum industry. Alongside iron ore and soybeans, crude petroleum has consistently ranked among the top three export products in terms of trade value since 2010 [98], bolstered by the participation of prominent international oil companies that have obtained operator status in Brazil. Despite its status as a major global petroleum producer, Brazil stands out for its commitment to a low-carbon energy matrix, making it one of the least carbon-intensive countries in the world.

Brazil's journey towards energy diversification can be traced back to the 1970s, a period preceding the pre-salt discoveries, during which the country faced severe challenges due to the oil crisis. To mitigate Brazil's 80 percent oil import dependency, the military government, which governed the country from 1964 to 1985, implemented decisive policies. One notable milestone in this endeavour was the establishment of a

national programme in 1975 to produce ethanol from sugar cane as a substitute for gasoline for transportation. Moreover, the government has focused on the development of hydroelectric power, nuclear power programmes and energy integration with neighbouring countries. Brazil's strategic geographical location, serving as a convergence point for the main hydrographic basins in the continent and sharing borders with ten out of twelve neighbouring South American countries, positions it as a key player in promoting regional energy flows and formulating bilateral and multilateral treaties governing regional energy trade. It is worth mentioning that significant changes occurred in Brazil's energy sector following the end of the military government. The initiation of the National Privatisation Programme in 1990 opened the electricity system to competition and private investment, facilitating market-oriented reforms.

The Ministry of Mines and Energy (Ministério de Minas e Energia, MME) in Brazil has been entrusted with the responsibility of developing energy policies since 1997. It also chairs the National Council for Energy Policy (Conselho Nacional de Política Energética, CNPE), the highest-level body in charge of setting energy policy in the country. Regulation of the electricity market falls under the jurisdiction of the National Electric Energy Agency (Agência Nacional de Energia Elétrica, ANEEL), which not only publishes and manages energy auctions but also operates nationwide tariff-based schemes [36]. To facilitate both public and private investment, the energy sector in Brazil was divided into regulated and unregulated markets in the early 2000s [37]. This division aimed to ensure sufficient investments to meet the country's increasing electricity demand, which was growing at a rate of approximately 5 percent annually [141]. According to data from the World Bank, private energy investments in Brazil increased significantly after 2009, reaching USD$2 billion in 2004, USD$11 billion in 2009 and USD$31 billion in 2012 [97]. However, in subsequent years, Brazilian economy contracted, affecting the energy sector.

Government interventions have been employed to accomplish energy policy objectives of renewable energy. The Incentive Programme for Alternative Sources of Electric Energy (Programa de Incentivo às Fontes Alternativas de Energia Elétrica, PROINFA), established in 2002, aims to foster the diversification of Brazil's energy matrix by exploring alternative sources that enhance electricity supply security. Simultaneously, PROINFA also seeks to boost the generation of electricity from wind, small hydroelectric plants and biomass burning within the Brazilian National Interconnected Electrical System [41]. This initiative has been complemented by more favourable prices offered at government electricity auctions for wind and other renewable power sources, which were introduced in 2004 alongside a legal framework for energy auctions. These auction prices, guaranteed by the government, have facilitated the advancement of renewable technologies that may have initially struggled to compete [37]. Between 2002 and 2012, the programme facilitated the establishment of one hundred and thirty-four plants, encompassing 533 megawatts (MW) of biomass from twenty-one plants, 1,182 MW of wind from fifty-one units and 1,157 MW of small hydro from sixty-two units, all operating under twenty-year contracts [142]. The objective was for these technologies to eventually become cost competitive with hydroelectric power, thereby meeting the rising electricity demand in the regulated

market through new energy auctions and/or providing supplementary energy to bolster the system's reserve margin via reserve energy auctions [260].

Between 2012 and 2015, a prolonged three-year drought resulted in concerns regarding water supply, exacerbated by climate phenomena like El Niño and La Niña. As a result, there was a notable shift towards diversifying the energy generation landscape, with an increased focus on non-hydroelectric technologies. Besides signing a new National Biofuels Policy – known as RenovaBio – into law in 2017 to promote the national biofuel industry [38], wind energy emerged as the second most prominent energy source by 2019, following hydroelectric power. The goal was to achieve a capacity of 20 gigawatts (GW, equivalent to 20,000 MW) in wind energy by 2022. To address the evolving energy landscape, Brazil introduced its Ten Year Energy Expansion Plan 2027 (Plano Decenal de Expansão de Energia 2027, PDEE 2027). This plan places significant emphasis on expanding the capacity for solar photovoltaic energy, leveraging Brazil's favourable geographical location, which receives abundant solar irradiation. This geographical advantage has stimulated the development of viable solar projects throughout the country. The PDEE 2027 aims to increase the installed solar capacity to 8.6 GW by 2027, a substantial increase from the 2.5 GW recorded in February 2019 [39]. With Brazil ranked eighteenth out of forty countries on the 2023 Renewable Energy Country Attractiveness Index (RECAI) [178], major international oil companies operating in Brazil, including Exxon Mobil Corp., British Petroleum plc, Royal Dutch Shell and Equinor, have expressed their commitment to developing renewable energy projects in the country. This commitment is noteworthy, considering Brazil's significant oil and natural gas reserves. Looking towards the future, Brazil's 2050 National Energy Plan (Plano Nacional de Energia 2050) provides a comprehensive framework outlining the long-term strategy for Brazil's energy sector. This plan sets forth directives and goals that will shape the country's energy landscape in the coming decades.

Published during the coronavirus disease 2019 (COVID-19) pandemic by the MME in 2020, the 2050 National Energy Plan, which replaced the paralysed National Energy Plan 2030 since its publication in 2007, signified the symbolic gesture of the administration of Jair Bolsonaro to guide energy policy decisions. In a context of great uncertainty, the 2050 National Energy Plan aims to explore future alternatives to improve the decision-making process in energy policies, with four main core objectives: 1) energy security; 2) adequate return on investment; 3) energy access and affordability; and 4) socio-environmental sustainability. It recognises the crucial role of market design and effective institutional governance in driving innovation, fostering sustainable development and facilitating renewable energy transition [40]. Moreover, the MME and other public and private institutions have actively engaged in the Energy Big Push project, which aims to promote investment in novel approaches for the green transformation of the country's energy sector [198]. To optimise the utilisation of energy resources in Brazil, policy-makers in the country should also consider multiple factors. These factors encompass not only the increase in energy consumption and technology and business advancements but also the emergence of new consumer behaviours. In this context, public consultation was launched for three months in 2020 to survey public opinion on the 2050 National Energy Plan [305].

Brazil has made significant strides in harnessing valuable resources in the form of fossil fuels and renewable energy to meet its continuously expanding energy demand. The data published by the International Energy Agency (IEA) in 2022 revealed that the proportion of electricity produced in Brazil through Wind-Water-Solar technology stood at 79.79 percent, placing it twentieth out of forty-seven countries that generated at least 50 percent of their electricity from renewable sources [103]. With achievements in areas such as near-universal energy access and clean cooking fuel availability, Brazil was ranked fourteenth out of one hundred and twenty countries in the WEF's Energy Transition Index for the year 2023 [167]. However, despite Bolsonaro's commitment in 2021 to achieving climate neutrality for Brazil by 2050, a decade earlier than originally planned [91], the occurrences of climate-induced droughts in Brazil and the Amazon rainforest since the 2010s have sparked debates concerning the necessity of reevaluating the energy sources utilised by the respective countries to ensure a reliable power supply. This would involve reducing reliance on hydroelectric, wind and solar energy and instead focusing more on natural gas, biofuels and nuclear energy as a means of safeguarding against climate uncertainty.

It is worth noting that alongside its abundant potential in conventional and renewable energy, Brazil has recently been hailed as one of the top countries for software development and technology talent because of its increasing focus on higher education, specifically in the technology sector. The Brazilian government has made significant efforts to entice foreign corporations to relocate their operations to the country through the implementation of a range of tax benefits, and Sao Paulo is where most information technology talent is found. The University of Sao Paolo (Universidade de São Paulo) holds the one hundred and fifteenth position in the QS World University Rankings 2022/23. This esteemed institution not only stands as a beacon of excellence in South America's higher education landscape but also plays a pivotal role as a research centre, contributing approximately 20 percent of Brazil's academic output [117]. As of 2022, the most significant information technology market in South America was Brazil, totalling USD$45 billion [118]. An equally noteworthy aspect of Brazil's standing in the field of renewable energy lies in its role as a significant job creator. In 2020, the country witnessed the emergence of approximately one million and two hundred thousand employment opportunities in the renewable energy sector, making it one of the largest contributors globally. China is the only country that surpasses Brazil in terms of the number of jobs added. Although most of these positions have been concentrated in the biofuels domain, there has been a substantial upswing in the wind and solar workforce since 2019. In 2020, Brazil's wind and solar photovoltaic industries had an estimated employment of approximately forty thousand and two hundred and approximately sixty-eight thousand people, respectively, as stated in the 2021 Annual Review of the International Renewable Energy Agency (IRENA). Specialisation in sustainability or renewable energy is not a primary requirement for employers. Rather, they seek professionals with a well-rounded understanding of the production chain and knowledge in related fields, implying the significance of human capital in renewable energy transition [186].

1.2.2 Intra-regional relations

The enhanced energy security in Brazil is greatly attributed to the diversified generation capacity provided by large hydroelectric power plants, wind farms and solar farms. In addition, the existence of electricity interconnections with neighbouring countries, particularly Argentina, has played a significant role in this achievement. The formation of MERCOSUR, which includes Argentina, Brazil, Paraguay and Uruguay, on March 26, 1991, marked the end of decades of political tension between Brazil and Argentina and the beginning of their pursuit of common strategic interests that revolve around defensive, offensive and socialisation considerations [296]. This regional integration agreement was established under the principles of open regionalism and was formalised by the signing of the Asuncion Treaty. The Framework Agreement on Energy Cooperation in 2005 further emphasised the potential for consolidating regional, sub-regional, or bilateral agreements among these countries in various areas, such as the commercial exchange of fossil fuels, the interconnection of electric transmission networks, the interconnection of pipeline networks, cooperation in the exploration, exploitation and industrialisation of fossil fuels, as well as the promotion of renewable and alternative energy sources. It has been argued that energy integration within MERCOSUR not only reduces the need for extensive investments in expanding power supply but also mitigates the socio-environmental impacts associated with electricity projects in the region, highlighting the benefits of pursuing cooperative energy security for the entire continent grounded in neoliberal principles [297].

In retrospect, the South American member countries within MERCOSUR embarked on the path of integrating their electricity and energy markets by signing the Tripartite Agreement Corpus-Itaipu in 1979. The agreement, which involved Argentina, Brazil and Paraguay, was a significant milestone in their efforts. Their shared geographic reality, together with neighbouring Uruguay, has played a pivotal role in fostering regional electric trade, with several large hydroelectric power dams, such as Yaciretá, Salto Grande, Chocón and Itaipu. In addition, noteworthy natural gas pipeline connections can be found between Bolivia, Brazil, Argentina and Chile, as well as power line connections linking northern Argentina and Brazil. These infrastructural links form a robust foundation for energy regionalism, motivated by the quest for absolute gains facilitated by a well-structured cooperative energy security policy [357]. According to a research study conducted by the Inter-American Development Bank in 2017, Brazil and MERCOSUR have the opportunity to realise significant financial savings, prevent power outages and decrease their GHG emissions by increasing the integration of solar and wind power into their energy systems and by fostering stronger cross-border connections with neighbouring countries throughout the continent [299]. In this context, a Pan-American interconnected energy system based on a mix of renewable energy sources, battery storage and a transmission grid that connects North, Central and South America is equally feasible in technical terms [256].

Despite the numerous advantages stemming from the interconnectedness of MERCOSUR member countries, it is essential to recognise the potential security threats that may arise due to the unpredictable actions of other countries, as proposed by

neorealism. This is particularly relevant in the context of energy security. The frequent power failures encountered by the state of Roraima in Brazil in March 2019 – due to events in neighbouring Venezuela – and the widespread electricity outage that affected large regions of South America in June of the same year – due to heavy rains in and around Buenos Aires – underscored the vulnerability of the interconnected South American power grid. Moreover, MERCOSUR appeared to be losing momentum for rapid integration and economic growth as a lack of internal cohesion was shown in 2021 when member countries raised complaints about the bloc on its thirtieth anniversary. While the COVID-19 pandemic has undoubtedly led to diplomatic tensions regarding border politics, trade and energy price fluctuations, fragmented visions of regionalism, ideological polarisation and weak leadership, which prevailed before the pandemic, along with adverse interactions among the great powers, cooperation has remained bilateral rather than regional [298]. Javier Milei's victory in the 2023 presidential election in Argentina could have led to increased instability within MERCOSUR given his intentions to exit the South American trade bloc. This development has sparked deliberations on whether MERCOSUR will join the list of unsuccessful endeavours in regional integration within South America. In this connection, energy security through intra-regional energy cooperation appears to be challenging in the absence of political stability, resilient energy infrastructure and internal cohesion among participating countries. These criteria could be viewed as necessary conditions to fulfil both local and regional demands, but the inflow of FDI and the adoption of innovative technologies from sources beyond MERCOSUR could also have laid the groundwork for addressing certain aspects related to intra-regional energy cooperation.

While water resources foster hydroelectric power cooperation among South American countries, the Amazon rainforest produces an additional binding effect in terms of global climate adaptation and global environmental governance. The Amazon Sustainable Landscapes Program, which commenced in 2015, is a regional initiative encompassing Brazil, Colombia and Peru. The World Bank, in collaboration with the World Wildlife Fund (WWF) and the United Nations Development Programme (UNDP), leads this programme. Its overarching goal is to preserve an expansive seventy-three million hectares of forest land. Moreover, it endeavours to foster sustainable land management practices across fifty-two thousand and seven hundred hectares, while also supporting actions that contribute to a reduction of three hundred million tonnes of carbon emissions by 2030 [206]. In 2019, in response to record-breaking numbers of wildfires, Brazil signed the Leticia Pact along with Belize, Colombia, Ecuador, Guyana, Peru and Suriname, which underscored the importance of implementing and generating synergies between the United Nations' Sustainable Development Goals until 2030, the Paris Climate Agreement and the Post-2020 Global Biodiversity Framework [216]. It has been proposed that to minimise the harmful socio-environmental consequences of large dams, in-stream turbines that use the kinetic energy of water from a fraction of the river stretch should be employed to produce electricity in regions such as the Amazon River basin [251].

1.2.3 Extra-regional relations

Brazil's participation in international affairs has been primarily shaped by its regional dynamics, given its status as a regional powerhouse that shares borders with ten South American countries. Nevertheless, a notable shift occurred in the early 2000s, particularly during the first presidential tenure of Luiz Inácio Lula da Silva (2003-2010, 2023-), as Brazil embarked on a mission to strengthen its position as a global player. This has entailed strengthening connections with both developed economies and emerging regions of the Global South. This multi-faceted strategy is exemplified by Brazil's renewed engagement with the United States and Europe, which are characterised by a greater sense of equality than in the past. In addition, Brazil has fostered closer ties with China, India, Russia and South Africa. Biofuels offer Brazil a unique opportunity to demonstrate its global leadership by significantly expanding the production, consumption and international trade of bioethanol. Africa, with its favourable agro-climatic conditions and vast land area, emerged as an ideal location for this endeavour. Consequently, Brazil actively pursued bilateral collaborations with African countries within the framework of the "South Atlantic" initiative. Additionally, Brazil engaged in trilateral collaborations known as North-South-South partnerships, which involved the United States and the European Union.

Brazil's progress towards emerging power status has not been without challenges in maintaining strong connections with North Atlantic countries. Throughout its trajectory, Brazil has oscillated between cooperating with the United States, as observed during World War Two and the post-Cold War period in the 1990s, and carving out its own independent route towards attaining great power status during the Cold War and the initial decades of the twenty-first century. By adopting neorealist and constructivist frameworks, an analysis of regional cooperation within MERCOSUR sheds light on Brazil's purposeful endeavours in external balancing with the objective of projecting its influence beyond the confines of the region. In this context, cooperative energy security serves as a political instrument through which Brazilian leaders can assert their authority and elevate their country's status on the global stage. By forming a regional power bloc in South America under Brazil's leadership, MERCOSUR can be perceived as a cohesive alliance for Brazil to offset the prevailing influence of the United States in the region. It has been reported that over the last twenty years, Brazil had waited for recognition that never materialised, which includes permanent seats on the United Nations Security Council in a hypothetical reform. The latest aspirations are membership in the Organization for Economic Cooperation and Development (OECD) and deepening security cooperation with the North Atlantic Treaty Organisation (NATO) countries by becoming a global partner.

The dynamics of Brazil-China relations have undergone notable transformations since 2010, with China taking on a prominent role as a major foreign investor in Brazil. Notably, this investment has been driven primarily by state-owned enterprises that focus on infrastructure development, particularly within the energy sector. Given the prevailing circumstances of declining investment rates and sluggish economic growth, the influx of Chinese investment has been widely accepted as a positive development

for Brazil. One of the signature institutions through which China-Brazil international cooperation has been formalised is the BRICS partnership. The BRICS, formed in 2009, effectively brought together Brazil, Russia, India and China, with South Africa joining the alliance in 2010. The primary objective of this coalition is to collaboratively tackle global issues of common interest by leveraging the developmental knowledge gained by the countries in the Global South. This shared knowledge serves as the basis for developing suitable cooperation models at bilateral and multilateral levels [309]. Subsequently, in 2024, this coalition of founding countries expanded to include Egypt, Ethiopia, Iran, Saudi Arabia and the United Arab Emirates. Regarded as a club of "emerging powers," the BRICS has served as a neoliberal venue for mutual admiration, for club deals among its members and sometimes for proposing an alternative world order. Brazil and China, renowned for their significant contributions to renewable energy production, have forged strategic and mutually advantageous bilateral partnerships in their pursuit of enhancing energy efficiency. Partnerships encompassing policy, financial and technological dimensions have been actively pursued since the late 2000s. It is noteworthy that most Chinese companies in Brazil display a major discernible trend in their investments in renewable energy, which contrasts with the dominance of coal in China's overall power generation portfolio in other countries. Chinese companies have also introduced the most advanced ultra-high voltage (UHV) technology to address the supply and demand bottleneck in Brazil. They have established transmission lines across Brazil, connecting the northern region to the southeast, the primary consumer market in Brazil [303]. However, Brazilian policy-makers and analysts have raised concerns since the mid-2010s regarding the economic and geopolitical risks associated with an "excessive" dependence on Chinese state-owned companies in sectors considered vital for the economy. Following Bolsonaro's inauguration as the Brazilian president in early 2019, a noticeable shift was observed in the country's approach to foreign affairs and diplomatic objectives.

Bolsonaro and his foreign policy advisors chosen to adopt a bandwagoning strategy in their approach towards the United States during the administration of Donald Trump (2017-2021), which saw him boast of joining Trump in taking Brazil out of the Paris Climate Agreement and following Trump's animosity towards China. After Trump's defeat in the 2020 presidential election, Bolsonaro's disregard for the environmental agenda was confronted by a new administration in the United States, led by Joe Biden (2021-2024), who pledged to put climate change at the centre of all foreign and security policy. Mounting pressure from other international actors has also prompted Bolsonaro to reconsider the balance between the protection of the Amazon rainforest and his country's right to exploit its natural resources, especially when considering the possible cancellation of the European Union-MERCOSUR trade agreement. Struck in 2019, after two decades of negotiation, the ratification process of the European Union-MERCOSUR trade agreement stalled among the twenty-seven European Union members in 2020, notably due to concerns about deforestation in the Amazon rainforest and the adherence of MERCOSUR countries to the Paris Climate Agreement [200]. However, both sides expressed optimism to ratify the agreement in 2023 after Lula narrowly defeated Bolsonaro to win the Brazilian presidency again.

Regarded as a pivotal moment, the trade agreement plays a crucial role in advancing Brazil's integration into technological and business networks and facilitating stronger connections between developing and industrialised countries. This mutually beneficial prospect is of great value for both blocs. As efforts are underway by the United States and the European Union to forge a Transatlantic Green Technology Alliance, which seeks to facilitate the growth and expansion of green technologies crucial for attaining a future characterised by climate neutrality [62], the failure of Brazil and MERCOSUR to align with these Western green technology frontrunners could hamper the aspirations for an integrated power grid and a decarbonised energy system in South America. Amidst dire circumstances and an imperative for prompt action, China's revolutionary strides in green technology innovation can offer Brazil a potential alternative avenue to realise these aspirations.

The Brazil-America-China relations have been characterised by their immense magnitude and complexity, particularly in the late 2010s. This period witnessed a growing polarisation between the United States and China, specifically in relation to the competition for technological leadership. Despite South America's neutral stance in the ongoing technological conflict between the two great powers, the United States remains committed to exerting pressure on various sectors to prevent losing ground in the race for technological supremacy within the region. The importance of this issue was underscored by Huawei Technologies Co., the largest provider of 5G technology in China, which was placed on a trade restriction list by the United States in 2019. Among western politicians, there is a prevalent perception that the adoption of Huawei's technology carries an inherent risk of compromising the national security of their countries and their allies [60, 217]. To enhance Brazil's communication networks, the United States has proposed a range of remedies centred on the adoption of the Open Radio Access Network [219]; however, as of 2024, the use of this technology within the networks of telecommunication service providers, specifically among the established 5G operators in the United States, is still in the developmental stage.

In contrast, the adoption of Huawei's patented technologies offers a promising digital energy solution that is both environmentally friendly and intelligent, ensuring the progress on renewable energy transition for Brazil and MERCOSUR. After a smart factory that uses Huawei's 5G equipment was built in São Paulo state in March 2022, a collaborative Memorandum of Understanding was signed in June 2022 between Huawei and Brazil's own telecommunications company TIM Brasil to transform the city of Curitiba, the capital of Paraná state, into a "5G City" [218]. Lula's state visit to China in 2023, while serving his second presidential term in Brazil, exemplified his commitment to enhancing synergies between Brazil and China. While it was widely speculated to be a deliberate effort to emphasise his foreign policy approach, which focuses on pragmatism and dialogue, Lula demonstrated little concern for potential tensions between Brazil and the United States or the Western world. The visit was a reminder of his unwavering commitment to pursuing Brazil's interests on the global stage.

Aside from the sphere of great power politics, Brazil has a longstanding tradition in biofuel production, specifically in the production of first-generation ethanol using sugar cane as the primary raw material. Drawing on this expertise, Brazil has developed

a distinctive foreign policy instrument referred to as "ethanol diplomacy." This approach involves the transfer of technical knowledge, the sharing of best practices and encouraging private sector investments related to sugar cane cultivation. During his first term as president, Lula believed that other countries could emulate Brazil's experience to partially fulfil their own energy requirements, albeit on a smaller scale. The continent of Africa was considered particularly vital to Brazil's ambition to become a world leader in bioenergy based on a few key factors. First, the agroclimatic conditions in the African savannahs bear similarities to those in Brazil's cerrado region, providing a familiar agroecological context. This similarity has prompted Brazilian policy-makers to explore the possibility of replicating their successful sugar cane ethanol model in African savannahs. Second, the geographical aspect is crucial because Africa is perceived to possess vast expanses of land suitable for expanding biofuel production. This contrasts with Central American and Caribbean countries, where limited land availability restricts investments to less than twenty thousand hectares. Furthermore, Brazil shares cultural, historical and economic affinities with certain Lusophone African countries, such as Mozambique, Angola and Cape Verde. These connections, along with the influence of business, language and the African roots of Brazilian black culture, have played a significant role in Brazil's efforts to strengthen its ties with the African continent [301]. It is worth noting that the literature on Brazil's engagement with the Global South presents two main narratives. The first narrative, propagated by Brazil's official discourse, emphasises the unconditional nature of its development assistance [302]. Conversely, the second narrative offers a more critical view, portraying Brazil's engagement with Africa as a form of neo-colonialism [300].

Despite a high degree of speculative potential, bioenergy development in Africa throughout the 2000s and 2010s has remained in its infancy with little breakthrough. The hindrance to progress in the agricultural sector can be attributed to the relatively poor level of agricultural development. This was primarily due to the prevalence of complex and disputed customary land rights as well as the presence of small-scale farmers who frequently changed their crops and lacked cooperative organisation. Besides, the proceedings were impeded by the great uncertainty prevailing in markets and investors, driven by the absence of capital, infrastructure, skilled labour and legal and regulatory frameworks. In addition, limited local research and development played a crucial role, considering the variations in sugar cane varieties between Africa and Brazil [301]. The tenure of Dilma Rousseff as president of Brazil (2011-2016) witnessed the implementation of policies aimed at maintaining domestic gasoline prices below market averages to tackle inflation. These measures have unintended consequences for the low-carbon sugar cane biofuel industry. The resulting decline in investment posed significant challenges for producers who aspired to expand their output but faced an unfair market landscape. Moreover, these policies conveyed negative signals to countries where Brazil sought to promote biofuel production. Furthermore, the unexpected and enduring slump in oil prices, with a decline of more than 50 percent since mid-2014, marked the longest-running decrease in two decades. This decline has further dissuaded numerous African countries from investing in biofuels. By that time, Brazil's incompetence in garnering

international support to promote ethanol as the fuel of the future and create a global market was beyond question.

1.2.4 Renewed green energy ambitions

During Bolsonaro's presidency, there was significant justified doubt surrounding his commitment to environmental and climate protection. However, Brazilian enterprises have started to recognise the importance of addressing environmental, social and governance (ESG) initiatives [203] to safeguard their reputation and address broader environmental issues. As a result, these initiatives began to gain prominence on corporate boardroom agendas, which prompted the Brazilian government to address the close nexus between climate problems and energy policy. The introduction of ESG is expected to address a crucial barrier to attracting new international investments in Brazil's green energy infrastructure. This transformation is vital for enhancing the country's energy security and resilience, particularly considering the vulnerability of Brazil's hydroelectric power generation to the impact of drought on river levels since the 2010s. The development of a reliable energy infrastructure is essential for Brazil to maintain its robust economy [304].

The waning prominence of hydroelectric power has expedited the rise of solar and other environmentally friendly renewable energy sources. Remarkable growth in Brazil's wind power output, which has increased twentyfold over the last decade, was witnessed. Brazil's abundant sunlight has also played a crucial role in promoting the generation of solar energy. One of Brazil's competitive advantages lies in the natural conditions of its extensive coastline. With seven thousand and four hundred kilometres of Atlantic shoreline, Brazil's nascent offshore wind market is far from complete. It has been speculated that with the deployment of floating offshore wind technology, Brazil's offshore wind sector will become a world leader in this sector. As of March 2024, statistics from the Brazilian Solar Energy Association indicated that Brazil's solar capacity reached 39.8 GW, accounting for 17.5 percent of the country's total generation capacity, while the installed capacity of wind reached 29.5 GW at 13 percent [176].

Given its significant wind and solar resources, as well as its position as the world's second-largest hydroelectric power producer, Brazil is poised to harness its potential for green hydrogen production. In 2021, Enegix Energy, an international renewable energy company, announced the Base One green hydrogen project in partnership with the government of the state of Ceará. This groundbreaking initiative aims to establish and manage utility-scale energy grids powered by hydrogen. With a substantial investment of USD$5.4 billion, construction of the Base One is projected to take three to four years. Once completed, it will have the remarkable capacity to produce over six hundred thousand tonnes of green hydrogen annually, generated from 3.4 GW of caseload renewable energy. Five hundred hectares of commercial land have already been scoped in the Port of Pecém, a renowned deep-sea port equipped with well-developed infrastructure and ample water resources to enable the electrolysis process to separate hydrogen and oxygen elements [177]. The strategic positioning of the Port

of Pecém also offers convenient access to major global markets in Europe, North America, East and Southeast Asia and Africa through ocean freight. In 2022, on a much smaller scale, Brazilian chemical manufacturer Unigel, using the technology developed by German company Thyssenkrupp Nucera, announced plans to invest USD$120 million in constructing the initial phase of a green hydrogen production site in the northeastern state of Bahia. The estimated installed capacity is set to achieve one hundred thousand tonnes of green hydrogen per year by 2027 [192]. The significance of hydrogen lies in its potential application in industries that face difficulties in reducing their carbon footprint, such as steel and cement. It can also be blended with methane in gas pipelines and used in fuel cells for electric vehicles, serving as a catalyst for expediting the decarbonisation of the economy and for fostering a more environmentally friendly and sustainable future. Beyond energy, hydrogen has important applications in the manufacture of fertilisers, which are fundamental for the food sector. It is not an overstatement to assert that the inclusion of hydrogen is paramount for effectively combating energy, food and environmental crises.

Brazil's pursuit of establishing a prominent role in the global hydrogen market does not undermine its experience in developing an ethanol economy. This expertise remains relevant and continues to assist other countries in developing strategies to effectively integrate ethanol into their fuel economies. The introduction of the "flex engine" technology, pioneered by Brazil in 2003, allows vehicles to run on either 100 percent ethanol or petrol, providing a viable alternative to battery-powered electric vehicles in reducing greenhouse gas emissions. Moreover, the implementation of E5 and E10 petrol, which contain 5 percent and 10 percent renewable ethanol, respectively, in the European Union and the United Kingdom since 2009 has contributed to an increased utilisation of renewable sources in the transportation energy mix. Furthermore, while Brazil's ethanol diplomacy in Africa has faced challenges, collaboration on ethanol between Brazil and other BRICS member countries appears more feasible due to their shared status as rapidly growing economies. India's Prime Minister Narendra Modi (2014-) announced in 2021 that ethanol would be a focal point in his energy and environmental plan [44, 45].

Brazil and India, two prominent emerging economies, heavily rely on agriculture as the foundation of their economic systems. Given their tropical climates, these countries have the distinction of being the world's largest producers of sugar cane. These advantages enable them to lead the way in promoting ethanol as a global commodity, thereby creating a new international market that primarily benefits developing countries. India has already accelerated its target of blending 20 percent ethanol in petrol by five years, aiming to achieve this goal by 2025 [45]. The widespread adoption of flex-fuel vehicles would undoubtedly provide the necessary momentum for this effort. Moreover, to facilitate continuous knowledge exchange regarding the production, regulatory frameworks and technological aspects of ethanol supply chains, various bilateral initiatives have been organised by Brazilian and Indian institutions. These initiatives involve both governmental and private sector entities, such as the Brazilian Sugar Cane Industry Association and the Society of Indian

Automobile Manufacturers, to unlock the true economic, environmental and social potential of ethanol as a sustainable fuel.

In summary, Brazil has made significant strides in its commitment to clean and renewable energy since the 1970s, leading to impressive domestic and international accomplishments. By focusing on the development of alternative energy sources beyond conventional fossil fuels, Brazil has outperformed many other developing countries in its transition towards renewable energy.

1.2.5 Low-carbon diplomacy indicators

International relations research uses indicators to identify concepts that are less directly quantifiable and consist of information that signals change. Indicators can be used to track the way in which a transition evolves and its progress towards reaching certain goals by providing data that helps approximate the change [368]. The creation of indicators is of utmost significance when monitoring the availability of crucial resources and prerequisites for the effective execution of an activity or intervention. This becomes particularly imperative given the increasing role of renewable energy in the interaction between nation-states and non-governmental organisations, which span various domains such as politics, economics and security.

With regard to Brazil's low-carbon energy diplomacy amidst global energy landscape shifts, MAXQDA, a software package for qualitative data analysis, was employed to code and analyse the embedded qualitative data in line with the aforementioned international relations theories to facilitate assessment, classification and comparison of renewable energy transition-related formulations and measures in individual countries. Eight internal and external conditions were identified as indicators:

1) Renewable energy potential;
2) Ruling elite's change competency to pursue renewable energy transition;
3) Foreign policy resilience to renewable energy transition;
4) National measures to increase sustainable energy security;
5) Electricity infrastructure;
6) Human capital;
7) Energy cooperation with intra-regional actors; and
8) Energy cooperation with extra-regional actors.

Each reflects reality and has significant implications for how renewable energy shapes foreign policy-making. The details are as follows:

Evaluating "Renewable energy potential" enables policy-makers to determine the feasibility of implementing a particular technology for energy production, considering factors such as system efficiency, geographical features, environmental considerations and land usage restrictions. This is crucial for the formulation of renewable energy-oriented foreign affairs strategies in collaboration with foreign partners to achieve synergy or complementary measures to achieve energy security.

The "Ruling elite's change competency to pursue renewable energy transition" refers to a regime's ability to react to and manage changes through a fundamental shift in culture and values associated with the changing energy landscape. The ruling elite,

in particular, are key players as they must be given the perspective, tools and techniques to develop policies and make decisions with respect to new patterns in international energy relations to achieve energy security while not neglecting climate, environmental and technological benefits.

"Foreign policy resilience to renewable energy transition" reflects the new diplomatic challenges caused by the decline in the fossil fuel industry. Foreign policy resilience is about developing a proactive and transformative strategy centred upon responsiveness, adaptability, flexibility and hybridity to adapt and stabilise within a new reality associated with renewable energy rather than being stuck in a pre-existing state dominated by scarcity of energy supplies and energy imbalance when dealing with other foreign state and non-state actors.

"National measures to increase sustainable energy security" is an indicator that explores government programmes and action plans to tackle climate change while reinforcing energy security and propelling innovation and economic growth at the national level with the support of international partners.

"Electricity infrastructure" is built on the basis that it can make a niche contribution to the adoption of intermittent renewable energy resources and improve load efficiency. Moreover, consisting of the equipment and services necessary to transmit electrical energy generated from hydroelectric dams, fossil fuels, nuclear, solar, wind, geothermal, biomass power plants and energy storage systems to end-use residential, commercial and industrial customers, the resilience of a country's electricity infrastructure can be found hinging on the extensity of cross-border interconnections supported by grid-enhancing technologies that incorporate various energy sources and types. This implies not only rational resource-use objectives but also a form of energy relations among the countries in proximity.

"Human capital" is an indicator associated with the joint actions of multiple stakeholders, including the education and training sector, to achieve the target of carbon neutrality by the mid-century. The deliberate implementation of measures to encourage the research and development of advanced energy-efficient technologies, along with educational campaigns to raise awareness about the importance of the environment, are key elements of public diplomacy and knowledge diplomacy. These strategies contribute to human capital growth and accumulation.

"Energy cooperation with intra-regional actors" is founded on the premise that interconnections in regional transmission aid in enhancing the stability of power grid following the integration of a significant proportion of renewable energy into the system. Additionally, the energy sector plays a pivotal role in fostering the socio-economic progress of the region and facilitating its overall integration. Renewable energy transition is also presumed to be capable of strengthening the position of a region to become an energy cluster, prompting further collaboration based on shared long-term visions and a common development agenda.

"Energy cooperation with extra-regional actors" explores opportunities presented by the technical experience and financial strength of countries in neighbouring regions, as well as the effects produced by the great power competition over renewable energy.

Table 3 summarises the ingredients of these indicators.

Table 3 – List of eight indicators and their ingredients used in this dissertation

Indicator components	What is to be analysed?
1) Renewable energy potential	- geographical landscape - types of renewable energy potential - capacity to be exploited
2) Ruling elite's change competency to pursue renewable energy transition	- relationships among the state, patrimonial order and oligarchs in response to the changing energy landscape
3) Foreign policy resilience to renewable energy transition	- handling of the great powers' energy interests and investment patterns - facilitation of FDI inflows to new energy technologies
4) National measures to increase sustainable energy security	- efforts to ensure energy security by complying with international agreements on GHG emission reduction - financing
5) Electricity infrastructure	- power grid layout and implications - access to enabling technologies to harness renewable energy resources - potential for cross-border interconnections
6) Human capital	- knowledge required for climate diplomacy and renewable energy transition - state investment in education - state efforts to retain talented individuals
7) Energy cooperation with intra-regional actors	- history and prospects of energy interdependence with regional neighbours - pros and cons of regional energy cooperation - involvement of extra-regional actors
8) Energy cooperation with extra-regional actors	- key actors and ties - the intervention of the great powers - implications for knowledge and technology transfer

It is worth noting that each indicator is a composition of features found in the four international relations theories, implying that foreign relations in the context of renewable energy are configured by a series of logical relations between a finite collection of different criteria embedded in geo-related factors, neorealism, neoliberalism and constructivism. Using these indicators for model-based forecasting enables an investigation into Kazakhstan's foreign affairs strategies with respect to the ascending role of renewable energy in world politics, as well as the Republic's capacity and characteristics to use renewable energy as a foreign policy instrument.

1.2.6 The theory-practice nexus in Brazil

With the eight indicators that mark the internal and external conditions to move renewable energy to a central position in foreign policy-making identified through this case study, Brazil's renewable energy-oriented foreign affairs strategies in terms of theoretical composition and indicators can be quantitatively defined. Following the guidelines laid out in Section 1.1.1 that explain how the estimated ratio score is used to quantify the findings of the survey of international relations theories and case study, the dissertation author has produced Table 4 to present the characteristics of Brazil's renewable energy-oriented foreign affairs strategies in numerical form, considering the relative importance of the four international relations theories for each indicator. Table 5 illustrates a separate set of estimated ratio scores, focusing on Brazil's renewable energy-oriented foreign affairs strategies and their corresponding indicators.

Table 4 – Theoretical composition of Brazil's renewable energy-oriented foreign affairs strategies: 0 implies no relevance, 1 implies maximum relevance

Brazil		Estimated ratio scores
IR Theories	Geo-related factors	0.20
	Neorealism	0.18
	Neoliberalism	0.34
	Constructivism	0.28

Table 5 – Brazil's renewable energy-oriented foreign affairs strategies in terms of indicators: 0 implies no relevance, 1 implies maximum relevance

Brazil		Estimated ratio scores
Indicators	A. Renewable energy potential	0.15
	B. Ruling elite's change competency to pursue renewable energy transition	0.14
	C. Foreign policy resilience to renewable energy transition	0.12
	D. National measures to increase sustainable energy security	0.14
	E. Electricity infrastructure	0.14
	F. Human capital	0.11
	G. Energy cooperation with intra-regional actors	0.12
	H. Energy cooperation with extra-regional actors	0.08

While the two sets of quantified data, as shown in Table 4 and Table 5, prompt more discussion in Chapter Three in connection with the findings about Kazakhstan, they highlight Brazil's tendency to employ neoliberalism and constructivism when developing its current renewable energy-oriented foreign affairs strategies. The rather even estimated ratio scores distributed across the indicators – except "Energy cooperation with extra-regional actors" – also mark Brazil's expertise in responding to the local and global energy agenda in a fairly balanced manner. The reason for Brazil's low score for "Energy cooperation with extra-regional actors" is reflective of Bolsonaro's right wing and populist approach to foreign affairs, as well as his disregard for the global environmental and climate agenda since 2019. Lula's 2023 attempt to lead negotiations for Russia-Ukraine and Israel-Hamas conflicts did not affect this result as he continued to exhibit reasoning that deviated from the agenda of the West.

1.3 Global Data Analysis

Correlation analysis, also referred to as bivariate analysis, determines whether a relationship exists between variables and assesses the magnitude and direction of that relationship. In this dissertation, its application as a secondary diagnostic tool aims to enhance and support the conclusions drawn from the case study. Rather than exploring the details concerning how a single country develops its renewable energy-oriented foreign affairs strategies, the statistical relationship verified by the Pearson Correlation Coefficient between the Energy Architecture Performance Index [159-167] and the Global Sustainable Competitiveness Index [129-137] of more than one hundred countries from 2014 to 2022/23 helps address renewable energy-oriented foreign affairs strategies from a wider perspective.

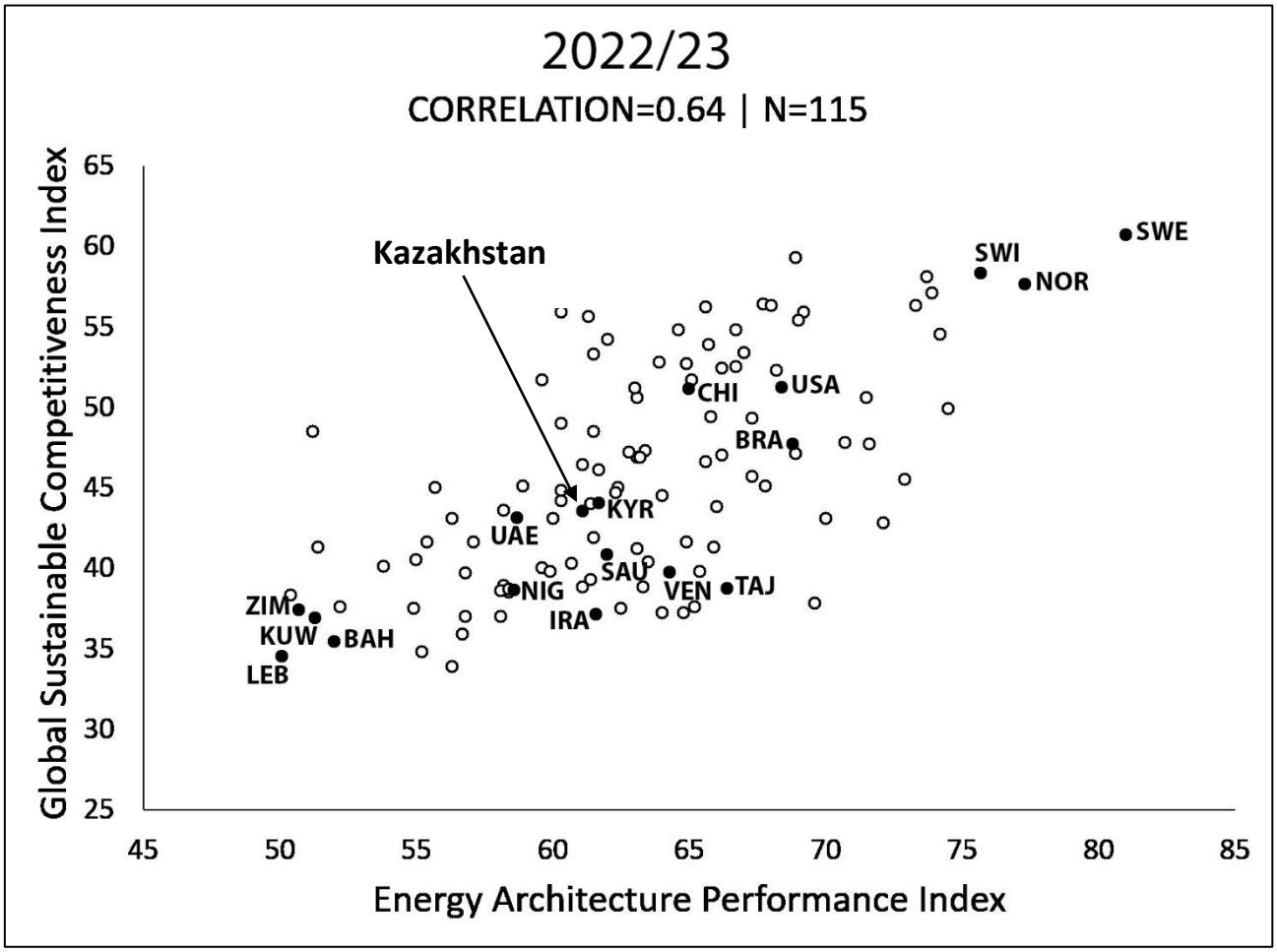
Table 6 – Pearson Correlation Coefficients between the Energy Architecture Performance Index and the Global Sustainable Competitiveness Index from 2014 to 2022/23

Year	Pearson Correlation Coefficients (r)
2014	0.76
2015	0.74
2016	0.76
2017	0.76
2018	0.64
2019	0.71
2020	0.73
2021	0.79
2022/23	0.64

The complete statistical data sets for each year are provided in Appendices A to I. Table 6 shows the values of r, which range from 0.64 to 0.79, for consecutive years. In accordance with Table 2, which lists correlation strength, the data patterns and positive values demonstrate a rather strong linear correlation between the two indices

from 2014 to 2022/23, meaning that higher capabilities to shift away from petroleum dependence result in higher sustainable diplomatic capacity overall. Taking into account the components embedded in the data sets, which include low-carbon energy, diversification of energy supply, energy security and foreign affairs resilience, these findings imply that countries ahead in transitioning away from fossil fuels tend to have good prospects for promoting sustainable and mutually beneficial interstate relations while building resilience against shocks related to fossil fuels in the international system. In contrast, countries lagging in transitioning away from fossil fuels tend to have poor prospects for promoting sustainable and mutually beneficial interstate relations, being vulnerable to shocks related to fossil fuels in the international system.

Figure 2 – Positions of key countries according to the Energy Architecture Performance Index and the Global Sustainable Competitiveness Index in 2022/23



A dot chart containing the data sets for 2022/2023, according to Appendix I, is presented in Figure 2. Out of one hundred and fifteen countries, most of the top thirty are European countries. Sweden, Norway and Switzerland lead with a high percentage of low-carbon resources in their energy matrices while being capable of promoting sustainable welfare among other countries. The United States, China and Brazil are ranked in the upper mid-range. Kazakhstan is positioned in the lower mid-range, along with other Central Asian countries and petroleum-producing countries, such as

Venezuela, the United Arab Emirates, Saudi Arabia, Iran and Nigeria. Kuwait, Bahrain, Lebanon and Zimbabwe are ranked among the lowest. This distribution pattern indicates that European countries have the potential to develop their foreign relations as a novel category of energy agents based on their outstanding performance in renewable energy expertise, technology, investment and innovation. It also illustrates a globally uneven low-carbon transition, with the frontrunners, improvers and laggards clearly distinguished. Due to their failure to harness intellectual and financial capital, some countries have encountered difficulties in joining the transition. In contrast, countries that have made significant progress have been able to thrive and reap the rewards of a low-carbon future. The formation of these clusters implies the emergence of different types of energy cooperation and competition among the countries within and between the clusters. Thus, new energy relations between countries are anticipated, and hence, changes in a country's energy matrix trigger changes in the formulation of its foreign affairs strategies.

Given Kazakhstan's position as an improver in renewable energy transition among a host of petroleum-producing countries from the Middle East in the lower mid-range, the Republic's energy diplomacy can be speculated in the context of some fundamental commonalities and discrepancies within this cluster. However, there has been debate regarding the potential ramifications of shifting towards a low-carbon economy for petrostates. This implies that the future prospects of these countries may vary significantly based on their position in the energy value chain, specifically their ability to establish refining capacity or nurture a sustainable petrochemical industry [278]. Another speculation is that the climate aspirations of Kazakhstan at home and abroad under Tokayev's leadership could prompt the Republic to actively seek collaboration opportunities in sustainable development, policy resonance and action alignment with countries in Europe, North America and South America, which are ranked in the upper mid-range. Simultaneously, alongside extra-regional cooperation within the improver cluster and with the frontrunner cluster, the uneven distribution of fossil fuels and hydroelectric resources in the intra-regional context requires cooperative and collective action. For Kazakhstan, interdependence rather than competition with its Central Asian neighbours – also identified as the improvers located in the lower mid-range – is considered the most feasible approach to achieving intra-regional energy security and reducing GHG emissions.

This dissertation recognises the drawbacks of quantitative correlation analysis, which yields broad generalisations but limited case depth. However, the dissertation author relied on these emerging trends, clusters and patterns in the global energy landscape as vital elements of its model building to anticipate the trajectory of Kazakhstan's foreign affairs strategies centred on renewable energy. These elements also facilitated the triangulation of findings from the survey of international relations theories and the empirical case study on Brazil to develop a realistic and credible forecasting model.

2 Kazakhstan and Renewable Energy

This chapter provides a comprehensive analysis of Kazakhstan's developmental milestones, focusing particularly on the energy sector since the Republic gained independence. The scope extends to the current renewable energy-oriented foreign affairs strategies of Kazakhstan, along with trajectories of their future development across eight internal and external conditions. The chapter concludes by offering estimated ratio scores that reveal the Republic's effectiveness and limitations in employing renewable energy as a foreign policy instrument.

2.1 Energy and State-Building

With a population of over nineteen million and a territory larger than Western Europe, Kazakhstan is Central Asia's most developed economy. Its energy sector, characterised by substantial reserves-to-production (R/P) ratios in coal, oil and natural gas, significantly contributes to domestic electricity needs, with coal alone supplying over 70 percent of the demand [101]. This section reviews the milestones of Kazakhstan's state-building efforts, particularly in relation to its development of both conventional and renewable energy.

2.1.1 The Soviet era, independence and the Kazakhstan 2030 Strategy

During Soviet rule, Kazakhstan assumed a crucial economic role that had a profound impact on its development in the years following independence. The Republic's economic progress initially focused on supporting the broader Soviet system, primarily relying on the extraction and export of raw materials. The production of non-ferrous metals and liquid fuels was of particular significance during World War Two between 1941 and 1945. However, it was not until the discovery of two colossal fields, the Tengiz field in western Kazakhstan and the Karachaganak field in the northwestern region near the Russian border, in 1979 that the true potential of Kazakhstan's oil reserves began to emerge [280]. During that period, the majority of oil production was dominated by five leading state enterprises: Aktobemunaigas, Embamunaigas, Mangistaumunaigas, Tengiznunaigas and Yuzhneftegas. The primary natural gas-producing field, Karachaganak, was under the management of Kazakhgazprom, with the state holding a 90 percent stake and the remaining 10 percent being owned by the enterprise's workers. Before 1991, these enterprises operated under the regulation of the Moscow-based Ministry of Energy, although they enjoyed significant autonomy from local authorities [287].

Following the dissolution of the Soviet Union, Kazakhstan became the recipient of an infrastructure that was primarily developed to facilitate the transportation of its abundant natural resources to refineries located in various parts of Russia. The majority of pipelines were interconnected with Russia, and a notable portion remains under Russian authority. As a result, the Republic has developed a significant dependence on Russia for its transit routes. Owing to the asymmetrical nature of Russia-Kazakhstan

relations, Russia has not ceased its interference in Kazakhstan's energy sector. Throughout the years, Russia has utilised transit fees and the regulation of oil flows to manipulate Kazakhstan's decision-making, aligning it with Russia's pursuit of geopolitical, security and economic interests.

In 1991, the Nazarbayev government established the Kazakhstan Oil and Gas Corporation to consolidate control over energy enterprises, which was renamed the KazakhstanMunayGas holding company in 1992. The formation of the Ministry of Energy and Mineral Resources in the newly independent Kazakhstan marked a significant stride towards a dedicated governmental entity for energy policy-making. With the Republic, like other post-communist countries, embarking on a free market journey, the circumstances it encountered served as a prime example of the challenges it faced in advancing its energy sector. Previously, the funding and management of this sector were intricately linked to a comprehensive plan for the entire Soviet Union. Upon attaining independence, Kazakhstan required new avenues to attract investment and expertise to ensure the continued growth and development of its energy sector. The introduction of a privatisation scheme for national enterprises and industries in the mid-1990s led to substantial economic transformation, redirecting its attention towards oil as a primary catalyst for potential revenue generation. The energy industry's organisational design was characterised by a division of labour, with the government as the primary policy-maker, the Ministry handling regulations, and state-owned and private companies pursuing commercial objectives within this triangular structure [346]. With a consortium of local, Russian and American companies starting operations at the Tengiz oil field in 1993, an energy-based approach to domestic state-building cemented the role of extractive industries in the Republic's national security [289]. It is evident that, contrary to the rhetoric emphasising the virtues of free markets and transparency, these privatisations reinforced the corruption system established during the Soviet era by empowering government-connected individuals to expand their patronage networks and exert significant influence. Against this background, the presidential decree of 1997 adopted the comprehensive development strategy "Kazakhstan 2030: Prosperity, Security and Ever Growing Welfare of All the Kazakhstanis."

The Kazakhstan 2030 Strategy was developed to articulate the aspirations of the Republic and establish the key objectives that needed to be given precedence for their successful attainment. The goal was to construct an autonomous, prosperous and politically stable state of Kazakhstan. Seven long-term priorities were laid out: 1) safeguarding national security; 2) ensuring the stability of the political landscape; 3) fostering economic progress through a market economy that encourages substantial foreign investments and domestic savings; 4) prioritising the welfare, education and overall well-being of the citizens of Kazakhstan; 5) promoting the exportation of oil and natural gas resources; 6) developing a robust transportation and communications infrastructure; and 7) establishing a proficient and competent state administration. These priorities set by Nazarbayev were a manifestation of his belief that economic advancement should be prioritised over political advancement. Regarding the fifth priority, Nazarbayev highlighted the significance of energy resources as a vast treasure, underscoring their role as "the very key of gold" that would bestow prosperity and

independence upon Kazakhstan [75]. His assertion proved accurate, as petroleum production facilitated Kazakhstan's rapid advancement, propelling it to the status of a post-Soviet petrostate and surpassing Uzbekistan as the most influential player in global politics within Central Asia in the years that followed.

The Kazakhstan 2030 Strategy provided a detailed framework for the effective utilisation of energy resources. Within this strategy, five key points highlighted the significant role of petroleum in the Republic's multi-vector foreign policy, economic security and energy security: 1) establishing long-term contracts with prominent international oil companies to obtain technologies and know-how and attract major companies to ensure that the natural resources of the Republic are effectively exploited; 2) building a comprehensive pipeline system for the export of oil and natural gas; 3) attracting investments from key players, such as the United States, Russia, China, Japan and Western Europe, in Kazakhstan's oil and natural gas sector; 4) maintaining self-sufficiency and competitive independence in the domestic energy infrastructure through foreign investments; and 5) prudent utilisation of future revenues [75]. These five key points indicated the Nazarbayev's recognition of the crucial role played by petroleum in the first decade. Furthermore, it was evident that his government's efforts in the 1990s primarily focused on enhancing oil exports. The emphasis on fostering an oil and natural gas processing industry and establishing an integrated oil-gas-chemical industrial complex appeared only during the 2000s. On the contrary, although Kazakhstan's potential in harnessing solar and wind energy was acknowledged, the document did not provide any specific information regarding renewable energy initiatives or the detrimental impacts of the extractive economic model on human and ecological security. Thus, Nazarbayev's statement "the wealth of the entrails of the earth is the property of all subsequent generations" played into two conflicting relationships between humans and nature: 1) the environment as an inheritance from nature belongs to all people; and 2) the environment as an exploitable object exists for human benefit [289]. This subtle conflict over norms and ideas persists throughout Kazakhstan's pursuit of a diversified economy.

In addition to adopting the Kazakhstan 2030 Strategy, in 1997, an important development occurred with the division of KazakhstanMunayGas, which resulted in the establishment of the Kazakhoil state oil company and the formation of Kaztransoil and Kaztransgas transportation companies, which led to the creation of separate entities dedicated to the production, transportation and distribution of oil and natural gas resources. In 1999, despite a decline of over one-third in GDP compared to its 1989 level, signs of economic recovery emerged due to the implementation of policy reforms that focused on currency depreciation. By 2000, the government of Kazakhstan realised the importance of strengthening the national oil company and its presence in the industry. Concerns within the Republic's oil sector also emerged about the possibility of additional privatisation of the Republic's resources. The following year saw the merger of Kaztransoil and Kaztransgas, two prominent transportation companies, creating the Oil and Gas Transportation Company. This newly-formed entity assumed responsibility for the efficient transportation of hydrocarbons, development of pipeline infrastructure, and facilitation of both import and export activities related to oil and natural gas products

[346]. The implementation of these structural modifications has resulted in an annual influx of over USD$2 billion in FDI into Kazakhstan's oil, natural gas and metal extraction sectors since 2000. Furthermore, the private sector's contribution to the Republic's GDP has experienced significant growth, escalating from 25 percent in 1995 to 60 percent in 1999, and further reaching 65 percent in 2002 [287]. In 2002, the formation of KazMunayGas, a national company, was a significant milestone in the oil and natural gas industry. This entity brought together previously separate companies responsible for the production and transportation of these valuable resources. Following its establishment, KazMunayGas embarked on a strategic path, repurchasing shares in Kashagan and Karachaganak, and acquiring substantial holdings in smaller producing assets that were part of the privatisation programme in the 1990s. These strategic moves proved instrumental in boosting the company's overall oil production by nearly 40 percent. Consequently, the Republic experienced a remarkable economic growth during the new millennium, driven by robust demand and rising global oil prices [280].

Regarding electric power production in Kazakhstan, it underwent a formidable post-Soviet transformation in terms of electric power production, as the generation and utilisation of electricity experienced a substantial decline after Kazakhstan gained independence in 1991. Because of privatisation and free market competition since the mid-1990s, the configuration of the electricity sector in the Republic was shaped by three distinct entities with economic independence: 1) the National Company joint stock company (JSC) Kazakhstan Electricity Grid Operating Company (KEGOC), which was established in 1997 to be responsible for managing the backbone electric grids that supplied electricity to major consumers, as well as the power distribution lines connected to large thermal power plants and hydropower plants; 2) regional electricity companies that operated at the regional level, transmitting power to local areas; and 3) electricity producers, which could either be independent entities or integrated with large industrial enterprises and power plants [1]. During the early 2000s, the economy experienced a significant surge in growth, which had a positive impact on electricity generation. However, the financial and economic crisis that occurred later in the decade led to stagnation in production within metallurgical plants and the construction industry, resulting in a decline in both electricity generation and consumption. It is worth noting that coal accounted for approximately 70 percent of the Republic's electricity production throughout the 1990s and reached over 75 percent in the mid-2000s [104].

2.1.2 2008 Global financial crisis and the Kazakhstan 2050 Strategy

Kazakhstan's impressive economic growth since 2007 was disrupted by two external shocks. The initial shock occurred in mid-2007, when the global financial crisis caused liquidity crisis. As a result, Nazarbayev's government implemented measures to tighten credit markets and adopted a more cautious approach to risk, which negatively affected capital inflows, asset prices and investment. The second round of shocks was triggered by a decline in Russian demand for Kazakhstan's export commodities, particularly energy and metallurgical products. The simultaneous increase in international food prices during 2007 and 2008 further exacerbated the

situation. It is worth noting that the energy intensity of GDP in Kazakhstan was almost twice the OECD average in the early 2010s after almost two decades of applying inefficient practices and using outdated technologies and ageing infrastructure [128], leading to a situation in which the Republic's natural resources and environment were found to be seriously deteriorating across all essential environmental benchmarks. The consumption of coal for electricity production reached its highest level in 2011, accounting for 81.1 percent of all energy sources [104].

Considering the fossil fuel sector's disproportionate influence in supporting economic growth beyond its own confines, policy-makers have acknowledged the inherent risks and emphasised the importance of embarking on structural and institutional reforms to facilitate the development of a thriving, modern and innovative non-fossil fuel sector that can drive Kazakhstan's future economic progress. In fact, the Kazakhstan 2030 Strategy warned against the danger of sliding into a cumbersome raw material-oriented production structure and mentioned the need for an active industrial policy of diversification [75]. On this basis, through the implementation of the Ecological Code in 2007 and the enactment of the Law on Support for the Use of Renewable Energy Sources in 2009, the transition towards a sustainable economy was commenced. According to Article 1 of the Law on Support for the Use of Renewable Energy Sources, renewable energy sources include those that are consistently replenished through natural mechanisms. These sources include solar energy, wind energy, hydrodynamic energy from water, geothermal energy (derived from the heat of the ground, groundwater, rivers and basins), as well as anthropogenic sources of primary energy (like biomass biogas and other fuels derived from organic waste). These renewable sources can be harnessed to generate both electric and thermal energy [2]. The government also underwent re-organisation in 2010 in response to the increasing awareness surrounding environmental protection and the significance of alternative energy production. This re-organisation involved replacing the Ministry of Energy and Mineral Resources with the Ministry of Oil and Gas, along with the establishment of the Ministry for Industry and New Technologies. The main function of the Ministry of Oil and Gas was to develop and implement policies related to petroleum and petroleum products in the Republic, which were largely carried out by KazMunayGas beforehand. On the other hand, the Ministry for Industry and New Technologies was assigned the responsibility of supervising the non-fossil fuel sector, which had various functions in the fields of electric power, mining and the nuclear industry. Certain functions from the abolished Ministry of Energy and Natural Resources were also transferred to the Ministry of Environmental Protection.

Kazakhstan embarked on a journey in 2012 to construct its own domestic emissions trading system (ETS). This effort culminated in the launch of its ETS pilot phase in January 2013, which was designed on the basis of the European Union ETS framework. The primary objective of this initiative was to assist the Republic in transitioning to cleaner and more efficient technologies. However, the most significant milestone had to be the introduction of the Kazakhstan 2050 Strategy in late 2012, which meant that the Kazakhstan 2030 Strategy was being superseded. The aspiration to elevate the Republic to the status of one of the world's thirty most developed

countries by 2050 compelled Nazarbayev to formulate a new, all-encompassing state plan that would harmoniously advance his vision for state-building.

The Kazakhstan 2050 Strategy was designed to achieve this ambitious goal by focusing on seven priorities: 1) economic policy of the new course, which revolves around a pragmatic approach to economics, emphasising profitability, return on investment and competitiveness; 2) comprehensive support of entrepreneurship, which is recognised as the leading force in the national economy; 3) new principles of social policy, which prioritise social guarantees and personal responsibility; 4) knowledge and professional skills, which are considered crucial landmarks of the modern education, training and retraining system; 5) further strengthening of statehood while simultaneously promoting the development of democracy within Kazakhstan; 6) consistent and predictable foreign policy pursued to advance national interests and enhance regional and global security; and 7) new Kazakhstan patriotism on the basis of success in establishing a multiethnical and multi-confessional society. The strategy implementation comprised two distinct timeframes. The initial stage encompassed the period leading up to 2030, during which Kazakhstan aimed to undergo transformative modernisation, similar to the advancements witnessed in South Korea and Singapore over the past five decades. This phase primarily focuses on the growth of conventional commodities and industrial sector expansion. Subsequently, the second stage, spanning from 2030 to 2050, will prioritise sustainable development by placing a strong emphasis on the knowledge economy, the production of high value-added goods and the establishment of a robust foundation of engineering services [76]. To facilitate the successful implementation of the Kazakhstan 2050 Strategy, Nazarbayev endorsed the Foreign Policy Concept for 2014-2020, which advocated the adoption of a multi-vector foreign policy approach, as well as the promotion of regional integration and the resolution of conflicts [5]. The announcement of the infrastructure development programmes “Nurly Zhol” in 2014 and “One Hundred Concrete Steps to Implement Five Institutional Reforms” in 2015 was intended to complement the Kazakhstan 2050 Strategy by enabling comprehensive reforms in the economic, social and political spheres.

Concerning energy, in the Kazakhstan 2050 Strategy, Nazarbayev highlighted Kazakhstan’s significant role in global energy security because of its abundant reserves of oil and natural gas. He emphasised the Republic’s commitment to maintaining reliable strategic alliances and fostering mutually beneficial collaborations in the energy sector [76]. However, recognising the projected decline in oil production capacity beyond 2035 [356], Nazarbayev acknowledged the necessity of prioritising the transition to a non-oil economy and the significance of developing a non-extractive sector that revolves around alternative and green energy technology to generate employment prospects and encourage economic growth. By asserting that the era of a hydrocarbon-based economy was approaching, he instigated a significant shift in the trajectory of state-building. To mitigate any potential negative impacts, Nazarbayev emphasised the significance of the Republic’s establishment of a strong national industrial sector that would function autonomously, separate from its reliance on oil and natural gas reserves. Thus, the primary objective was to ensure that by 2050,

alternative and renewable energy sources would account for at least half of Kazakhstan's total energy consumption [76].

In 2013, Kazakhstan made a significant move by adopting the Concept for the Transition to a "Green Economy" until 2050. This visionary plan outlined a strategic pathway hinged on the implementation of green energy policies. The primary aim was to fortify the Republic's energy security, stimulate economic development and safeguard the environment. A pivotal aspect of this plan was the gradual increase in the use of renewable energy sources in electricity production. By 2020, the objective was to achieve a 3 percent share, followed by an ambitious target of 10 percent by 2030. Ultimately, the plan aspired to reach an impressive milestone of 50 percent renewable energy by 2050. The development of small hydroelectric power stations and solar and wind power stations was considered a crucial element in this transition. The Republic also devised a comprehensive plan to gradually retire outdated infrastructure, introduce energy-efficient machinery and adhere to stringent environmental regulations [4]. In 2014, the Ministry of Energy was established as part of the restructuring of the Kazakhstan government. This new ministry was formed by merging the functions and powers of the Ministry of Oil and Gas, the Ministry of Industry and New Technologies and the Ministry of Environment and Water Resources (previously known as the Ministry of Environmental Protection). The main objective of this consolidation was to enhance coordination and collaboration in various areas, such as energy, environment, climate, sustainability, green technology and digitalisation. The Department of Renewable Energy Sources was established within this structure of the Ministry of Energy.

With respect to renewable energy development, Kazakhstan joined the IRENA and ratified its charter in 2009 to gain further insights into international experiences. In addition, the Republic established partnerships with global financial institutions such as the Asian Development Bank (ADB), the European Bank for Reconstruction and Development (EBRD) and the Asian Infrastructure Investment Bank (AIIB). These collaborations aligned Kazakhstan's policies with international standards, combating corruption in key sectors and enhancing the Republic's renewable energy infrastructure. The hosting of EXPO-2017, centred around the theme "Future Energy," marked a significant milestone in Kazakhstan's long-standing commitment to pursuing a renewable energy future. Furthermore, in the same year, the implementation of the New Rules for Determining Fixed Tariffs and Marginal Auction Prices, as part of the Law on Support for the Use of Renewable Energy Sources, introduced an auction scheme. This initiative opened doors for both local and foreign developers and financiers to contribute investment, technical expertise and cutting-edge renewable energy technologies [6]. According to the Order of the Minister of Energy Number 280 dated August 7, 2017, the Kazakhstan Electricity and Power Market Operator (KOREM) JSC was designated as the Organiser of renewable energy auctions. Despite criticism of a missing linkage to USD and an extremely long wait for a return on investment, these efforts placed the Republic among the top forty markets in renewable energy for the first time in 2017 [178]. Following the conclusion of the first pilot auction in 2018, a total of thirty-six renewable energy projects were selected, with a combined installed capacity of 857.93 MW. These projects encompassed various types,

such as wind power plants with a capacity of 500.85 MW, solar power plants with 270 MW, small hydroelectric power plants with 82.08 MW and biomass power plants with 5 MW. In 2019, thirteen renewable energy projects were selected, collectively possessing an installed capacity of 212.89 MW, including wind power plants with a capacity of 108.99 MW, solar power plants with a capacity of 86.5 MW, hydroelectric power plants with a capacity of 7 MW and biomass power plants with a capacity of 10.4 MW [194]. According to data released by the Ministry of Energy, at the end of 2020 there were a total of one hundred and fifteen renewable energy facilities with a collective installed capacity of 1634.7 MW. Solar power plants contributed more than half of all energy generation, while wind farms accounted for one-fourth. In addition to verifying Kazakhstan's achievement of its renewable electricity target of 3 percent within the total electricity output by 2020, the Ministry of Energy also confirmed the pivotal role of auctions in facilitating price reductions and establishing market prices for electricity generated from renewable energy installations [32].

While the development of renewable energy was gaining momentum, the ruling elite did not dismiss the use of nuclear energy as an alternative energy source, in particular Russia had claimed to be ready to build a nuclear power plant in Kazakhstan using Russian technology. This proposition has been a topic of discussion since 1997, with nuclear energy portrayed as a 100 percent GHG emissions-free energy type that could enhance the Republic's energy security in the face of growing electricity consumption. In 2014, a confluence of factors prompted Nazarbayev to set forth the objective of advancing the Republic's nuclear power industry and constructing a nuclear power plant [77]. First, Kazakhstan has become the world's top uranium producer and exporter since 2009. This position, coupled with its well-established and reliable nuclear industry, has provided a strong impetus for constructing a nuclear power plant. The inauguration of the International Low-enriched Uranium (LEU) Bank in 2017 also solidified Kazakhstan's nuclear capabilities. However, despite the potential benefits of utilising nuclear energy for peaceful purposes and leveraging uranium diplomacy, the Republic's history as a nuclear test site for the Soviet Union led to its prominent role in the global anti-nuclear movement. This legacy provoked public outrage and opposition to the construction of the new nuclear power plant. Moreover, concerns regarding the probability of a nuclear accident also contributed to public resistance. In response, many exprerssed the desire to develop renewable energy sources as a safer and more environmentally friendly alternative to meet the Republic's growing energy demand. This shift towards renewable energy not only helped diversify Kazakhstan's petroleum-oriented economy but also positively influenced its image on the international stage.

Furthermore, it is noteworthy that despite its dissolution in 2014 and the subsequent transfer of its functions to the Ministry of Energy and partially to the Ministry of Agriculture, the Ministry of Environment and Water Resources was re-established as the Ministry of Ecology, Geology, and Natural Resources in June 2019, shortly after Nazarbayev's resignation. This decision demonstrated Tokayev's commitment to fostering climate-sustainable low-carbon development in Kazakhstan,

ensuring that the Republic aligns with the principles of a green economy before facing potential challenges arising from extensive environmental pollution.

In addition to the implementation of renewable energy auctions, several noteworthy advancements have been made in Astana, the capital city of Kazakhstan. These include the establishment of the Astana International Financial Centre (AIFC) in accordance with Constitutional Law No.438-V [8], the International Centre for Green Technologies and Investments and the Astana Hub International IT and Start-ups Hub, which have played pivotal roles in shaping the city's landscape. Inaugurated in 2018, these institutions were created to facilitate Kazakhstan's rapid transition towards a green economy by promoting technology and best practices, fostering business development and attracting investments. The AIFC's Green Finance Centre (AIFC-GFC), with the assistance of the EBRD, was launched to develop and advocate for green finance in Kazakhstan and neighbouring regions, such as the CIS, the EAEU, the Middle East, West China, Mongolia and Eastern Europe. This centre serves as a vital platform that plays a key role in advancing inter-regional sustainability efforts, with the aim of driving progress in multiple domains, including: 1) renewable energy; 2) energy efficiency; 3) pollution prevention and control; 4) sustainable management of living natural resources; 5) terrestrial and aquatic biodiversity preservation; 6) clean transportation; 7) sustainable water management; 8) climate change adaptation; 9) eco-efficient products, production technologies and processes; and 10) clean buildings [196].

2.1.3 COVID-19 and the post-pandemic energy order

Kazakhstan's economy experienced a substantial shock in 2020 due to the COVID-19 pandemic, marking the most significant downturn in nearly two decades. The diminished demand for industrial, gasoline and aviation fuels, both internationally and domestically, resulted in a slowdown in the operations of the three refineries located in Atyrau, Shymkent and Pavlodar. Moreover, a 3 percent decline in GDP, elevated unemployment rates and depreciation of the tenge currency further exemplified the deteriorating state of the economy [96]. It is noteworthy that the consumption of coal for electricity production was in decline, reaching its lowest level in 2022 at only 60.05 percent of all energy sources. In contrast, the consumption of natural gas witnessed a significant increase, reaching 28.52 percent in 2022 [104], reflecting the Republic's efforts to substitute coal in its electricity sector. Following a period of economic recuperation in Kazakhstan, which started from the latter half of 2020 to the first three months of 2021, international deliberations have surged regarding the potential to leverage this recovery phase as an opportunity to foster a new socio-economic model. This model, characterised by climate neutrality, resilience, sustainability and inclusiveness, has gained significant traction under the term "green recovery." According to data released by the OECD in 2022, the budget allocated to environmentally beneficial measures within the COVID-19 recovery packages adopted by OECD members, the European Union and selected non-OECD major economies amounted to USD$1090 billion. Notably, over half of this budget was allocated to

energy and transport. The rapid adoption of electric vehicle, renewable power technologies and energy efficiency measures were considered pivotal in achieving net-zero emissions and ensuring energy security, forming the core of a green recovery plan aimed at "build back better" and creating a greener post-pandemic future [202].

Leading the way is the European Union, which has been planning a green transformation since the initial proposal for Clean Energy for all Europeans in 2016. The European Green Deal aspires to establish the bloc as the first carbon-neutral continent by 2050. In addition, the European Union has intensified its commitment to transport electrification and introduced a carbon border adjustment mechanism to tax high-carbon imports, thereby pressuring non-member countries to enforce stricter climate regulations from 2026 [70]. The urgency of transitioning to renewable energy has been heightened by the European Union's decision to cease Russian oil imports following Russia's 2022 invasion of Ukraine.

Equally significant is China's progress. When Xi addressed the United Nations General Assembly in September 2020, he pledged to peak China's GHG emissions by 2030 and fulfil the net-zero goal by 2060 [92]. Four critical aspects of a green stimulus have been established to revive the domestic economy as well as the countries along the BRI: 1) enhance investment in emerging technology-driven infrastructure; 2) ensure that investments in traditional infrastructure align with green and energy-efficient urbanisation principles; 3) foster sustainable consumption patterns with a strong emphasis on electrifying road transport and space heating systems; and 4) facilitate the advancement of investment in zero-emission electrification [205]. However, China's Green BRI, referred to as a refinement of the original BRI, has not yet produced a substantial impact on Central Asia's green infrastructure despite a trend of continuous improvement [314]. Concerns surrounding energy security and increasing geopolitical tensions aside, a 2024 research article also sheds light on the adverse impact of reducing fossil fuel consumption on China's current economic structure and speculates on the feasibility of achieving a profound decoupling between economic progress and carbon emissions by 2060 [317].

While the European Union and China are the leading economies on the two ends of the Eurasian supercontinent, during the 2021 Leaders Summit on Climate, Putin emphasised Russia's efforts in developing legislation aimed at establishing effective monitoring of carbon emissions and encouraging their reduction, as well as a commitment to attaining carbon neutrality by 2060 [93]. However, according to its Energy Strategy until 2035, Russia appears determined to retain its prominence in multiple energy domains for geopolitical leverage, making fossil fuel extraction, consumption and exports prime components of the country [51]. Amidst deepening Western sanctions as a result of the Russo-Ukrainian war, serious concerns have been raised about the emissions trajectory of Russia, especially as Russia has been counted among the world's main sources of anthropogenic methane (CH_4) emissions, second only to China [120].

The United States, with its Bipartisan Infrastructure Law introduced in 2021, aims for a carbon-neutral electricity sector by 2035, along with the ambitious objective of achieving net-zero emissions by 2050 [63, 64] and creating jobs no longer intricately

linked to the consumption of coal, oil and natural gas [94, 95]. However, partisan politics have caused uncertainties in the plan's implementation. The Russo-Ukrainian conflict in 2022, which escalated global energy insecurity and fuel prices, has also entangled Biden's renewable energy agenda in debates over fossil fuels, geopolitical influence and economic liberty. The adoption of solar energy technologies across the United States experienced a decrease in pace, as indicated by the 2022 data from the United States Energy Information Administration [121].

As crucial vectors in Kazakhstan's foreign policy, the post-pandemic recovery packages of the European Union, China, Russia and the United States have emerged as essential factors, influencing the Republic's energy diplomacy and its prospects as a key element in global energy security. Despite the limited contribution of renewable energy to Kazakhstan's electricity generation, Tokayev, a vocal proponent of clean energy and green technologies [80], has initiated measures to strengthen the Republic's commitment to climate change mitigation. At the 2020 Climate Ambitions Summit, Kazakhstan pledged to achieve carbon neutrality by 2060 and announced several decisions to accelerate decarbonisation efforts [79]. In alignment with the United Nations' Sustainable Development Goals and the Paris Climate Agreement, the government introduced an Environmental Code in 2021, which was developed in accordance with the principles of the OECD and the European Union. This code mandates that the fifty largest enterprises, responsible for 80 percent of the Republic's emissions, must replace their outdated technologies with the best available technologies by 2025 [10]. The government also announced the National Development Plan Through 2025 [20] and the Ten National Development Projects [21, 22], with substantial financial allocations directed towards these initiatives to facilitate the implementation of innovative funding mechanisms for green projects. This resonates with the objectives of the International Center for the Development of Green Technologies and Investment Projects, established in 2018, to synergise Kazakhstan's commitment to sustainable development. Most significantly, the planned percentage of renewable energy sources in the electricity supply for 2030 was raised from Nazarbayev's 10 percent to 15 percent [80]. The Strategy on Achieving Carbon Neutrality until 2060, approved by Tokayev in 2023, outlined Kazakhstan's ambitious net-zero carbon goals for climate action and identified key technological transformations needed for decarbonisation [11]. By the end of 2023, renewable energy facilities contributed 6.675 billion kWh of electricity, accounting for 5.92 percent of the total electrical energy production [33].

The Tokayev government's determination to achieve innovative development amidst the rising electricity consumption rate has also rekindled the discussion about building nuclear power plants. In his address to the Members of Parliament and Members of the Government on September 1, 2021, acknowledging the impending electricity scarcity in Kazakhstan by 2030, Tokayev pledged to enhance the progress of renewable energy and hydrogen energy. Furthermore, he emphasised the importance of exploring the feasibility of developing nuclear energy that is both safe and environmentally friendly [81]. In 2022, not only the area of Lake Balkhash in the Alma-Ata region was suggested as one of the best locations for the plant, but also a

Memorandum of Understanding was signed with Korea Hydro & Nuclear Power to collaborate on building new nuclear power plants in Kazakhstan [150]. NuScale Power of the United States, General Electric-Hitachi Nuclear Energy of an American-Japanese consortium, China National Nuclear Corporation, Rosatom State Atomic Energy Corporation and Électricité de France were reported as other interested parties. As of 2023, a final decision on nuclear technology remained pending, but the Declaration to Triple Nuclear Energy, announced at the COP28 by over twenty countries across four continents [65], sought to enhance the position of nuclear proponents in the Republic. Energy Minister Almassadam Satkaliyev (2023-) projected in 2024 that the breakdown of installed capacity based on fuel type by 2035 would include 34 percent coal, 25.8 percent natural gas, 24.4 percent renewable energy, 10.8 percent hydroelectric energy, and 4.7 percent nuclear energy [33].

Although outdated and polluting energy generators are in the process of being phased out, the largest protests witnessed in Kazakhstan in January 2022 have prompted discussions on the government's hypothetical stance towards the imposition of new fuel taxes or the reduction of fuel subsidies in the face of renewable energy transition and civil unrest [152]. It is also worth noting that pipeline politics between Russia and Kazakhstan have become complicated since the start of the Ukrainian war in February 2022. With the Caspian Pipeline Consortium (CPC) handling almost all Kazakhstan's oil exports via an export terminal at the Russian Black Sea port of Novorossiysk, the spill-overs of the United States-led sanctions on Russian energy exports and Tokayev's refusal to recognise the independence of the so-called Donetsk and Lugansk People's Republics added to Kazakhstan's concerns about the trajectory of its foreign energy policy. Since the invasion began, the CPC has had stoppages on a few occasions, which led to speculation on the emerging fault lines in the Russian-Kazakhstan alliance. Tokayev's speech at the General Debate of the seventy-seventh session of the United Nations General Assembly in September 2022 summarised that the long-standing order- and responsibility-based international system is increasingly being displaced by a new, more chaotic and unpredictable one [86].

2.2 Assessing Renewable Diplomatic Prospects

Over the course of the 2010s, renewable energy has gained traction, transforming from a marginal sector into a central and widely recognised aspect of the energy industry. This section scrutinises the potential for renewable energy to be used as a foreign policy instrument for Kazakhstan in accordance with the eight indicators outlined in Section 1.2.5.

2.2.1 Renewable energy potential

Kazakhstan, among the five Central Asian countries, is widely regarded as the most proficient in harnessing renewable energy due to its extensive range of sources and significant generation capacity. With the Irtysh and Ili rivers in the east and the Syrdarya river in the south being important sources of the Republic's hydroelectric

power (Appendix J and Appendix K) [112,108], a capacity of generating 62 billion kilowatt-hours (kWh) of hydroelectricity per year is technologically feasible [191]. However, it is worth noting that due to its downstream location, Kazakhstan faces limitations in exerting direct influence over the timing, volume and quality of water inflows from across its borders. Such challenges caused by geo-related factors imply the importance of water management in cooperation with neighbouring countries, especially China, Kyrgyzstan and Tajikistan, for the Republic to capture the energy potential of these rivers. In addition, the adverse effects of climate change are affecting previously dependable hydroelectric power through seasonal changes in water level fluctuations in Central Asia, causing supply instability and dilemmas in balancing the needs of domestic energy consumption with the economic benefits of exporting energy. By the end of 2023, thirty-nine hydroelectric power plants had been established in Kazakhstan with a capacity of 269.61 MW [33]. Since it is unreasonable to design a national grid based on one type of power, wind and solar power are among the most appropriate renewable energy alternatives for Kazakhstan.

Wind resources are widely distributed throughout Kazakhstan. Due to the Republic's vast size, three-quarters of the theoretical wind power potential in Central Asia is located within its territory. Through a collaborative effort between the United Nations Development Program and the Ministry of Energy and Mineral Resources of Kazakhstan, a series of specialised studies have been conducted to examine the wind climate and potential for wind power system development in different areas of Kazakhstan. Using meteorological data, the wind atlas of Kazakhstan (Appendix L) was developed, which reveals the Republic's potential to achieve an estimated yearly wind energy generation of approximately 0.929 to 1.82 billion kWh [113, 353]. The Dzungarian Gate, a narrow valley that passes through the Dzungarian Alatau mountain range, is home to the largest wind energy reserves. Situated along the border between Kazakhstan and China's Xinjiang Uyghur Autonomous Region, this region boasts an impressive capacity of 17,000 kWh per square metre. In addition, Yerementau in the Akmola region, Fort Shevchenko on the Caspian Sea coast and Korda in the Zhambyl region have been identified as potential sites for wind energy development [191]. By the end of 2023, fifty-nine wind farms had been established in Kazakhstan with a capacity of 1409.55 MW [33].

Despite the benefits of wind power generation, the main disadvantage of wind energy is its intermittent nature. Hence, to ensure a continuous and reliable electricity supply without any disruptions, it is imperative to integrate wind energy with other forms of energy, incorporate energy storage systems, or establish connections with a vast transmission network spanning continents and countries. This approach maintains a harmonious equilibrium between electricity supply and demand, mitigating the risk of blackouts and any potential cascading issues. This makes energy regionalism a relevant topic in Central Asia when considering Uzbekistan's wind power potential, which is estimated to be ten times greater than its currently installed electricity generation capacity. Equally significant is the theoretical capacity of wind power in Kyrgyzstan, Tajikistan and Turkmenistan, which is estimated to be even higher than their hydropower potential [339]. In this regard, although wind energy is viewed as a complementary

source of energy, it can significantly improve energy security while reducing GHG emissions in Central Asia if bilateral or multilateral electricity trade is enabled.

Similar to wind, solar depends on natural systems, but both of these renewable energy sources can be modelled and forecast with reasonable accuracy using current technology. As the largest Central Asian country, Kazakhstan is renowned for its exceptional levels of solar radiation per capita, which are among the highest in the world. According to estimates, the solar energy capacity in the Republic is approximately 2.5 billion kWh per year, which would require an area of around ten square kilometres covered with solar cells operating at an efficiency of 16 percent [138]. The solar atlas (Appendix M) provides a comprehensive illustration of the solar energy potential in two-thirds of the Republic's territory, primarily in the southern regions, during the summer months from June to August [111, 354]. A boost in the efficiency of commercial photovoltaics, from today's average of 16 percent to a prospective 47 percent, as achieved by the latest perovskite solar cell technology [179], could further improve Kazakhstan's overall energy security and prospects for renewable electricity exports. By the end of 2023, forty-six solar power plants had been established with a capacity of 1222.61 MW [33].

Given Kazakhstan's geography and climate, small hydroelectric power, solar and wind energy are the most promising renewable sources of energy. Yet, not to be taken lightly is the Republic's potential in biomass and geothermal power. Kazakhstan has one of the largest agricultural-based economies in Central Asia, with extensive crop cultivation that generates large volumes of agricultural residues, which can be converted into bioenergy for heating, cooking and electricity production. Biofuel power plants play a crucial role in simultaneously addressing multiple issues, including waste recycling, household waste management, the advancement of green economy technologies and the generation of new employment opportunities [349]. By the end of 2023, three bioelectric power plants had been established with a capacity of 1.77 MW [33].

Kazakhstan's possession of significant geothermal water at medium and low temperatures is a little-known fact awaiting utilisation. According to preliminary studies (Appendix N) [351], at least one-fourth of the Republic's territory is rich in geothermal resources. The Kaplanbek geothermal field near Shymkent has used geothermal water at 80°C to supply heat to residential buildings [350]. In the Panfilov district of the Almaty region, two facilities near Zharkent have used geothermal water between 90°C and 120°C for recreation and tourism, greenhouse farming and fish farming [351]. While geothermal resources are undoubtedly suitable for heating, they are also technically feasible for electricity production. Unlike solar and wind energy, geothermal power plants can supply almost a constant amount of energy throughout the year, regardless of the weather conditions. However, compared to recent wind projects in Kazakhstan, the price of electricity from a geothermal power plant appears to be in the upper range of electricity prices, making geothermal electricity generation an unattractive investment [294]. In addition, lack of legislation to regulate issues related to geothermal resources creates a serious barrier for investors wishing to develop projects in this field in Kazakhstan. Currently, no data on geothermal power generation is available in the Republic.

The effort to reduce GHG emissions from electricity generation by promoting renewable energy sources requires a range of metals, such as copper, silver, zinc, aluminium/bauxite, iron ore, lead, tin, cadmium, selenium, manganese, molybdenum, chromium and titanium, for which Central Asia has a rich resource base and a high geological potential, making it a key player in the global market. Kazakhstan, in particular, is in a prime position to capitalise on the rising global market of critical raw materials and rare earth elements, which are used in the production of wind turbine magnets, solar cells, smartphone components, batteries used in electric vehicles and energy-efficient lighting, among others [342]. As the world's largest uranium producer, rare earth elements (both heavy and light rare earth elements) as by-products of uranium mining are commonly found in Kazakhstan. Local companies in the sector hold a dominant position, with many of them being privately owned but having partial government ownership. During the 1990s and 2000s, Russia had strong ties with Kazakhstan and served as the primary importer of minerals from both Kazakhstan and other Central Asian countries. However, China has assumed this leadership since 2010. Despite being initially overlooked, Kazakhstan has also gained recognition as a strategic supplier of critical raw materials for the manufacturing of renewable energy technologies and their components by the European Union. In 2019, the Republic accounted for 16 percent of the European Union's chromium supply, 7 percent of cadmium and 7 percent of titanium. Additionally, the European Union has been importing significant quantities of minerals, such as phosphorus, from Kazakhstan for use in other industries [252]. In 2022, the European Union and the Republic entered into a Memorandum of Understanding, which is of immense importance in the context of critical raw materials, batteries and renewable hydrogen [29]. This agreement can be considered a noteworthy achievement for Kazakhstan as it strives to position itself as a fundamental player in ensuring global energy security in the face of the changing dynamics of the energy sector.

With reference to Brazil: Brazil's vast energy potential, regardless of the energy type, is a direct result of its favourable geography and geology. The country's conducive geo-related factors have facilitated the formation of a joint energy security structure with other South American countries. The prominence of hydroelectric power in Brazil's energy landscape underscores the importance of intra-regional collaboration in promoting sustainable utilisation of shared water resources while tackling the prevalent challenge of energy scarcity in the region.

Forecasts for Kazakhstan: Kazakhstan is well positioned to simultaneously forge cooperative energy security with other Central Asian countries, engage in global renewable energy supply chains and attract renewable energy FDI from industry leaders in the relevant sectors. Cooperative energy security in the context of intra- and extra-regional interdependence is anticipated to make the Republic a central component of multiple energy clusters over the mid- to long-term in a complementary manner. While Kazakhstan's multi-vectoral approach to foreign affairs will remain unchanged in its entirety, the Central Asian vector is expected to be driven by specific requirements related to renewable energy technologies, various regional initiatives to reduce GHG emissions and geopolitical considerations. Despite the region's lack of history of security and order-making collaboration, the future holds promising

opportunities for Central Asian energy regionalism, particularly when considering the potential mutual gains for the five Central Asian countries in areas such as transboundary water management, cross-border electricity interconnections and the establishment of a common electricity market.

2.2.2 Ruling elite's change competency to pursue renewable energy transition

Change is an ongoing and dynamic process that requires certain level of competency. Change competency refers to the establishment of a business culture that not only anticipates changes but also responds effectively to them. This requires a deep understanding of the implications of change, adopting different perspectives and utilising various tools and techniques to ensure smooth and effortless transition. In an organisation that is change-competent, individuals define their roles in relation to change and prioritise the ability to adapt as a key responsibility [264]. To navigate the shifting dynamics of the global stage, Kazakhstan's ruling elite must embrace change and effectively respond to emerging market needs and technological advancements in the energy sector. The level of change competency plays a crucial role in determining the Republic's diplomatic capacity and global presence in the face of renewable energy transition [355].

Power dynamics in Kazakhstan have been characterised by a tendency towards exclusivity and hierarchy, with the breadth and extent of influence determined by familial, business and regional affiliations. However, when compared to his Communist Party counterparts, who assumed power in neighbouring countries like Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan after 1991, Nazarbayev demonstrated a greater understanding of the necessity to adapt to change in international affairs. Under his leadership, Kazakhstan attracted the much needed foreign investment to tap into its hydrocarbon potential. Due to political stability and regulatory reforms, the Republic ascended to become one of the world's thirty best countries in which to conduct business in 2018, up from eighty-sixth place in 2006 [139]. To a large extent, Kazakhstan's successes in handling the great powers while achieving the agenda for state-building owed much to Nazarbayev's adeptness in leveraging the Republic's vast oil reserves. Equally significant was his change competency when faced with global climate change, setting out ambitious plans for renewable energy increase in 2013, adopting the United Nations' Sustainable Development Goals in 2015, the Paris Climate Agreement in 2016 and hosting EXPO-2017 under the theme of "Future Energy."

However, reaching the goal of increasing the share of renewable energy to 3 percent of the energy matrix in 2020 is not equivalent to reducing emissions by at least 15 percent by 2030 compared to 1990, as pledged by Kazakhstan's NDCs under the Paris Climate Agreement [35]. The projected GHG emissions of the Republic in 2030 are anticipated to align closely with a "business as usual" scenario [246, 352], implying a lack of measures to fulfil its promise. Although continuity was once a buzzword to describe the presidential transition from Nazarbayev to Tokayev, failure to deliver tangible emissions

reductions even with a nationwide ETS launched in 2013 raised questions about the effectiveness of Nazarbayev's attempts to build a green economy. It is worth noting that since the COVID-19 pandemic, Kazakhstan has been under enormous international pressure to re-invent a new identity based on green growth and climate-compatible development. One year into his presidency, Tokayev was faced with a critical juncture in which the concept of continuity in his policies was no longer tenable. This change in perspective was primarily driven by the European Union's ambitious green recovery agenda, which included the implementation of a carbon border adjustment mechanism on imports. Tokayev had to re-evaluate his policy options and seek alternative strategies to adapt to the shifting international landscape.

In a virtual event held to mark the fifth anniversary of the Paris Climate Agreement in 2020, Tokayev highlighted the remarkable strides made in development over the past thirty years, while acknowledging the dependence of Kazakhstan's economy on fossil fuels, which presented a dual challenge for the Republic. To address this challenge, he proclaimed that Kazakhstan is compelled to simultaneously address two interrelated issues: 1) diversify its economy away from fossil fuels; and 2) combat climate change. In a resolute declaration, Tokayev announced Kazakhstan's ambitious target of achieving carbon neutrality by 2060 [79]. In 2021, Tokayev decided to enhance the proportion of renewable energy sources within the Republic's overall energy portfolio from 10 percent to 15 percent by 2030. Having identified the development of renewable energy as a national objective, Tokayev conveyed a crucial message to the leadership of Kazakhstan's energy sector, emphasising the need to comprehend that, in the current phase of global progress, a country's standing, prestige and global potential would primarily rely on its efforts to decarbonise the global economy. Specifically, this factor can serve as a significant benchmark for assessing Kazakhstan's eligibility for OECD membership [80]. At the Eighth Summit of the Organization of Turkic States, previously known as the Cooperation Council of Turkic Speaking States, in 2021, Tokayev urged the adoption of renewable energy sources and the advancement of hydrogen energy production as a sustainable and environmentally friendly fuel [71]. When the Strategy on Achieving Carbon Neutrality until 2060 was approved in 2023, a pragmatic roadmap – using natural gas as an intermediate fuel in conjunction with wind, solar and nuclear energy – was laid down to gear Kazakhstan towards reaching the unconditional medium-term goal of reducing GHG emissions by 2030 by 15 percent compared to the level of emissions in 1990 [11]. With Tokayev's persistent supportive and forward-looking stance on renewable energy transition, the Republic's identity re-invention in domestic and international politics appears to have been set in motion, evolving from a post-Soviet petrostate to a country that has created an environment conducive to the growth and utilisation of renewable energy sources.

Despite Tokayev's change competency, the successful integration of renewable energy sources into the current national and regional power systems presents significant economic and technological hurdles. Hence, it is imperative for Tokayev to evaluate the change competency and proficiency of his government in adapting to changes in hydrocarbon resources [355]. Moreover, it is crucial to consider the responses of the oligarchs in the Republic. These individuals not only serve as vital

sources of revenue but have also been instrumental in exerting influence and facilitating enrichment for well-connected horizontal networks within Nazarbayev's inner circle since the 1990s [286]. For over thirty years, foreign resource investments have facilitated the establishment of a system in which local informal networks leverage their connections with the ruling elite to secure advantages and economic power. This phenomenon is characterised by rampant corruption, weak legal and banking institutions, authoritarianism and patrimonial politics. As a result, the ruling elite and the oligarchy have succeeded in attracting capital from foreign investors and legitimising their wealth while failing to create a level playing field for local businesses. The shadow economy centred on the extractive sector could undermine Tokayev's efforts to implement reforms to traditional thermal power plants and the fossil fuel industry when the interests of informal networks are most certainly to be affected.

Besides, it is noteworthy that renewable energy is fundamentally different from the lucrative exploitation of raw materials. To ensure the establishment of a sustainable future, the primary emphasis is placed on transitioning away from hydrocarbon resources extraction and reducing the world's reliance on fossil fuels, as these activities typically concentrate wealth and power in the hands of a select few corporate and political elites. This movement addresses social justice and enables community-controlled and decentralised energy systems, encompassing various elements not only related to technological advancements but also grassroots activism and endeavours to re-organise governance systems [272]. On this basis, renewable energy transition is often referred to as the "democratisation of energy resources" or "energy democracy." These terms encapsulate the essence of the progressive social justice movement that led to the formulation of the Green New Deal in the United States in 2018. Since regime stability in Kazakhstan has predominantly relied on narrow interests, individual allegiance and the influence of informal networks, it could be deemed overly audacious for the government under Tokayev's leadership to enforce a radical approach towards advancing renewable energy. Potential resistance from the existing neopatrimonial system and the general population's lack of readiness to handle the consequences must be taken into account.

In January 2022, Kazakhstan witnessed the most severe mass riots, which led to the detention of Karim Masimov, the former Prime Minister (2007-2012, 2014-2016) and former Head of the National Security Committee (2016-2022), on charges of treason. This incident sheds light on the authenticity of an intra-elite conflict within Kazakhstan's domestic politics. It is worth mentioning that since then, the Republic has witnessed significant government reshuffles almost annually. By implementing political reforms, Tokayev could seek to redefine the intricate relationships between informal networks, the state and international actors. If implemented effectively, these reforms can facilitate not only a rapid shift towards a green economy but also stimulate nationwide incentives and advance social justice in the face of renewable energy transition.

With reference to Brazil: Throughout its modern history, Brazil's politics, economics and society have been plagued by widespread corruption and neopatrimonialism. However, the discovery of the pre-salt oil reserves in 2007 did not appear to have hampered the ruling elite's strong change competency in expanding

non-hydro renewable energy sources and transforming Brazil into a world leader in bioenergy. The pledge of Bolsonaro at the COP26 in 2021 to cut Brazil's GHG emissions by half by 2030 and that of Lula at the COP27 in 2022 to end illegal deforestation underscored the Brazilian ruling elite's consistent strong change competency in association with the global green agenda, including the goal of achieving climate neutrality by 2050.

Forecasts for Kazakhstan: Against the backdrop of Kazakhstan's petroleum-driven economy and foreign policy, the progressive moves made by Tokayev to adopt renewable energy transition demonstrate a breakthrough in the change competency of the Republic's ruling elite. His national climate targets reflect an ambitious vision for Kazakhstan's foreign policy-making, with an emphasis on increasing the influence of neoliberalism and constructivism. This will enable the Republic to be considered a reliable partner in global climate change mitigation efforts. The concern is that the Republic does not have a robust track record in abiding by a rule-based framework for managing energy affairs within its borders and on the global stage. Harmful practices and the resulting tragic consequences of corruption and injustice could drive the population and the regime apart, ultimately eroding Kazakhstan's diplomatic capacity and global presence.

2.2.3 Foreign policy resilience to renewable energy transition

In the sphere of international politics, resilience is a governance concept that encompasses strategic decision-making and effective system design. According to "A Global Strategy for the European Union's Foreign and Security Policy," a document published by the European Union in 2016, resilience encompasses the capability of states and societies to undergo reform, enabling them to effectively endure and recover from both internal and external crises [68]. This definition reflects one of the fundamental strengths of democracies: their capacity to adapt and adjust without undermining the overall system.

Kazakhstan's deliberate hedging strategy between Russia and China, coupled with the United States' efforts to create a protective barrier along the Russian border and the European Union's leadership in FDI in the petroleum sector, underscores the importance of leverage-seeking for the Republic to bolster its resilience against internal and external shocks. However, the sustainability of this situation is questionable, given the rising skepticism stemming from Kazakhstan's limited diversification of oil export routes, the ripple effects of Western sanctions on Russia's energy exports, the implementation of a carbon border adjustment mechanism by the European Union, and legal measures initiated by environmental advocates to ensure accountability of individual oil companies and governments for the climate crisis and toxic pollution. With the report *Net Zero by 2050* produced by the IEA in 2021 proposing that the realisation of the net-zero emissions target by 2050 would require a cessation of new undertakings in the spheres of coal, oil and natural gas projects [181], the window to invest in hydrocarbon energy might be narrowing for some countries.

Faced with the emergence of a scenario that endangers its oil rents, Kazakhstan could choose a compensation option by deepening ties with China to reverse its darkening diplomatic and economic outlook. Kazakhstan's crude oil exports, in particular, still play an important role in China's strategic priority for energy security through the Kazakhstan-China oil pipeline. As China's main partner in Central Asia and a key participant in the BRI, the inflow of FDI from China for infrastructure development in Kazakhstan and other Central Asian countries since 2013 has already turned the landlocked region into a transit hub with east-west and north-south connections, offering Kazakhstan endless potential to participate in the supply and value chains of various products. Equally significant is China's dominance over the renewable energy supply chain, which can enhance Kazakhstan's ability to transition towards renewable energy and become a low-carbon economy. Although the BRI has faced a slew of challenges since the late 2010s due to a trade war between China and the United States, the outbreak of COVID-19 and the growth of anti-China sentiment in the West, Xi's visit to Kazakhstan in September 2022, following a nearly three-year hiatus from international affairs, can be seen as a strategic move to revitalise China's extensive trillion-dollar initiative, particularly through the development of major infrastructure projects in Central Asia.

However, the Tokayev government must be aware that deepening ties with China could limit Kazakhstan's manoeuvrability in foreign affairs, especially given the lack of trust between the West and China. Considering the impact of Western sanctions on Russia and the spillover effects already on the Russia-led CSTO and EAEU, Kazakhstan requires redefining its multi-vector foreign policy [345]. One strategic approach to strengthening foreign policy resilience involves prioritising forward-looking bilateral and multilateral cooperation that aligns with the United Nations' Sustainable Development Goals and the Paris Climate Agreement. In this context, the private sector operating within the renewable energy industry, particularly those of Western countries, could be a valuable partner in Kazakhstan's renewable energy-oriented foreign affairs strategies. This was effectively demonstrated in 2018, when renewable energy auctions were held in Kazakhstan for the first time. In 2021, another escalation in efforts occurred, as Tokayev held discussions with European oil giants, including Total and Eni. His remarks at the meetings underscored the paramount importance of renewable energy as a means of decreasing Kazakhstan's dependence on carbon-intensive energy for economic growth and simultaneously acknowledged the substantial investment made by these oil companies in the Republic's renewable energy, storage, advanced transport, digital technologies, hydrogen and carbon capture and storage [12, 199]. Among them, the announcement made by the Swedish-German renewable energy firm Svevind Energy and the Kazakh Invest National Company JSC in the same year was considered the most groundbreaking. Their plan of action involved building one of the world's largest green hydrogen complexes in Kazakhstan, reflecting the Republic's ambition to establish a hydrogen economy that uses hydrogen as a decarbonisation tool and as a potential export commodity. With the installation of 45 GW of wind and solar energy in the predominantly steppe regions of western and central Kazakhstan, these facilities can supply 30 GW of electrolysers and enable the production of approximately three million

tonnes of green hydrogen annually from renewable energy sources. Although the completion of this ambitious endeavour is estimated to span a period of ten years [17], when completed, this green hydrogen complex and the associated infrastructure could practically elevate the Republic's status as a global leader in renewable energy in the medium-term future. The agreement signed by the Republic and the European Union in 2022 on the production of green hydrogen, along with cooperation in critical raw materials and batteries, further deepened both parties' determination to move away from traditional petroleum diplomacy and work towards achieving green targets for mutual and global benefit [29].

Although the role of the private sector from Western countries is vital in supporting the resilience of Kazakhstan's foreign policy through the strategic approach of hydrogen diplomacy, in analysing whether a country could find itself in a favourable position to become a producer of green hydrogen, three main requirements should be taken into consideration: 1) possessing a strategically advantageous geographical location; 2) maintaining a substantial proportion of renewable energy sources within the electricity matrix; and 3) possessing a robust and well-established industry with the expertise to effectively oversee the burgeoning hydrogen sector [180]. Kazakhstan's advantage is undeniable in the first requirement but lacks the second and third requirements to gain maximum benefits from a hydrogen value chain. Moreover, although the European Union has made significant investments in green hydrogen and hydrogen fuel cell technology as alternatives to traditional fossil fuels, there is no absolute certainty that hydrogen will become the future energy for the world, reminiscent of Brazil's past advocacy for ethanol. As of 2023, the cost of green hydrogen produced using carbon-free electricity was significantly higher than that of hydrogen produced from fossil fuels. The challenges posed by green hydrogen's low energy density, along with the high costs associated with the necessary pipeline infrastructure, have restricted its widespread adoption as an attractive energy solution [183].

For Kazakhstan, apart from building the capacity to turn green hydrogen into a potential foreign policy instrument for the future, uranium, critical raw materials and rare earth elements are among the alternatives that can be considered. While uranium diplomacy has been ongoing between Kazakhstan, the great powers and some specific countries, strict regulations and safety measures imposed on the global nuclear supply and value chain have made uranium a more costly and less profitable commodity than fossil fuels. In addition, after enrichment, uranium can be used not only as a fuel for electricity generation but also in the production of nuclear weapons. This makes uranium a highly sensitive and exclusive foreign policy instrument, which often requires the involvement of the International Atomic Energy Agency (IAEA), an eminent intergovernmental forum that fosters scientific and technical exchange and cooperation in the nuclear sphere. On this basis, despite the growth of the global nuclear power market, the revenue of Kazakhstan's National Atomic Company Kazatomprom JSC could hardly be measured on the same scale as that of KazMunayGas when petroleum trade is by far more profitable with fewer regulations and lower safety standards.

With respect to critical raw materials and rare earth elements, due to their pivotal role in the production of electric batteries, solar panels and wind turbines, companies

from Japan, Germany and France have been enticed to establish manufacturing facilities in Kazakhstan, specifically for the production of electric vehicles. However, while critical raw materials and rare earth elements can be used as foreign policy instruments to facilitate cooperation with the frontrunners in renewable energy transition, the environmental impact of mining can be devastating. In particular, the disposal of contaminated water from the extraction of critical raw materials and rare earth elements has already angered environmentalists. As of 2023, despite the formation of the ESG Club under the AIFC, ESG standards and corporate climate governance were still under development in Kazakhstan. Without the hasty adoption of ESG standards in their daily activities, businesses could exacerbate the already deteriorated environment due to decades of ecological mismanagement. Moreover, when considering the Kazakhstan 2050 Strategy's advocacy for a non-extractive and climate-resilient economy, it becomes clear that diplomatic efforts focused on uranium, critical raw materials and rare earth elements could deepen Kazakhstan's involvement in a rent-seeking economy. Nevertheless, these essential resources also provide avenues for the Republic to assert itself in the emerging energy order.

Green hydrogen, like other renewable energy sources, can reshape security and defence alliance maps. The geopolitical and geo-economic aspects of technological leadership and commodity control lead to a reconsideration of existing security partnerships. Kazakhstan's multi-vector foreign policy, which relies on petroleum as an instrument for leverage-seeking, may face challenges as the global shift towards renewable energy progresses unevenly. Reliance on oil rents for economic growth cannot be easily replaced by the production of hydrogen, uranium, critical raw materials and rare earth elements. This statement is particularly valid when considering the establishment of "green hydrogen corridors" that connect shipping routes with areas rich in renewable energy resources. Kazakhstan's landlocked geography presents a major disadvantage when compared to countries like Australia, Brazil and the Gulf Cooperation Council (GCC) countries (Appendix O) [190]. To address energy supply disruptions resulting from the Russo-Ukrainian war, Tokayev stressed the need for Kazakhstan to diversify its oil export routes and decrease its dependence on Russia. While this response is timely, one must take into account that fossil fuel exports may face a substantial decline in the decades ahead. Thus, it is crucial to acknowledge that redirecting oil quantities from the CPC pipeline to the Baku-Tbilisi-Ceyhan pipeline, which traverses Azerbaijan, Georgia and Turkey, requires significant investments in additional infrastructure. Caught in the middle of the pulling forces caused by the European Union's forward-looking climate and energy policy framework, the United States' polarisation of opinions over the environment and the economy, China's pragmatic approach to infrastructure development and Russia's pipeline politics, Kazakhstan faces a growing threat of failing to adequately align with the swift expansion of global renewable energy collaborations, while simultaneously being overwhelmed by the varied energy strategies of the great powers.

With reference to Brazil: Brazil's energy security policy is characterised by its flexibility to transition between different approaches, including energy independence through its own renewable sources and the pre-salt petroleum reserves, energy

interdependence with neighbouring countries and energy cooperation with partners from beyond the region. This diverse adaptability was exemplified during the severe droughts in 2021 and 2023, when Brazil managed to stabilise its electricity supply in line with demand amidst the failure of its hydroelectric power generation. The widespread use of biofuels further enhances Brazil's overall resilience. This diversified approach to energy security aligns with the country's foreign policy objectives and demonstrate its ability to develop resilient solutions when confronted with internal and external disruptions.

Forecasts for Kazakhstan: Kazakhstan's substantial reliance on fossil fuel production, consumption and oil rents as a means of driving economic growth and asserting its global presence reflects a lack of resilience in its foreign policy in response to the emergence of the new energy order. Amidst renewable energy transition and the global trend of decarbonisation, the Republic's multi-vector foreign policy, which revolves around petroleum exports, is anticipated to lose its effectiveness as a tool for seeking leverage among intra- and extra-regional actors in the long term. Achieving greater foreign policy resilience requires addressing the influences of geo-related factors and neorealism by increasingly embracing neoliberalism, particularly in situations where cooperation, synergies and mutual gains are given priority. Kazakhstan's current foreign policy approach, which focuses on leverage-seeking with the use of fossil fuels, can evolve into a mechanism that consolidates and defines the common energy interests of intra- and extra-regional actors.

2.2.4 National measures to increase sustainable energy security

Next to national defence, energy security has been regarded as a primary issue for the survival and well-being of both developed and developing countries [229], which echoes Tokayev's remarks in 2021 that one of his main tasks was to address energy security [81]. From a historical perspective, energy security has been primarily viewed as a defensive measure against supply disruptions and price volatility. However, the global energy landscape is witnessing dynamic shifts. These shifts encompass the substantial increase in demand from emerging industrial economies, the harmful effects of global warming induced by GHG emissions and the advancements in alternative energy technologies. Consequently, maintaining reliance on traditional energy practices would jeopardise the security and competitiveness of individual countries in the future. Moreover, the energy infrastructures are also at risk due to the looming threat of climate change. The emergence of numerous risks and uncertainties due to climate change has far-reaching implications, extending beyond the energy sector to include society and industry. The expected disruptions in the availability of energy, water and other vital natural resources give rise to novel challenges in the spheres of politics, economics and human security, implying the need to re-frame the conventional approach to energy security [352]. Since 1992, the international community has been preparing for this emerging paradigm of shifting to a low-carbon economy. The Kyoto Protocol, which was ratified in 1997 and remained in effect from 2005 to 2020, represented the initial step towards implementing measures under the UNFCCC. Following its tenure, the Paris Climate Agreement emerged as its successor,

entering into force in 2016 and surpassing the Kyoto Protocol in importance. Since 2022, the international community has been grappling with two energy predicaments due to the ongoing conflict in Ukraine. The primary predicament involves identifying strategies to minimise long-term energy costs while simultaneously reducing vulnerability associated with dependence on countries that may harbour hostile intentions. The secondary predicament concerns the urgent need to decrease carbon emissions resulting from all activities to fulfil national commitments while also ensuring that the economic costs remain acceptable. Being energy-rich, Kazakhstan might appear to be less concerned with the first problem. However, the Republic's heavy reliance on Russia's pipeline networks for oil exports and oil processing, as well as electricity imports to cover shortages caused by the wear and tear of local power plants, implies the important foreign policy dimension of its energy security issues.

Kazakhstan is among the one hundred and ninety-eight parties that have signed and ratified the UNFCCC. On this basis, unlike the situation in the 1990s when the Republic's energy security was primarily about overcoming its landlocked geography to export its oil to foreign consumers, priority in the 2020s and beyond is increasingly associated with achieving sustainable energy security, which is characterised by four important dimensions: 1) energy; 2) environmental; 3) economic; and 4) social. While Nazarbayev's Kazakhstan 2050 Strategy and Concept for the Transition to a "Green Economy" until 2050 remain as the blueprint for achieving the national goal of becoming one of the world's top thirty developed countries, Tokayev's National Development Plan Through 2025 [20] and Strategy on Achieving Carbon Neutrality until 2060 [11] provide more concrete details on achieving the strategic objectives in alignment with the United Nations' Sustainable Development Goals and the Paris Climate Agreement and ensuring a post-pandemic resilient recovery. Following Tokayev's approval of the Ten National Development Projects in 2021, it became clear that among a series of national priorities to develop a new economic structure, multiple approaches must be taken to achieve sustainable energy security.

The Ten National Development Projects include: 1) "The Healthy Nation;" 2) "The Well-Educated Nation;" 3) "The Ulttyk Rukhani Janghyru (National Spiritual Awakening);" 4) "The Technological Breakthrough through Digitalisation, Science and Innovations;" 5) "The Entrepreneurship Development Project;" 6) "Sustainable Economic Growth aimed at raising people's welfare;" 7) "Green Kazakhstan;" 8) "The Agro-Industrial Complex Development Project;" 9) "The Safe Country;" and 10) "The Strong Regions – Driver of the Country's Development" [21, 22]. Sustainable energy security is considered most relevant to "Sustainable Economic Growth" with the objective of modernising the energy complex, "Technological Breakthrough through Digitalisation, Science and Innovations" with reducing power losses, "Green Kazakhstan" with creating a favourable living environment and "The Safe Country" with ensuring the security of citizens and the state [359]. According to Kairat Kelimbetov, the former Chairman of the Agency for Strategic Planning and Reforms (2020-2023), the primary objective of every national development project is to provide effective solutions to existing issues while simultaneously promoting the advancement of key industries through a comprehensive nationwide approach. Consequently, rather

than solely conducting their designated functional responsibilities, governmental entities adopt a collaborative framework with other state and non-state bodies to effectively execute shared national objectives [20].

Technological transformation requires significant investments. As the world moves away from fossil fuels, the expansion of renewable energy sources demands significant investments. According to experts, a staggering USD$131 trillion will need to be directed towards the global energy system by 2050, with a specific emphasis on technology avenues that are in line with the Paris Climate Agreement's 1.5°C climate objective [20]. Kazakhstan's aspiration to achieve carbon neutrality by 2060 likewise requires substantial investments in low-carbon technologies. According to Alibek Kuantyrov, the former Minister of National Economy (2022-2024), the estimated net investment required for this purpose was USD$610 billion [215]. In other words, to ensure the Republic's sustainable energy security, innovative financing mechanisms and strategies must be adopted to encourage environmentally-friendly investments, which encompass green bonds, green banks, carbon market instruments, fiscal policy, green central banking, fintech and community-based green funds. The implementation of these strategies by Kazakhstan has the potential to significantly transform the landscape of its economy, facilitating an increase in private investments from both local and international entities aimed at fostering sustainable economic development. Consequently, this shift is expected to result in a greater representation of low-carbon energy sources within the Republic's energy matrix.

To facilitate favourable external conditions for the implementation of national development projects to achieve sustainable energy security, the Concept of the Foreign Policy for 2020-2030 was approved by Tokayev in 2020, in which a new level of "economisation" of foreign policy to strengthen Kazakhstan's position in the system of global economic relations was set among other foreign policy priorities. More active engagement with non-state actors in the international and regional economic and financial spheres, such as the OECD, the International Monetary Fund (IMF), the World Bank Group, the AIIB, the EBRD, the ADB, the Eurasian Development Bank, the European Investment Bank, the Islamic Development Bank and other institutions, and the reference to the AIFC within the same strategic document indicates a close correlation between sustainable energy security, integration into the global financial ecosystem and economic diversification [9]. This serves to underscore the limitations of neorealism's self-help and also demonstrates Kazakhstan's unwavering determination to explore global resources and facilitate its transition towards a green economy and green growth in accordance with rational choice amidst the complexities of dependence and interdependence [345]. Moreover, Kazakhstan's significant endeavours in non-fossil fuel energy initiatives play a crucial role in fostering a more equitable economic framework and achieving a carbon-neutral future [352].

Alongside the extensive deployment of renewable energy on a large scale, expanding the use of nuclear energy makes it feasible to provide modern and affordable energy to those currently lacking access, while simultaneously mitigating the human impact on the natural environment and ensuring that the world's ability to fulfil its other sustainable development goals remains unhampered. Given the growing concern over

power shortages and reduce electricity imports from Russia, it is not unexpected that Kazakhstan has opted to pursue nuclear energy as a practical solution for ensuring sustainable energy security [81]. The notion of nuclear energy as a sustainable energy option is inherently robust because of its innate energy density and its incorporation of health and environmental costs. In 2021, recognising that the development of renewable energy sources could not keep pace with the increasing energy demand, Tokayev announced that his government, along with the Republic's Samruk Kazyna sovereign wealth fund, would explore the feasibility of developing a nuclear power industry that is both safe and environmentally sustainable to maintain sufficient supplies of electricity while fulfilling the Republic's goal of achieving carbon neutrality by 2060. In 2022, the information in circulation was that if Kazakhstan had set a course for carbon neutrality, there was no alternative but to construct several nuclear power plants [14]. Tokayev's 2023 national address indicated plans for a national referendum to be conducted to address the establishment of a nuclear power plant [89]. The announcement of the Declaration to Triple Nuclear Energy at the COP28 in the same year [65] was expected to significantly boost advocates for nuclear energy.

In addition to Kazakhstan, the disclosure of Uzbekistan's plan to integrate nuclear energy into its energy portfolio occurred in 2018, when Mirziyoyev and Putin signed a cooperation agreement to build a nuclear power plant. The two VVER-1200 pressurised water reactors developed by Rosatom State Atomic Energy Corporation were designed to have a capacity of 1200 MW each and are scheduled for operation in 2028 and 2030 at a site near Lake Tuzkan in the Farishsky district [56].

With reference to Brazil: Brazil has established itself as a leading player in the fields of biofuels and hydropower technologies for a considerable time. In recent years, the country has broadened its focus on energy innovation to include new technological domains such as solar power, wind energy and hydrogen. By prioritising research and development in these areas, Brazil significantly contributes to the global clean energy technology value chains. This strategic move not only enhances the country's sustainable energy security but also propels its economic growth. With the Brazilian government announcing ambitious climate goals to achieve carbon neutrality by 2050 and eliminate illegal deforestation by 2030, the relevant state agencies are expected to create enabling conditions to mobilise the required local and international investments to increase the country's sustainable energy security in compliance with the long-term thirty-year roadmaps laid out in the 2050 National Energy Plan.

Forecasts for Kazakhstan: Kazakhstan has undertaken various national measures to create fundamental economic transformation and redefine its energy security. These measures include the National Development Plan until 2025, the Ten National Development Projects and a Strategy for Achieving Carbon Neutrality by 2060. Aligned with the United Nations' Sustainable Development Goals and the Paris Climate Agreement, these endeavours reflect the incorporation of neoliberal and constructivist principles into the framework of foreign policy. The AIFC is expected to be increasingly featured as a niche in Kazakhstan's economisation of foreign policy and its comprehensive agenda for sustainable growth.

2.2.5 Electricity infrastructure

To tackle global concerns regarding energy security and climate change, the integration of widespread electrification and digital technologies, alongside the utilisation of renewable energy sources, has emerged as a fundamental element of energy and climate policies. This approach enables countries to effectively fulfil their NDCs. However, this strategy implies massive modernisation of the national electricity infrastructure to enhance connectivity to the edge and improve asset management, which poses challenges to some developing countries, including Kazakhstan. The data extracted from a 2018 national report revealed that the average age of power plant equipment in Kazakhstan was thirty-two years. Among the power plants, the equipment that was commissioned over seventy years ago constituted a meager 0.54 percent, corresponding to 118 MW, of the total installed capacity. It is also important to highlight that power plants constructed over thirty years ago have made a substantial contribution to the total installed capacity, accounting for 54.3 percent, or 11,892 MW [34]. Developed during the Soviet period, the Republic's electricity grid in general does not offer substantial electric, environmental and economic benefits to all parties involved because of its heavy reliance on local fossil fuel resources, which also marks the stark contrast between the north and south in terms of power generation capacity. Owing to the concentration of Kazakhstan's coal reserves in the northern and central regions, most power plants in the Republic are located in the northern region. However, the main power consumer of the Republic is in the south, where conventional energy sources are limited.

In Kazakhstan's early days as a newly independent state, the KEGOC-operated north-south connections for power transfer had a transmission capacity of 650 MW, which was grossly insufficient to meet the demand in the booming southern part of the Republic, especially in the industrial region that stretches between Almaty and Shymkent. The power deficit in the south was approximately 900 MW, equivalent to half of the regional consumption [169]. In 2014, an extensive initiative named the "Construction of 500 Kilowatts (KW) North-East-South Transmission Grid" (Appendix P) [113] was launched by Nazarbayev to establish a modern power line infrastructure to ensure uninterrupted power supply to specific regions within the Republic. The project was divided into two phases: 1) construction of the 500 KW Ekibastuz-Shulbinskaya-Ust-Kamenogorsk transmission line; and 2) construction of the 500 KW Shulbinskaya-Aktogai-Taldykorgan-Alma line. The initial stage aims to guarantee sufficient electricity supply in eastern Kazakhstan by establishing a separate network of power lines that is independent of Russia's transmission infrastructure. On the other hand, the subsequent phase focuses on enhancing the transmission capacity of the national power grid in a north-south direction. This expansion aims to meet the electricity requirements of electrified railroads and energy-intensive facilities in the metal mining industry. In addition, it aims to facilitate the development of cross-border territories, harness the vast potential of renewable energy and reinforce the connection with Zone East of the Kazakhstan Unified Power System [155].

It is noteworthy that a narrow emphasis on renewable energy generation, without sufficient investment in upgrading the electricity grid alongside traditional power generating facilities, may result in an increase in emergency shutdowns, short circuits and power interruptions. The experiences of other countries have demonstrated that integrating renewable energy production into an existing electricity grid is a technically complex undertaking, which also entails significant costs for existing electricity providers, given the considerable variability of renewable energy supply [250]. Thus, power system optimisation in Kazakhstan is subject to the Republic's access to smart devices and other information technologies that make a smarter and more flexible electricity grid that can take full advantage of intermittent renewable sources, not to mention the growing threats of climate change and cyberattacks. A report by the ADB in 2020 showed that KEGOC was in the process of increasing its technical capability to integrate electricity generated from wind and solar power plants into the Republic's power system [174].

Moreover, it is essential to recognise that the National Power Grid acts not only as the primary backbone infrastructure for the electricity distribution network in Kazakhstan but also facilitates interconnections with the power systems of neighbouring countries, including Russia, Kyrgyzstan and Uzbekistan. This unique bi-directional nature of Kazakhstan's electricity grid can be attributed to its historical ties to the Soviet-era grid, which was constructed without considering modern-day national boundaries. As a southern extension of the electricity system of the Russian Soviet Federative Socialist Republic, Pavlodar in northern Kazakhstan played a significant role as the primary energy-producing hub for a region that spans the current Kazakhstan-Russia border. In the Republic's Zone West, where generating capacity is insufficient, Russian imports have become increasingly critical to overcome power deficits [156].

Simultaneously, part of Kazakhstan's electricity grid was designed to operate in parallel with the power systems of Kyrgyzstan and Uzbekistan. Uzbekistan, due to its central geographic location in Central Asia, possessed the most intricate power transmission infrastructure that linked all the adjacent countries. In fact, southern Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan are still tightly interlinked in an electrical sense and strongly depend on each other for electricity supply. This Soviet-built CAPS (Appendix Q) [105] makes the best use of the hydroelectric power potential of Tajikistan and Kyrgyzstan in the summer and the coal and natural gas resource bases of Kazakhstan, Turkmenistan and Uzbekistan in the winter, which was designed to be largely self-sufficient. Most importantly, the CAPS has a centralised dispatcher that controls power flows across the region.

Although energy independence was once one of the policy priorities of the newly independent Central Asian countries after the dissolution of the Soviet Union, the annual five-way summits held since 2018 have seen the leaders of Central Asian countries emphasise the need for bolstering cooperation in the energy sector. Their primary objectives include expanding the scope of the electricity trade and facilitating the growth of modern electricity infrastructure. As the region's largest economy and electricity market, the promotion of regional electricity cooperation greatly relies on Kazakhstan's active participation. In his 2022 remarks, Tokayev urged the leaders of other post-Soviet

Central Asian countries to acknowledge the urgency for the region to become a vast area of sustainable socio-economic development, comprehensive cooperation, peace and prosperity [84]. Viewed from the perspective of the current renewable energy transition to decarbonise the global energy system, infrastructure diplomacy is feasible and achievable at both the intra- and trans-regional levels when a reformed CAPS could stimulate private sector investment from local and foreign developers to further accelerate the expansion of renewable energy that brings technical, economic and environmental benefits to all Central Asian countries and neighbouring regions.

Due to Central Asia's geographical centrality at the heart of the Eurasian landmass, a readily available platform in the format of the CAPS can play a significant role in transcontinental energy security through electricity interconnections with China, Russia, the European Union and the Indian subcontinent. The Central Asia-South Asia Power Transmission Project, commonly known as the "CASA-1000" (Appendix R) [170], is one example that demonstrates the optimistic prospect portrayed by the CAPS for the envisaged Central Asia-South Asia Regional Electricity Market. Initiated by the World Bank Group, the CASA-1000 is a high-voltage electricity transmission system supported by several donors and international financial institutions that would allow for the export of surplus hydroelectricity, totalling 1,300 MW, from Kyrgyzstan and Tajikistan to Afghanistan and finally to Pakistan to meet their rising electricity demands [154]. However, work on one of the longest stretches of the power transmission line in Afghanistan was reported to have been suspended since NATO forces withdrew in 2021. As a result, the World Bank expressed its inability to maintain financial terms with the Taliban. However, by 2024, as the work in the three other countries neared its conclusion and they had already started repaying their debts to the World Bank and other financiers, the World Bank made a compromise to resume project activities in Afghanistan in a "ring-fenced manner" by not involving the Taliban administration [168]. Instances of similar project complications illustrate the risk of cross-border electricity interconnections when political instability in one country could jeopardise the energy security of others on the same grid.

Another type of complication that hinders state-led collaboration on grid modernisation and interconnections is attributable to great power competition over industrial structure, cutting-edge technology and market size [249]. When considering the political and investment climate in Central Asia in the aftermath of Russia's invasion of Ukraine, given the growing mistrust between the West and the "China-Russia axis," Kazakhstan finds itself in a unique opportunity to leverage its strategic position and foster multiple forms of bilateral cooperation with China, Russia, the European Union and the United States to enhance mutual endeavours aimed at mitigating global climate change. If the Republic capitalises on this opportunity, it can attract more FDI into its renewable energy development and grid infrastructure modernisation, contributing to both national and regional interests.

With reference to Brazil: Brazil has long developed the necessary infrastructure and a specialised MERCOSUR mechanism to import and export energy with Argentina, Paraguay, Uruguay and Venezuela, making mutual help possible. The 2050 National Energy Plan also addresses the transition towards a decarbonised economy,

decentralised energy resources and digitalised energy production and use, preparing the conditions for the construction of new architectures of interconnected low-carbon energy systems. At the national level, Chinese enterprises have undertaken numerous UHV direct current power transmission line projects to fulfil the electricity demands of the Brazilian population, while also aiding the country in its pursuit of green development goals.

Forecasts for Kazakhstan: Kazakhstan's foreign energy relations are inseparable from the Soviet electricity infrastructure in the format of the CAPS, making the Republic an irreplaceable contributor to Central Asian energy prosperity. Thus, it is fair to forecast that substantial involvement of intra-regional actors is embedded in Kazakhstan's renewable energy-oriented foreign affairs strategies. However, being aware of the outdated grid technologies across the region and its neighbours' unpredictability, the Republic's pursuit of a nuclear power plant is reflective of policy-makers' inclination and priority to achieve energy independence and self-sufficiency. Neorealism's concept of self-help continues to exert a significant influence on Kazakhstan's theoretical approach towards attaining energy security.

2.2.6 Human capital

Diplomacy on the climate-energy nexus has escalated to become a top priority for the international community. The technical character of this category of diplomatic activities necessitates practitioners to possess a specific degree of expertise in ecological, biological, engineering, economic, legal and other relevant domains, in addition to the fundamental training required for every diplomat. Consequently, several countries have taken the initiative to appoint one or more ambassadors who specialise in matters of the intricate relationship between humans and the environment. Apart from interstate negotiations and dialogues, a comprehensive analysis of the OECD countries spanning the period from 1980 to 2015 elucidated the connection between knowledge and the implementation of strategies aimed at mitigating the negative consequences of climate change. The research findings suggested that development of human capital has been observed to play a crucial role in decreasing the consumption of non-renewable energy [263]. Another study conducted specifically on the G7 countries likewise unveiled that investment in human capital, such as education and health, must be encouraged as it is a crucial component to enhance skill level, optimise the use of natural resources, minimise energy waste and leakage, and foster environmental sustainability, all of which are integral to improving overall economic performance. [316].

Human capital refers to the manifestation of human potential, encompassing the acquisition of knowledge, skills and physical well-being that individuals accumulate throughout their lifetimes. This accumulation enables individuals to effectively use their abilities and contribute meaningfully to society as productive members [173]. Since 2017, the World Bank has taken the lead in a global effort focusing on human capital development. This initiative expedites the allocation of substantial and superior investments in individuals with the goal of achieving greater equity and economic growth. These efforts are particularly crucial given the transformative changes brought

about by the evolving energy landscape, the digital transformation of manufacturing and production, and the consequential impact on related industries and value creation processes. This new agenda characterises education and society in relation to market forces, stresses the importance of links between education and industry, and frequently cites the importance of human capital to meet present and future market needs at national, regional and international levels. The WEF highlights the crucial role of higher education in determining national competitiveness. It emphasises that in the current era of globalisation, countries must prioritise the development of a highly educated workforce that possesses the ability to tackle complex tasks and readily adapt to the ever-changing environment and evolving requirements of the production system [140]. The IRENA asserts that many of the most significant changes in skills and occupations in the green economy occur at higher-skill levels that require university education [186].

Following EXPO-2017, which focused on the concept of "Future Energy," Kazakhstan took the initiative to launch a range of public diplomacy initiatives and programmes. A significant step in this direction was the establishment of the International Center for Green Technology and Investment. This Center bolsters cooperation among Central Asian countries in their pursuit of sustainable development, with the support of influential international institutions and the private sector. Serving as a platform for the exchange of knowledge and technologies, the Center facilitates the transfer of expertise across Central Asia. It is worth mentioning that the Center's key cooperation partners included industrially advanced countries such as members of the OECD, the European Union, the United States, Russia, China, India and specific Latin American countries [204], reflecting the complexity and high costs of innovation when technological expertise from different fields from leading countries is brought together to tackle issues that are not confined to the borders of one country. The state-driven initiative "Digital Kazakhstan" since 2018 has also yielded significant ramifications for the Republic's adoption of Energy 4.0. The emergence of Energy 4.0, a result of technological advancements and the advent of the Internet of Things, signifies the fusion of electricity and digitalisation on a large scale. This convergence is distinguished by the application of automation and data to establish intelligent grids, facilitate the integration of renewable energy sources and effectively regulate distributed generation [348].

It is worth noting that with an estimated ten thousand vacancies expected to emerge in Kazakhstan's electricity supply sector by the mid-2020s [193], since the late 2010s, the Ministry of Energy has been actively working with Nazarbayev University, Almaty University of Power Engineering and Telecommunication and Kazakh-German University to train specialists in the field of electric power. Moreover, specialised government institutions have been actively engaged in formulating comprehensive, enduring plan to identify, evaluate and alleviate investment risks. This strategic approach fosters an environment conducive to private sector investments and the expansion of renewable energy markets. Furthermore, local enterprises have consistently played a pivotal role in offering services to the renewable energy sector. They have emerged as catalysts for job creation, actively overcoming various obstacles such as technical, legal, economic, financial, administrative and bureaucratic hindrances that impede the rapid deployment of renewable energy technologies [19]. As the 2020 Human Capital Index

(HCI) of the World Bank showed, Kazakhstan was ranked fifty-fifth among one hundred and seventy-four economies with a value of 0.63, fifty-four places below the HCI leader Singapore's 0.88 but one hundred and nineteen places above bottom place Central African Republic's 0.29 [173]. The Republic appears competent to rejuvenate its momentum to create the conditions necessary for renewable energy transition.

However, the accelerated outflow of professional personnel has presented a significant challenge in the broader context of Kazakhstan's human capital development and inclusive economic growth, commonly referred to as domestic "brain drain" through migration. The concept of brain drain denotes the transnational flow of human capital, with a particular emphasis on the emigration of highly educated individuals from developing countries to developed countries [262, 265]. The European Training Foundation's 2020 report explores Kazakhstan's talent shortage in the local job market, noting that out of the three hundred and sixty-six thousand people who emigrated from the Republic during the 2010s, economists, teachers and technicians constituted the three largest professional groups among the emigrants. These individuals were subsequently replaced by a less qualified influx of migrants, primarily from economically disadvantaged neighbouring Central Asian countries, as well as marginalised ethnic Kazakhs from various parts of Eurasia, China and Mongolia. Incoming migrants possessed only basic or lower secondary education, indicating a significant decline in the overall skill level of the workforce [172]. According to Kazakhstan's Bureau of National Statistics, between 2014 and 2023, the total number of Kazakhstan citizens who permanently left significantly exceeded immigrants entering [116], implying the pessimistic direction for human capital and energy innovation to accelerate renewable energy transition.

Although sixteen universities in Kazakhstan are featured in the QS World University Rankings 2022/23, ranging from Al-Farabi Kazakh National University of Almaty at the one hundred and fiftieth position to S. Toraighyrov Pavlodar State University at one thousand two hundred or below [117], the lack of achievement of world-class status by most of the other local public and private universities presents a realistic obstacle for Kazakhstan's economy to diversify into more complex, skill-based sectors for the production of high-value and low-carbon products. Kazakhstan's youth who studied overseas at both undergraduate and postgraduate levels, especially those who were participants in the Bolashak International Scholarship Programme, might have been regarded as an antidote to brain drain [343]. However, based on an extensive investigation conducted on a specific cohort of young Kazakhstani individuals residing overseas, aged up to thirty-five years, a significant proportion of 51.3 percent cited "corruption, bureaucracy at all levels, impunity and irresponsibility of officials, and inefficient government" as the primary factors influencing their decision to leave their home country. Conversely, 31.3 percent attributed their departure to "professional lack of demand, lack of prospects for self-realisation and career advancement [171]." Whereas knowledge is usually considered an important asset for the younger generation as it can affect their competitiveness and salary gained in society, these findings imply that Kazakhstan's brain drain has its roots in the emigration problem, which could be traced to systematic defects originating in the

Republic's higher education, labour market and public administration. Social injustice, characterised by an imbalanced allocation of resources within a community and an unequal distribution of opportunities, rewards and prospects for enhancing one's quality of life, can be held responsible for the emigration of highly skilled or educated individuals from their place of origin.

The stereotype that the emigration of educated youth depletes Kazakhstan's human capital is widely accepted by both experts and the public. However, there is an expectation that the government will undertake necessary reforms to enhance the Republic's attractiveness to qualified professionals. The latter has been demonstrated through Tokayev's elite programme Presidential Youth Personnel Reserve since 2019 [19] and his approval of the Ten National Development Projects in 2021, in which various public goods aimed at enhancing the quality of life, education, healthcare, environmental sustainability, public services and security are embedded [21, 22]. After the protests in January 2022, Tokayev's government further addressed the Republic's economic inequality by raising youth wages under the Youth Practical Training and First Job Projects [25]. Another initiative that has been put in motion is the development of a residence-by-investment programme with tax benefits to reach the goal of attracting up to one hundred business investors to the AIFC annually [8]. The unprecedented influx of mainly young men from Russia in September 2022 , who have experience working in high technology, communications, or finance but were unwilling to be recruited in response to Putin's partial military mobilisation remarks, could also be critical in rapidly reducing brain drain and serving as a catalyst for the advancement of human capital and renewable energy transition in Kazakhstan.

With reference to Brazil: Brazil, as the largest economy in South America and a member of the Group of Twenty (G20), has consistently held the top position in renewable energy employment in South America since 2018. These employment opportunities encompass several roles, including specialists in sustainability and renewable energy, as well as professionals with expertise in associated fields who possess a comprehensive understanding of production, supply and value chains. Despite the rise in Brazilian emigration to OECD countries following economic instability since 2014, the country has demonstrated resilience by maintaining a strong foundation of human capital, supported by top-ranked universities and a growing information technology industry. Taking into account the South American continent's historic link with Europe, as well as neighbours such as Argentina of the G20 and Chile, Colombia and Costa Rica of the OECD, Brazil possesses good potential for "brain circulation (brain drain + brain gain)" through intra- and inter-continental human capital flows.

Forecasts for Kazakhstan: The lack of human capital prevents any country from surviving, building alliance and re-inventing its identity associated with cutting-edge energy technologies and sustainable innovation. Geo-related factors, neorealism, neoliberalism and constructivism all contribute to explaining the impact of brain drain on Kazakhstan to varying extents. Among the various potential solutions, public diplomacy and knowledge diplomacy are expected to play significant roles in the Republic's foreign policy. These efforts will be accompanied by student mobility and exchange programmes, talent pools and skills ecosystems desgined to address the

challenges of renewable energy transition. The key issue is the potential lack of sufficient incentive mechanisms to tackle brain drain and social injustice, which could hinder Kazakhstan's progress in renewable energy transition and its achievement of a knowledge-driven economy on both domestic and international fronts.

2.2.7 Energy cooperation with intra-regional actors

Regional cooperation on electricity encompasses both physical infrastructure and market dimensions, which involve the establishment of rules and regulations to facilitate cross-border electricity trade. However, when the CAPS was established in the Soviet Union during the 1970s, the market dimension was not considered. The primary purpose of the CAPS was to exchange hydroelectric power for fossil fuels between the upstream and downstream republics of Central Asia. Managed by the Unified Dispatch Office of Central Asia in Uzbekistan, the CAPS in its original configuration covered a vast operating footprint of approximately two million square kilometres, including Uzbekistan, Tajikistan, Kyrgyzstan, Turkmenistan and five adjacent regions of southern Kazakhstan. The whole network comprised eighty-three power plants of different types, with 30 percent being upstream hydroelectric power plants and 70 percent being downstream thermal power plants, which were all interconnected through power transmission lines with capacities of 220 and 500 kilowatts [337]. Significant cross-border electricity exchanges occurred among the various republics, with Uzbekistan accounting for 51 percent of the total electricity generated by the CAPS. Kyrgyzstan contributed nearly 14 percent, while Kazakhstan and Tajikistan generated over 9 percent and 15 percent, respectively. Turkmenistan accounted for 10 percent of the electricity generated within the CAPS framework [336]. However, the dissolution of the Soviet Union resulted in a progressive decline in the crucial role of the CAPS, as each country embarked on independent decision-making regarding energy issues. This led to the erosion of established practices and the abandonment of the physical and technical parameters associated with the infrastructure. Subsequently, between 1990 and 2016, the intra-Central Asian electricity trade experienced a drastic decline from 25,413 million kWh in 1990 to 2,080 million kWh in 2016 [145]. This decline can be attributed to several significant events, namely Turkmenistan's split with the CAPS in 2003, Tajikistan's disconnection from Uzbekistan in 2009 and the withdrawal announcements made by Kazakhstan and Uzbekistan.

The absence of robust cross-border electricity cooperation in Central Asia can be attributed to a range of factors, which include the authoritarian political systems, dire economic circumstances, continuation of traditional trade relations, unresolved ethno-territorial conflicts and external great power competition. Central Asia's remote geographic location from major centres of world business activity, uneven pace of economic reform, landlocked situation and underdeveloped transportation infrastructure also do not facilitate the region's participation in the world economy as a trade and economic bloc. Kazakhstan's Concept for the Development of the Fuel-Energy Complex by 2030 (decree No.724) brings into focus some crucial energy policy

priorities and the Republic's proposition for intra-regional electricity collaboration. Released in 2014 on the basis of a thorough examination of the circumstances prevailing in the early 2010s, the document highlights the significance of bolstering energy self-sufficiency to ensure national energy security, thereby supporting economic growth and enhancing the living standards of the population [7]. The exclusion of low-carbon hydroelectric power imports from Kyrgyzstan and Tajikistan is notable. Conversely, substantial emphasis is placed on exploring investment prospects to enhance Kazakhstan's electricity generation capacity, aiming to amplify its export capability. Such quest for energy independence by the Republic can be understood as a reaction of the Nazarbayev government to the repeated violations by neighbouring countries of their obligations under the CAPS. It was reported that wide-ranging blackouts in southern Kazakhstan in the early 2010s were caused by unscheduled and noncontractual "overdrafts" of electricity by Uzbekistan, which intensified the long-running rivalry between the two countries [292].

The collapse of the CAPS led to widespread power outages, particularly in Kyrgyzstan and Tajikistan during winter, while Kazakhstan, Turkmenistan and Uzbekistan increased their use of environmentally harmful fossil fuels during the summer. As a result, since 2018, negotiations have been underway to re-establish the intra-regional resource-sharing mechanism and establish a common power market. This endeavour is considered a positive step forward because by sharing electricity, these Central Asian countries can achieve cooperative energy security. Furthermore, this collaboration will provide advantageous circumstances for effective emissions management. A consequential decrease in GHG emissions through their transfer from one country to another can facilitate a mutual shift towards the adoption of sustainable and environmentally friendly energy systems [318]. In 2018, the ADB granted USD$35 million to Tajikistan to reconnect its electricity system to the once-unified Central Asian power grid through Uzbekistan. This was followed by a technical assistance grant of USD$4.5 million in 2019, aimed at exploring the possibility of reconnecting Turkmenistan to the CAPS and extending the system to Afghanistan. These initiatives have played a crucial role in accelerating the region's progress towards more liberal energy markets, with increased participation and investment from the private sector. In addition, they have successfully facilitated the enhancement of grid connections and electricity exchanges between countries, exemplifying a steadfast commitment to utilising renewable energy sources and embracing sustainable technologies [146]. In 2021, despite tensions over water at a disputed section of the border between Kyrgyzstan and Tajikistan in April, a consistent bilateral electricity trade was reported to have occurred, highlighted by Turkmenistan exporting electricity to Uzbekistan and Kyrgyzstan, as well as from Tajikistan to Uzbekistan [338]. However, given that power shortages in the five Central Asian countries have been reported annually, whether these exporting countries can afford to share their surplus electricity on a sustainable basis remains a serious concern. Even for energy-rich Kazakhstan, achieving sufficient power generation to meet local needs is a challenge. It has been reported that an incompetent electrical power infrastructure has already created many doubts about Tokayev's ambition to turn the Republic into an

international leader of digital technology, cryptocurrency ecosystem and regulated cryptocurrency mining because it is common knowledge that a vast amount of electricity is required to solve computer algorithms that generate cryptocurrency. In 2021, when Kazakhstan emerged as the world's second-largest cryptocurrency miner, with an 18 percent global market share [99], the same year saw an increase of 6.1 percent in electricity consumption compared with previous growth by no more than 2 percent in a year [26]. The hindrance to the expansion of Kazakhstan's cryptocurrency industry quickly became evident as the Republic faced escalating GHG emissions and an insufficient electricity supply. Recognising the importance of promoting environmental friendliness within this fast-growing industry, local blockchain and data centre industry associations have concurred on the necessity of embracing renewable energy. Nevertheless, establishing new generation capacity to offset the obvious shortage is a time-consuming endeavour.

Struggling with a lack of capabilities to instantly produce more electricity, policies were introduced in 2021 to set limits on the electricity consumption of the cryptocurrency mining industry and crack down on unregistered miners, which resulted in a 1.4 percent decrease in electricity consumption over twelve months [28]. In addition, Kazakhstan negotiated with Russia to purchase electricity, taking advantage of its power lines that are interconnected Russia's electrical grid with some of the main cryptocurrency mining hubs located in northeastern Kazakhstan. Although theoretically electricity from the CAPS could also be transmitted simultaneously through southern Kazakhstan to these locations via the Republic's refurbished north-south transit line to address the electricity deficit, policy-makers deemed this option unfeasible due to the lack of recognition of electricity inflows from the CAPS into Kazakhstan's national power grid, as stated in both the national electricity laws and the Republic's development plans [7]. To facilitate the simultaneous functioning of the energy systems in both countries, Inter RAO, a prominent diversified energy utility company in Russia, signed a commercial contract with KEGOC in 2022 [157]. This agreement was established in accordance with the intergovernmental agreement between Russia and Kazakhstan dated September 20, 2009, highlighting the importance of inter-regional transmission between Kazakhstan and Russia [3].

In comparison, despite being created in 1999 to act as a consultative body for coordinating the parallel operation of the CAPS, the Central Asia Coordination Electric Power Council faces challenges due to the lack of a binding legal framework between the countries and businesses that are engaged in, as well as the outdated Soviet-built electricity infrastructure interconnections. However, the potential for intra-regional interdependency of electricity is promising, particularly because of the great powers' interest in transforming Central Asia into an integrated regional energy market that would benefit a vast population across the Eurasian continent. A notable example of progress in this direction is the collaborative effort between the World Bank, the EBRD, the ADB's Central Asia Regional Economic Cooperation (CAREC) programme and KEGOC. Their joint initiative in the early 2000s to construct the north-south electricity transmission in Kazakhstan not only created a crucial lifeline for the Republic's economy but also established an energy bridge connecting Russia and Central Asia.

This development effectively bridged the infrastructure gap, which was once considered a hindrance to the establishment of a transcontinental electricity network. The global energy crisis in 2021 and 2022 further underscored the importance of electricity interconnections between clusters of countries. Alongside cross-border electricity trading and a greater share of renewable energy generation, these interconnections can enhance energy security and system stability, reduce losses and decrease emissions. In this context, the CAPS assumes significant strategic importance as a cluster of national grids that operate in complementary ways and in parallel with the Russia-Kazakhstan energy system. Its role in facilitating east-west and north-south electrical interconnections should not be overlooked.

Under the leadership of Russia, the EAEU is actively promoting the establishment of a unified electricity market, with plans to inaugurate it by January 1, 2025 [67]. Pursuing the status of the twenty-first century's energy superpower amidst Western economic sanctions, the CAPS theoretically offers Russia the opportunity to enlarge the EAEU's interstate power network infrastructure and connect it with Afghanistan, the Indian subcontinent, the Middle East and West Asia through the Caspian Sea [322]. By leveraging the hydropower resources of Kyrgyzstan, the CAPS also has the capacity to supply electricity to Russia and other EAEU countries via Kazakhstan, thereby generating positive outcomes for the electricity sector in all relevant countries [320]. Provided that the EAEU and the European Union establish pragmatic cooperation, the CAPS can even become an integral part of a transnational low-carbon electricity network that extends from western Siberia to Lisbon [326]. Nevertheless, Russia's aspirations in the field of electricity geopolitics are hindered by the significant financial burden of approximately USD$400 billion in cumulative investments required until 2030 to repair and upgrade power stations and transmission lines from the Soviet era. This challenge was further compounded by the adverse impact of stricter Western sanctions imposed on Russia following its invasion of Ukraine in 2022.

Billions of dollars pledged by China's BRI will help address the pressing demand for enhanced electricity infrastructure in Central Asia. In accordance with Xi's proposal in 2015 to establish a global energy network that uses clean and environmentally friendly energy sources, China has undertaken a thorough assessment of the feasibility of establishing power grid interconnections between its Xinjiang province, the five Central Asian countries and Pakistan [311]. As the importance of electrification continues to rise and China maintains its leading position in global solar energy capacity, the BRI represents not only China's financial investments in Central Asia but also serves as a platform for sharing knowledge and expertise on renewable energy systems integration, smart grid technologies, ultra-high voltage (UHV) transmission, and electric vehicles with partner countries. As of 2023, despite the absence of a direct connection to China, a modernised CAPS can transform China's reliance on fossil fuel imports from Central Asia into an electricity trade that caters to the escalating electricity demand of all involved parties. This transformation will also align GHG emissions with the respective set limits, thereby exemplifying the BRI's contemporary win-win proposition for sustainable development.

Despite the withdrawal of its military forces from Afghanistan, the United States persists with its C5+1 multilateral dialogue platform. In 2018, the United States Agency for International Development (USAID) initiated the Central Asia Regional Electricity Market (CAREM) project to establish an expanded Central Asia-South Asia regional power market [208]. In 2020, USAID introduced the "Power the Future" programme, which seeks to expedite the development of cost-effective, low-emission and climate-resilient economies in all five Central Asian countries. This programme primarily focuses on the deployment of renewable energy and energy efficiency measures [210]. The launch of the "Power Central Asia" regional energy programme in the same year, with a budget of USD$38.9 million over five years, further highlights the continuous commitment of the United States to bolster local energy market reforms, enhance the regional electricity market and encourage the utilisation of clean energy technologies derived from both conventional and renewable sources [211]. In 2022, the USAID-sponsored Central Asia Clean Energy Forum, centred around the theme of "Energy Transition and Innovation," brought together approximately three hundred participants from the Central Asian region and beyond to address significant challenges and opportunities in the energy sector [213].

Last but not least, the European Union plays an active role in supporting the development of interconnections in Central Asia. According to the 2019 European Union Strategy on Central Asia, entitled "The EU and Central Asia: New Opportunities for a Stronger Partnership," the European Union recognises the significant potential for solar, wind and hydroelectric energy in Central Asia and therefore pledges to offer European technology and guidance to foster collaborative partnerships [69]. The participation of European developers in Kazakhstan's renewable energy auctions since 2018 signifies important trends [210], in addition to a 2020 report from the Science and Knowledge Service of the European Commission that explores the feasibility of establishing electricity transmission interconnections between Central Asia and the European Union [295]. In response to the European Union's sustainable hydrogen strategy in the early 2020s, Kazakhstan [17], Uzbekistan [57] and Turkmenistan [55] also announced their respective hydrogen plans, with the European Union acting as either a partner in development or potential export destination. These developments indicate a shift in Central Asia's role within the European Union's energy security strategy, which is entering a new phase of cooperation and collaboration.

The role of FDI from the great powers in Central Asia's energy supply and value chains cannot be overstated as it can significantly enhance the region's technological innovation capabilities and competitiveness [344]. Among the five Central Asian countries, Kazakhstan plays an indispensable role in attracting investors for the CAPS and facilitating connections between foreign renewable energy developers, green technology companies and local experts from various Central Asian countries, with the AIFC acting as an ideal platform for managing the influx of investments. However, the involvement of foreign entities cannot be viewed isolated from the geopolitical significance of the region. The task at hand for Kazakhstan is to establish a foreign policy that accords with the mutual interests of major powers and regional neighbours in propelling a climate-friendly energy revolution across national, regional and global domains.

As a consequence of Russia's invasion of Ukraine in 2022, the fear of Russian expansionism and spill-overs of Western sanctions has prompted Central Asian countries to reassess their foreign affairs strategies, especially their ties to and reliance on Russia. In this connection, intra-regional electricity cooperation is essential for the conversion of the region's energy resources into dependable and adequate energy supplies for all consumers within the region, offering the five countries advantages in terms of shielding themselves from becoming dependent on any particular great power during times of uncertainty [335, 337]. At the General Debates of the United Nations General Assembly in September 2022, Tokayev delivered remarks that underscored the commitment of Kazakhstan and its Central Asian partners to enhance political interaction and strengthen economic ties, stressing their shared vision to propel the region forward through collaborative efforts [86]. Kazakhstan's Concept of the Foreign Policy for 2020-2030 also emphasises the growing importance of Central Asia in the Eurasian and global processes that can reinforce existing patterns of interaction between Central Asian countries and their external counterparts [9].

With reference to Brazil: State-led attempts to promote regional energy integration based on bilateral agreements in South America began in the 1990s. Continent-wide grid integration was further discussed in the 2000s. However, the progress of regional integration within the MERCOSUR framework has been hindered by political shifts in Brazil and Argentina since the late 2010s. Consequently, the creation of a single South American electricity market has become a complex endeavour. Nevertheless, proposals to enhance energy integration with other South American countries are featured in Brazil's 2050 National Energy Plan. The droughts in 2021 and 2023 also highlighted the significance of intra-regional electricity cooperation when energy independence, compared with energy interdependence, appeared to be more vulnerable to climatic variations. With the electricity matrices of countries like Argentina, Brazil, Chile, Peru and Bolivia already highly decarbonised, the establishment of an interconnected South American power grid is regarded as a pivotal development that positions the continent to become a key player in the global renewable energy sector.

Forecasts for Kazakhstan: Intra-regional electricity cooperation in the format of the CAPS provides a convenient and suitable mechanism for Kazakhstan to attain a sustainable energy future that is resilient, cooperative, impactful and environmentally friendly with its Central Asian neighbours. Goodwill and mutual trust between the countries concerned play decisive roles. Thus, Kazakhstan's renewable energy-oriented foreign affairs strategies are forecast to prioritise cooperation in Central Asian electricity and foster energy interdependence. The theoretical composition underscores the relevance of geo-related factors and the win-win notion of neoliberalism in shaping these strategies. The concern is that in a region where great powers' involvement is imminent, complications could occur and jeopardise the prospects of achieving Central Asian energy regionalism. Rather than provoking counteractions that may undermine the security of itself and the region, as well as its own global presence, Kazakhstan should strive to find common ground with the great powers and intra-regional actors alike.

2.2.8 Energy cooperation with extra-regional actors

In an era of shifting global dynamics, where the quest for dominance is reaching a critical juncture, strategically significant Central Asia emerges as a favourable arena for the great powers to partake in fierce rivalry. The investigation of Kazakhstan's foreign relations in the context of renewable energy in this dissertation is overshadowed by Russia, China, the United States and the European Union. However, Kazakhstan's multi-vector foreign policy takes into account the substantial influence exerted by Turkey, Iran and India on the Republic and the wider Central Asian region. In addition, the GCC countries have begun to assert their influence in the present landscape. Similar to the great powers that view Kazakhstan as both an independent state and an integral part of the Central Asian cluster, these "second-tier" countries seek to foster relations with the Republic through bilateral and multilateral channels [360]. This is primarily driven by the proliferation and interconnection of regional organisations, initiatives and memberships in Central Asia. Kazakhstan and almost all of these countries are participants in the SCO Energy Club, which has a nonbinding mechanism for full members, observers and dialogue partners of the SCO to join to discuss energy issues [361]. Turkey, which has been a dialogue partner of the SCO since 2013 and held the position of Chair of the Energy Club in 2017, is a prime example of the intricate nature of Kazakhstan's foreign relations beyond its immediate region. Despite their absence of geographical proximity, these two countries are strategic allies within and beyond the SCO Energy Club. Along with Kyrgyzstan, Turkmenistan, Uzbekistan and Azerbaijan, they constitute the Organization of Turkic States.

Turkey has experienced a significant surge in its energy demand compared with other OECD member countries in the past twenty years [54], resulting in heavy reliance on energy imports, particularly fossil fuels from Russia and Iran, to meet its growing energy needs. However, domestic energy production has increased rapidly since the mid-2010s, with a growth of 59 percent from 2014 to 2019. This grwoth was mostly driven by renewable sources, which accounted for 54 percent of total energy production in 2019 [147]. Consequently, Turkey has doubled its 2030 emission reduction target and set a target to achieve net-zero emissions by 2053 [52]. Moreover, Turkish renewable energy developers have actively participated in Kazakhstan's renewable energy auctions since 2018 [194], indicating potential avenues for further collaboration between the two countries. Of particular interest is the potential for cooperation in green hydrogen production, taking into account the launch of Turkey's "Hydrogen Technologies Strategy and Roadmap" in 2023 [53]. In this regard, Tokayev's proposal in 2021 to establish an international consortium among the member countries of the Organization of Turkic States was a timely initiative. This consortium will provide a platform for leading scientific institutions to gather and exchange valuable experiences and knowledge, ultimately enhancing technological capabilities in the creation, retention and movement of hydrogen. The concept of "green hydrogen diplomacy" within the framework of the Organization of Turkic

States holds the potential to open up new prospects for Kazakhstan-Turkey relations, particularly in terms of talent recruitment and development [71].

Kazakhstan and Turkey, in addition to Afghanistan, Azerbaijan, Iran, Kyrgyzstan, Pakistan, Tajikistan, Turkmenistan and Uzbekistan, constitute the member countries of the Economic Cooperation Organization (ECO). The ECO is an intergovernmental regional organisation in Asia that promotes sustainability, integration and a conducive environment. Among these countries, Iran holds significant importance to Kazakhstan, as evidenced by the negotiations on nuclear matters in Kazakhstan in 2013, which involved the five permanent members of the United Nations Security Council, Germany and Iran [347]. Kazakhstan and Iran, along with Azerbaijan, Russia and Turkmenistan, are also littoral countries that participated in the 2018 Convention on the Legal Status of the Caspian Sea. This convention resolved the demarcation issue concerning the world's largest inland body of water. The SCO provides an additional platform for these countries to engage in multilateral cooperation, especially since Iran's accession to the SCO in 2023. Through the SCO, Iran has become a key player in the Sino-Russian alliance in the Middle East. It can establish a southern corridor that bypasses the Caspian Sea, connects northern and southern Eurasia, and links the landlocked Central Asian region with its Chabahar port in the Gulf of Oman. Moreover, it is important to highlight that the SCO consists of the world's largest energy producers and consumers, as well as leaders in uranium deposits, nuclear reactor construction and crucial technologies for renewable energy transition. Consequently, collaborative energy projects have become increasingly prioritised in the organisation's pursuit of economic integration and sustainable development.

Apart from Iran, it is crucial to acknowledge the growing significance of India in Kazakhstan's foreign affairs strategies. India's policy of non-alignment is a defining characteristic, and its active participation in various summits, such as the Quadrilateral Security Dialogue in the Indo-Pacific region with Australia, Japan and the United States, as well as its partnership with China and Russia in the SCO and the BRICS, highlights its central role in a multi-alignment strategy. The roots of India's comprehensive approach to Central Asia can be traced back to its Connect Central Asia Policy, which was initiated during the first India-Central Asia Dialogue in Kyrgyzstan in 2012 before its SCO accession in 2017. Through strategic convergence with Russia and China, the country has effectively addressed new security challenges, facilitated the growth of infrastructure development projects and established an interconnected network of regional oil and gas pipelines in Central and South Asia. This collaborative endeavour brings substantial advantages to the broader Central and South Asian region. Responsible for nearly 7 percent of the total global GHG emissions in 2020, ranked third next to China and the United States [119], India relies heavily on its local coal production and fossil fuel imports from the GCC countries to meet the country's growing energy demand, but its rapid growth of renewable energy capacity since the mid-2010s has implied a change in its energy security strategy. By the end of 2022, renewable energy sources in India had a combined installed capacity of 167.75 GW, including 41.93 GW of wind power, 63.3 GW of solar power, 10.73 GW of biomass, 4.97 GW of small hydroelectric power and 46.85 GW of large hydroelectric power [46]. Looking ahead,

India has set a target to reduce the carbon intensity of the country's economy by less than 45 percent by the end of the decade, achieve 50 percent cumulative electric power installed by 2030 from renewable energy sources, and achieve net-zero carbon emissions by 2070 [47]. In line with its commitment to green energy, India has also launched the National Green Hydrogen Mission, which aims to establish the country as an eminent global green nexus for the production and distribution of green hydrogen [48]. Despite the delay in the CASA-1000 project, India's dedication to promoting sustainable energy practices is evident through initiatives such as the "One Sun One World One Grid." Released as a green grid initiative by India and the United Kingdom in 2021, One Sun One World One Grid was introduced at the first India-Central Asia Summit in 2022, which highlighted India's determination to foster cooperation with Central Asia in decarbonising electricity and managing emissions. The initiative also aims to establish an interconnected solar energy infrastructure on a global scale [49]. India's focus on improving energy efficiency and transitioning to green energy sources aligns with the growing demand for hyperscale green data centres powered by renewable energy. By engaging in knowledge sharing and technology transfer with India, Kazakhstan can benefit from India's expertise in managing energy-intensive industries, such as cryptocurrency mining.

According to Kazakhstan's Foreign Policy Concept for 2020-2030, establishing stronger ties with regional organisations, including the GCC, is a priority. The GCC, which consists of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates, shares several key similarities with Kazakhstan. These include their respective involvement in coordinating oil production (excluding Qatar since 2019), their abundant fossil fuel reserves, their need to diversify their economies, their common adherence to Sunni Islam and their preference for authoritarian governance. The GCC countries, known for their wealth, offer the Central Asian region valuable investments in infrastructure and technological support for petroleum and petrochemical projects, representing an alternative or complementary option to China's BRI. However, the GCC should not be underestimated in its endeavours to leverage renewable energy sources for the purposes of curbing fuel costs, mitigating carbon emissions, conserving water resources and fostering employment opportunities. The United Arab Emirates sets itself apart from other GCC countries through its remarkable achievement in constructing some of the world's largest solar power plants. This accomplishment exemplifies the United Arab Emirates' resolute efforts to achieve a clean energy capacity of 19.8 GW by 2030 [58], in accordance with its Energy Strategy 2050, which seeks to achieve carbon neutrality by 2050 [59]. Apart from the notable prospects offered by solar and wind energy, the adoption of carbon capture and storage facilities at scale, coupled with waste-to-energy and geothermal endeavours, offers the GCC countries a practical and effective approach to energy diversification, low-carbon economic growth, GHG emissions reduction and solid waste management. In the context of green hydrogen, the GCC countries also possess unique advantages in terms of funding availability, export infrastructure, central location to the energy demand market and local capabilities [189]. Most importantly, the GCC countries recognise the strategic significance of establishing a foothold in green hydrogen and its associated

supply chain at the earliest possible opportunity to secure their continued influence in the energy market in an increasingly decarbonised global landscape [190, 259]. Among them, Oman, Saudi Arabia and the United Arab Emirates are considered to possess the greatest potential [189]. On this basis, the development of energy transition-related measures heralds a new wave of opportunities for Kazakhstan-GCC cooperation as both sides navigate the evolving dynamics of a post-petroleum world. The GCC-Central Asia Summit held in 2023, following the GCC's first joint ministerial-level strategic dialogue with the five Central Asian countries in 2022, marked a significant milestone in fostering closer cooperation. This summit was a defining moment in effectively addressing contentious regional and international issues through enhanced collaboration. It is worth noting that since 2018, Kazakhstan has observed the active participation of renewable energy developers from the United Arab Emirates in its renewable energy auctions [194], which serves as a prime example of the increasing impact of the GCC on the renewable energy industry.

Upon careful evaluation of Kazakhstan's potential for fostering collaboration on renewable energy, it becomes obvious that there are distinct areas of mutual interest between Kazakhstan and external actors, such as Turkey, Iran, India and the GCC countries. By leveraging their strengths and experiences, the Republic can tap into a diverse range of renewable energy technologies and strategies, paving the way for a more sustainable and self-sufficient energy future. Nevertheless, these countries, categorised as "second-tier," lack the essential cutting-edge enabling technologies, manufacturing capability, financial stability and industrial expertise necessary to drive a clean energy future. A 2021 report by the IEA on patents for low-carbon energy technologies reveals that European companies and research institutes have established themselves as leaders in patenting low-carbon energy innovations, representing 28 percent of all global patents filed from 2010 to 2019. Following closely are applicants from Japan with 25 percent, the United States with 20 percent, South Korea with 10 percent and China with 8 percent [182]. These rankings significantly influence Kazakhstan's renewable energy-oriented foreign affairs strategies, shaping decisions related not only to attracting FDI but also to technology choices and regulatory support for the development of relevant infrastructure.

Although Kazakhstan-Japan and Kazakhstan-South Korea energy relations are not within the scope of this dissertation, Kazakhstan's electricity infrastructure and the adoption of high-efficiency and environmentally friendly production technologies have seen the involvement of notable entities such as the Japan-based ADB, Korea Electric Power Corporation and Samsung Construction & Trading Corporation. Tokayev's visit to South Korea in 2021 served as a testament to the recognition of the substantial presence of over five hundred and fifty enterprises with Korean capital currently operating in Kazakhstan [126]. In addition, Kazakhstan's extensive extra-regional relations, which are shaped by the proliferation and overlap of regional organisations, initiatives and memberships in Central Asia, offer convenient avenues for the transfer of technology and the sharing of knowledge in renewable energy development. This presents the Republic with the opportunity to play a pivotal role in facilitating mutually

beneficial relations between countries possessing advanced technological expertise and those seeking to bridge the technological divide.

With reference to Brazil: With a long history in biofuels, from 2003 until 2014, Brazil actively sought to use bioethanol as a foreign policy instrument to establish South-South bilateral partnerships with African countries and North-South trilateral partnerships involving the European Union and the United States to create a hub-and-spoke networked structure. However, the same period saw the rapid growth of Chinese investments in energy ventures in Brazil, especially with respect to the pre-salt oil and natural gas, hydroelectric power, the energy transmission sector, and wind and solar power projects. Being entangled in the geopolitical contest between the United States and China, Bolsonaro's right-wing foreign policy approach had not only impeded cooperation with China in some infrastructure and technology deals but also negatively affected Brazil's bilateral and multilateral cooperation with other extra-regional actors. Brazil's international status in global politics was further accentuated by Lula's reluctance to fully align with the West on the Ukrainian conflict.

Forecasts for Kazakhstan: To use its multi-vector foreign policy as a means of consolidation rather than leverage-seeking among the great powers, Kazakhstan has enormous potential to become a hub that facilitates technological innovations and knowledge transfer in the renewable energy sector among a host of intra- and extra-regional partners for mutual benefits. In the process, geo-related factors and key features of neorealism, neoliberalism and constructivism are to be of equal relevance and importance for optimised outcomes and shared solutions amidst a variety of energy interests, targets and expertise. To avoid being subjected to great power competition, Kazakhstan's renewable energy-oriented foreign affairs strategies are expected to involve the active participation of "second-tier" extra-regional countries such as Turkey, Iran, India and the GCC countries. These countries are deemed significant because they share a mutual interest with Kazakhstan in advancing the transition towards renewable energy, thereby fostering a partnership that holds appeal.

2.2.9 The theory-practice nexus in Kazakhstan

Forecasts inherently exhibit trend-following behaviour, rarely predicting trend shifts before their occurrence. The forecasts in this dissertation are no exception. However, the eight indicators identified through the case study on Brazil are proven to be applicable and practical for understanding energy development and associated programmes in Kazakhstan. This comprehension stems from the theoretical composition and emerging global trends, clusters and patterns revealed by correlation analysis. Recent advancements highlight opportunities for the Republic to enhance global energy security through renewable energy transition, emphasising the benefits of aligning its energy diplomacy to strengthen the energy interests of actors within and beyond the Central Asian region.

Following the guidelines in Section 1.1.1, respective estimated ratio scores were assigned to the international relations theories and indicators based on their relative importance to Kazakhstan's renewable energy-oriented foreign affairs strategies. The

dissertation author has produced Table 7 to present the characteristics of Kazakhstan's renewable energy-oriented foreign affairs strategies in numerical form, considering the relative importance of the four international relations theories for each indicator. Table 8 illustrates a separate set of estimated ratio scores, focusing on Kazakhstan's renewable energy-oriented foreign affairs strategies and their corresponding indicators.

Table 7 – Theoretical composition of Kazakhstan's renewable energy-oriented foreign affairs strategies: 0 implies no relevance, 1 implies maximum relevance

Kazakhstan		Estimated ratio scores
IR Theories	Geo-related factors	0.22
	Neorealism	0.32
	Neoliberalism	0.26
	Constructivism	0.20

Table 8 – Kazakhstan's renewable energy-oriented foreign affairs strategies in terms of indicators: 0 implies no relevance, 1 implies maximum relevance

Kazakhstan		Estimated ratio scores
Indicators	Renewable energy potential	0.21
	Ruling elite's change competency to pursue renewable energy transition	0.11
	Foreign policy resilience to renewable energy transition	0.06
	National measures to increase sustainable energy security	0.17
	Electricity infrastructure	0.11
	Human capital	0.06
	Energy cooperation with intra-regional actors	0.13
	Energy cooperation with extra-regional actors	0.15

By examining the various values that represent the ratio of each international relations theory in the composition, Table 7 highlights the dominance of neorealism and neoliberalism in Kazakhstan's current renewable energy-oriented foreign affairs strategies, whereas Table 8 displays a variety of estimated ratio scores that are unevenly distributed among the indicators, showcasing the Republic's inconsistent efforts in addressing the local energy agenda and a globally unbalanced low-carbon transition that is progressing at varying rates. The extremely high relevance of "Renewable energy potential" and the extremely low "Human capital" and "Foreign policy resilience to renewable energy transition" reflect the dichotomy faced by Kazakhstan's policy-makers when using renewable energy as a foreign policy instrument. Considering the important role of fossil fuel rents in the Republic's political, societal

and economic systems, the re-invention of identity in relation to the green agenda for foreign affairs is not perceived as a straightforward process.

Looking forward, although the current situation in Brazil may not reflect the future state of Kazakhstan, as Kazakhstan is increasingly aligned with various internal and external specifications pertaining to a new energy order, it is anticipated that the Republic will establish a corresponding institutional framework and legislation to facilitate the modernisation of its energy market. This will also strengthen local industries related to renewable energy, as Kazakhstan aims to bridge the gap in renewable energy development between itself and the frontrunners in this field. Achieving this goal requires embracing digital transformation and innovative financing methods to promote the adoption of renewable energy and ultimately achieve the objectives outlined in the Kazakhstan 2050 Strategy. Given the importance of intra-regional collaboration in hydroelectric power for Brazil during its transition to renewable energy, it is plausible to forecast that Kazakhstan will progressively adopt a foreign policy approach similar to Brazil's coordinated strategy for achieving energy security, economic growth and environmental sustainability through the utilisation of shared hydroelectric power with intra-regional neighbours. This alignment is expected to be observed in both theoretical frameworks and practical applications.

The next chapter will elaborate on the implications, opportunities, challenges and recommendations that can be expected to arise from the knowledge acquired thus far.

3 Foreign Energy Policy of Kazakhstan in the Post-Petroleum World

This chapter explores the ramifications of the research findings specifically on Kazakhstan's diplomatic capacity and global presence, focusing on the Republic's multi-vector foreign policy and its potential role in contributing to global energy security in the context of renewable energy. The chapter concludes with a prescriptive analysis in accordance with the changing global energy landscape, outlining the emerging opportunities, challenges and recommendations for the Republic to maintain relevance amidst renewable energy transition.

3.1 Summary of Research Findings

3.1.1 Survey of international relations theories

The findings of the survey of international relations theories unveil the significant presence of geo-related factors, neorealism, neoliberalism and constructivism in the theoretical composition of Kazakhstan's foreign energy policy, where energy security is a prime focus. Concerning diplomatic capacity and global presence in the post-petroleum world, a shift is emerging that diverges from the neorealist paradigm of self-help and power struggles among states but is increasingly articulated through a framework of interdependence, which is readily facilitated by drawing upon principles of neoliberalism and constructivism.

3.1.2 Case study

Brazil, as a global pioneer in low-carbon energy, was selected as the anchor country to demonstrate how renewable energy-oriented foreign affairs strategies are configured by internal and external conditions with different degrees of relevance to geo-related factors, neorealism, neoliberalism and constructivism (see Table 4). By reviewing Brazil's historical trajectory and notable achievements in renewable energy transition alongside its intra- and extra-regional relations, a set of internal and external conditions is represented by eight indicators (see Table 3 and Table 5): 1) Renewable energy potential; 2) Ruling elite's change competency to pursue renewable energy transition; 3) Foreign policy resilience to renewable energy transition; 4) National measures to increase sustainable energy security; 5) Electricity infrastructure; 6) Human capital; 7) Energy cooperation with intra-regional actors; and 8) Energy cooperation with extra-regional actors. These indicators are pointers that are closely linked to the aim of the dissertation and enable exploration of Kazakhstan's foreign affairs strategies with respect to renewable energy.

3.1.3 Correlation analysis

Correlation analysis was used to complement the findings of the case study by incorporating a global perspective. By verifying the statistical relationship between the

Energy Architecture Performance Index and the Global Sustainable Competitiveness Index across more than one hundred countries from 2014 to 2022/23, the data patterns and positive *r* values demonstrate a strong linear correlation between the two indices (see Table 6). Taking into account the components embedded in the data sets, which include low-carbon energy, diversification of energy supply, energy security and sustainable diplomatic capacity, these findings imply that countries ahead in transitioning away from fossil fuels tend to have good prospects for promoting sustainable and mutually beneficial interstate relations. The data sets also illustrate a globally uneven low-carbon transition, with the frontrunners, improvers and laggards clearly distinguished (see Figure 2). The formation of these clusters implies the emergence of new energy relations between countries; hence, changes in a country's energy matrix trigger changes in the formulation of its foreign affairs strategies.

3.1.4 Model-based forecasting

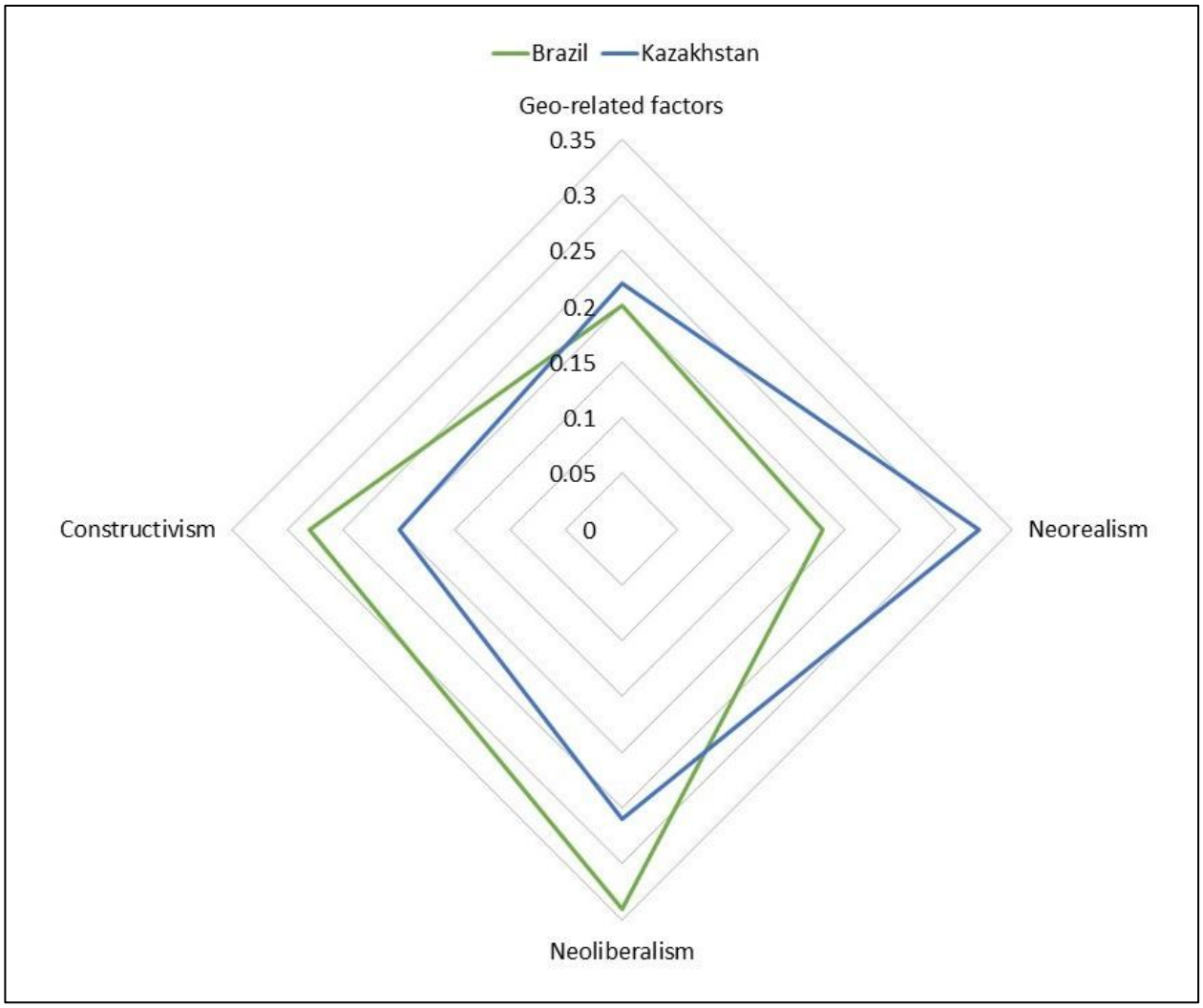
With geo-related factors, neorealism, neoliberalism and constructivism providing a theoretical foundation, the findings of the case study on Brazil's renewable energy transition and the correlation analysis of relevant quantitative data sets triangulate to provide a good basis of knowledge for model-based forecasting to be performed on Kazakhstan. The latest development acknowledges the new doorways that have been opened for the Republic to contribute to global energy security with respect to renewable energy transition. However, despite clear signs of an action plan on renewable energy adoption in the Republic's domestic and foreign policy, a careful examination reveals the dichotomy faced by policy-makers regarding a speedy and flawless transition.

The differences between Brazil (see Table 4) and Kazakhstan (see Table 7) in terms of the theoretical composition of renewable energy-oriented foreign affairs strategies are illustrated in Figure 3. The contrast between Brazil and Kazakhstan is evident in the subordinate role of geo-related factors to neoliberalism and constructivism in the former, and the dominant position of neorealism in the latter. Contrary to Brazil's cooperative approach to achieving energy security through neoliberalism's win-win energy interdependency with its intra-regional neighbours, Kazakhstan's energy strategy exhibits neorealist principles by leveraging energy resources to exert influence in the international political arena. While Brazil has long developed its foreign policy on the basis of its identity as an energy technology innovator characterised by its diversified and low-carbon energy matrix, the green ambitions of Kazakhstan have not yet disclaimed its identity as a post-Soviet petrostate.

Their differences in score distribution across the eight indicators (see Table 5 and Table 8) further highlight their differences in applying their respective renewable energy-oriented foreign affairs strategies, as shown in Figure 4. Kazakhstan tends to emphasise "Renewable energy potential," "National measures to increase sustainable energy security" and "Energy cooperation with extra-regional actors." Although impressive progress is also found in the Republic's "Energy cooperation with intra-regional actors," significant shortcomings in "Ruling elite's change competency to pursue renewable energy transition," "Foreign policy resilience to renewable energy

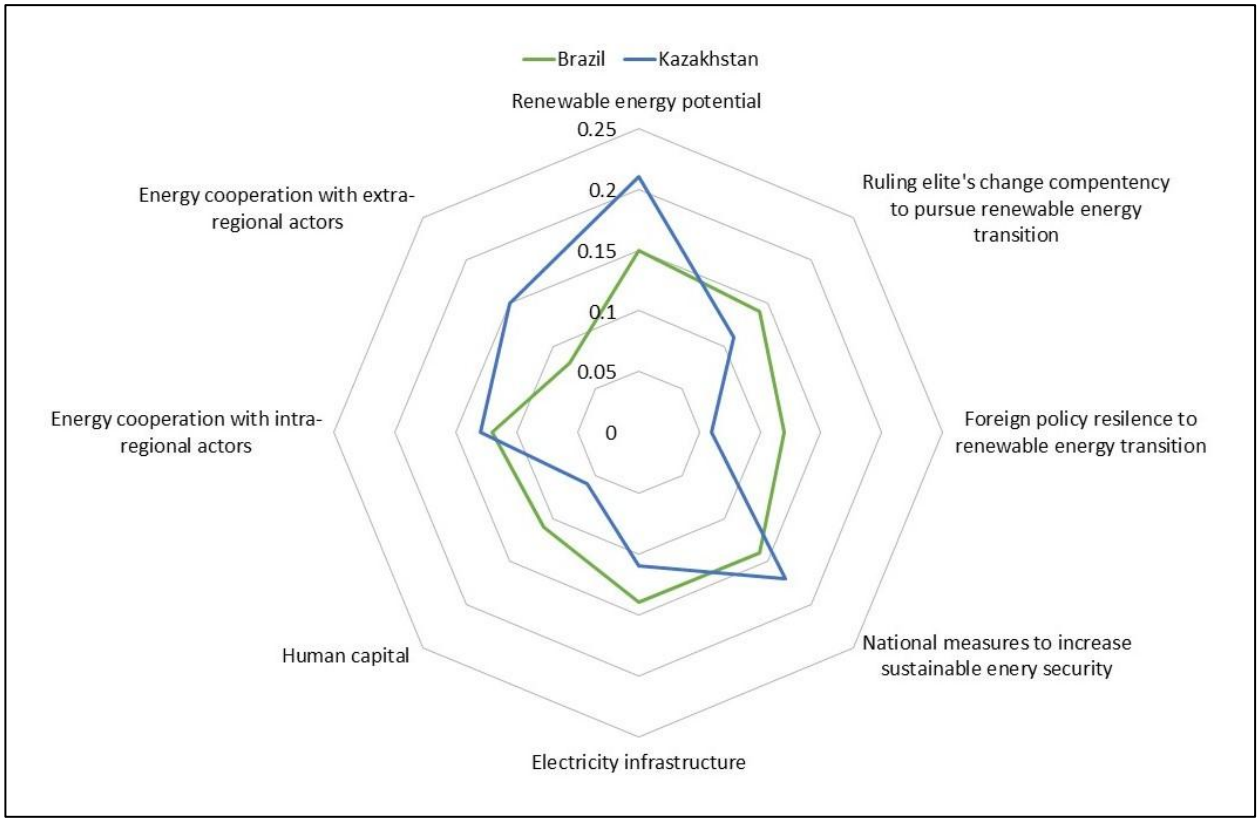
transition," "Electricity infrastructure" and "Human capital" reveal the Republic's internal constraints on using renewable energy as a foreign policy instrument.

Figure 3 – Comparison between Brazil and Kazakhstan in terms of the theoretical composition of renewable energy-oriented foreign affairs strategies



Brazil's diplomatic tracks are by no means perfect, especially when considering Bolsonaro's right-wing populist stance on foreign policy formulation between 2019 and 2022, which resulted in a degree of diplomatic isolation. However, the country's proficiency in addressing energy agendas is evident in its evenly distributed scores across the eight indicators. On the contrary, the uneven score distribution in Kazakhstan reflects the dilemma confronted by the Republic's policy-makers regarding the use of renewable energy as a foreign policy instrument. A lack of adequate safeguards and balancing mechanisms in relation to the local, regional and global energy agendas has typically been observed among the improvers in renewable energy transition when a period of trial and error is inevitable. This contrast precisely explains the theoretical and practical evolution of Kazakhstan's foreign affairs strategies amidst rising external pressure to replace petroleum with renewable energy as a foreign policy instrument.

Figure 4 – Comparison between Brazil and Kazakhstan in terms of indicators



According to the data collected and analysed in this dissertation, Kazakhstan's current foreign policy orientation is primarily defined by its national interests connected to the emerging new energy order. In the coming decades, with more regulations, standards and incentives anticipated to be implemented to enhance local renewable energy-related industries and to narrow the gap in renewable energy development between itself and the frontrunners, Kazakhstan's foreign policy orientation could undergo changes along the hypothetical axis and bear more resemblance to Brazil's coordinated approach that achieves energy security, economic growth and environmental sustainability in theoretical and practical terms. On this basis, the findings of the model-based forecasting spell out the necessity for Kazakhstan to adopt a more receptive stance towards energy interdependency and to re-invent its identity as a green advocate to develop its renewable energy-oriented foreign affairs strategies, with neoliberalism and constructivism having the largest share in the theoretical composition.

3.2 Theoretical and Practical Significance

As noted in Chapter One, since its independence in 1991, Kazakhstan has implemented a multi-vector foreign policy, balancing relations among the West, Russia, China and other influential actors in Eurasia. This pragmatic approach, coupled with its significant fossil fuel resources, allows the Republic to navigate complex geopolitical dynamics, secure benefits and protect its sovereignty. However, this

strategy is susceptible to geopolitical shifts [345], including but not limited to those driven by climate change and renewable energy transition. Consequently, theoretical adjustments and practical shifts within Kazakhstan's multi-vector foreign policy and its contribution to global energy security are anticipated.

3.2.1 Kazakhstan's multi-vector foreign policy

Theoretical contribution

With reference to Figure 3, Kazakhstan's inclination to consider neorealism in association with geo-related factors as theoretical imperatives of its current renewable energy-oriented foreign affairs strategies is reflective of the Republic's multi-vector foreign policy, which is dominated by the regime's primary concerns over petroleum exports as a means of ensuring security and survival to safeguard its autonomy and effectively manage its interactions with the great powers neighbouring its territory and beyond. The trajectory outlined by Magzum Mirzagaliyev, the former Minister of Energy (2021-2022), in 2021 indicated that oil production was not expected to decline but rather to grow from 85.7 million tonnes to 104.2 million tonnes by 2030 [24]. This forecast underscores the continued pre-eminence of petroleum in Kazakhstan's energy diplomacy. Nevertheless, as the efforts of the global community to combat climate change become more closely intertwined with energy security and economic stability, there is a growing need for more robust and transparent guidelines regarding net-zero emissions commitments from non-state actors. These non-state actors, including intergovernmental organisations, businesses, investors, cities and regions, play crucial roles in shaping energy sector policies.

Neoliberal scholars and practitioners have traditionally advocated international collaboration under anarchy by establishing international regimes that promote symmetrical interdependence and win-win absolute gains [254-257]. By governing the climate-energy nexus through multilateral negotiations and agreements, the theoretical relevance of neoliberalism to renewable energy-oriented foreign affairs strategies has been exemplified by the COP process, where heads of state, government ministers, experts in environmental science and non-governmental organisations convene annually to monitor collective progress. The recent enhanced collaboration between the IEA, the IRENA and the IPCC serves as another example. The IEA and the IRENA, established in 1974 and 2009, respectively, are intergovernmental organisations responsible for promoting greater international cooperation in conventional and renewable energy industries to ensure energy security and achieve universal energy access. The IPCC, established in 1988 as a joint initiative of the United Nations Environment Programme and the World Meteorological Organization, is mandated to synthesise the prevailing scientific knowledge on climate change, including strategies to limit global warming to 1.5°C above pre-industrial levels, a goal acknowledged by the Paris Climate Agreement. Moreover, the IPCC advocates a significant decrease in petroleum production to combat the adverse effects of climate change. In this

connection, as a member of these regimes, Kazakhstan must prioritise multilateral interests over its own petroleum-based economic interests.

Whereas a neoliberal decarbonisation project on a global scale implies the necessity for rules and regulations in areas that lie beyond almost all countries' national jurisdictions, certain countries – in particular those that are either laggards in renewable energy transition or have little trust in multilateral agreements at the international level – can be found marginalised in the process. To withstand global pressure on specific policy issues and pursue policy objectives that countries cannot independently attempt, the creation of regional blocs by countries in geographical proximity has been regarded as an ideal alternative, in which all features of neoliberalism apply but on a regional scale and at a lower cost. Advances in electricity production through renewable energy sources, including wind energy, solar energy, geothermal energy, wave energy, tidal energy, hydroelectric power, biomass energy, landfill gas, sewage treatment gas and biofuels, offer the most suitable approach to fostering regional development. Cross-border cooperation among a group of countries in close geographical proximity on renewable energy also provides a key solution to the intermittency problem caused by wind and solar technologies because it enables countries to gain access to a more diversified portfolio of electricity-generating plants, producing over a wider geographic area [255]. Brazil's foreign energy relations substantially exemplify this characteristic. As a regional power in South America, absolute gains with respect to Brazil's early uptake of electricity generation from low-carbon sources have been shared across MERCOSUR, other Amazon countries and beyond through the promotion of infrastructural integration – including electricity grids – and coordinated action in support of rainforest protection.

For Kazakhstan, amidst Central Asia's lack of collective vision since independence and the growing Sino-Western and Russia-West rivalry, the prospects of energy regionalism with other Central Asian countries cannot be pondered without first considering the theoretical composition of the Republic's multi-vectoral approach to foreign affairs. Driven by neorealism, concerns over security and survival in association with the interests of Russia, China, the United States and the European Union have long given shape to Kazakhstan's foreign policy. Yet, the Republic's pursuit of win-win energy cooperation with multiple partners in different institutional frameworks demonstrates a considerable degree of neoliberalism. With FDI from the European Union and China playing a key role in boosting Kazakhstan's renewable energy development and electricity generation capacity, the ideas of Russia and the United States about creating a common electricity market in Central Asia facilitate a move towards energy regionalism that supports the overall low-carbon, climate-resilient development strategy in Central Asia. It is worth noting that one important factor underlying the rise of neoliberalism in Kazakhstan's foreign energy policy-making, the accelerated uptake of renewable electricity generation and cross-border electricity interconnections, is the water-energy security nexus in Central Asia.

In 2022, following the electrical power outages in January that affected major cities in Kazakhstan, Uzbekistan and Kyrgyzstan for several hours, Tokayev's remarks in February about building a nuclear power plant implied his determination to

supercharge national energy security by using the Republic's well-developed nuclear industry. With Uzbekistan also signalling its ambition to develop nuclear energy [56], as of 2023, it remained unknown whether this would spark a new round of intra-regional power competition but there has been a strong expectation that once nuclear energy becomes on-grid, these countries' energy portfolios are anticipated to produce both national and regional benefits. In situations where surplus electricity exists, Kazakhstan and Uzbekistan have the option of either storing it to ensure their national capacity or selling it to neighbouring countries through cross-border transmission connections, thereby bolstering regional energy security and generating revenue. This decision is influenced by the balance between neorealism and neoliberalism in their energy approaches. Furthermore, from the perspective of sustainable development, nuclear energy's unparalleled energy density and minimal carbon footprint are indispensable features that add impetus for countries in proximity to cooperate in low-carbon electricity production and trading. This implies a neoliberal blueprint for future intra-regional energy relations in Central Asia. Given strong market incentives, accelerated uptake of renewable electricity generation across the region accompanied by cross-border smart grid technology could be a spinoff from the construction and commissioning of nuclear power plants in Kazakhstan and Uzbekistan.

Nuclear power plants aside, Kazakhstan has begun to attach particular importance to the implementation of joint hydroelectric power projects for the mutually beneficial use of transboundary river water resources. In this context, at the fourth Consultative Summit of the Leaders of Central Asian States in July 2022, with the intention of exploring feasible options to boost energy security of Central Asian countries and to improve the conditions for increasing agricultural production, the heads of state actively discussed the construction project of the Kambarata Hydroelectric Power Plant-1 in Kyrgyzstan, a prominent hydroelectric power plant in Central Asia [84]. Taking into account the agreements signed by the five Central Asian countries at the end of the summit that promoted cooperation and consolidated efforts to tackle critical topics on the regional agenda, the growing significance of neoliberalism in the form of regional electricity cooperation can be a realistic forecast with respect to Kazakhstan's multi-vector foreign policy. The Central Asian vector is anticipated to be featured more prominently in the Republic's multi-vectoral approach to energy diplomacy.

In addition, the research findings of this dissertation demonstrate the significant role of constructivism in the theoretical composition of a country's renewable energy-oriented foreign affairs strategies. Constructivism argues that state behaviour is not merely configured by distributing material power, wealth and geographical conditions but also by ideas, identities and norms [280-282]. For Brazil, having started its renewable energy transition in the 1970s to reduce its dependence on imported oil, low-carbon energy sources and their associated technologies have given shape to its foreign affairs strategies associated with its identity. Being home to two-thirds of the Amazon rainforest, often referred to as the "lungs of the world," and the world's first sustainable biofuel economy, Brazil's environmental policy and carbon emission reduction targets are accountable to the international community. With one of the cleanest energy

matrices in the world, despite growing oil production stemming from the pre-salt layer, Brazil is recognised as a benchmark for renewable energy transition on the world stage.

Kazakhstan's identity has been shaped by its reliance on a fossil fuels and associated patronal practices since gaining independence. It has been widely known as a post-Soviet petrostate, heavily dependent on coal for electricity generation and rapidly growing as a crude oil exporter. Thus, Tokayev's ambitious decarbonisation targets and accelerated adoption of renewable energy have been considered timely measures to establish a new identity for Kazakhstan. This new identity is intended not only to shape domestic policy and leader-elite relations but also to engage with foreign financiers and developers in pursuit of sustainable development and climate change mitigation. It is expected that this re-invented identity will lead to changes in Kazakhstan's diplomatic activities, as relations and collaborations with other countries will need to align with this new identity.

On this basis, considering the findings associated with Brazil and the latest developments in Kazakhstan, it is forecast that there is a shift in the theoretical composition of Kazakhstan's multi-vector foreign policy, particularly in relation to renewable energy diplomacy. This shift is expected to involve a greater emphasis on neoliberalism and constructivism, with neorealism becoming less prominent. The increased representation of neoliberalism and constructivism in the Republic's foreign affairs strategies may be calibrated with the geo-related factors that already support more sophisticated diplomatic activities centred around renewable energy. This transformation could convert the original leverage-seeking mechanism into a new mechanism for consolidation.

Practical implications

Kazakhstan's poor ratio scores for these indicators – namely "Ruling elite's change competency to pursue renewable energy transition," "Foreign policy resilience to renewable energy transition," "Electricity infrastructure" and "Human capital" – are reflective of the Republic's specific development constraints on renewable energy transition (see Figure 4). Poor electricity infrastructure impedes the development of neoliberal foreign policy with its Central Asian neighbours to create energy regionalism via a common electricity market, while a lack of human capital, low change competency of the ruling elite and weak foreign policy resilience to renewable energy transition limit identity re-invention. These deficits were perhaps best exemplified by the massive protests that erupted throughout Kazakhstan in January 2022, highlighting not only the long-term neglect of reforms in the Republic's energy sector but also the inability of the entire system of power and its representatives at all levels to recognise the new social, economic and political realities in association with major shifts in the global energy landscape. Like any other energy-exporting country, the pace of renewable energy transition in Kazakhstan cannot be drastic, especially when subsidies for fossil fuel consumption have long been a part of the social contract between the regime and the people. At current rates of progress, the target of reaching

net-zero emissions by 2060 does not appear to be on track in the energy sector when considering these development constraints.

However, the changing investment patterns of the European Union and China must be considered when analysing the Republic's renewable energy transition, especially when they have been among the leading investors in Kazakhstan and world leaders in renewable energy. With high ratio scores for "Renewable energy potential" and "Energy cooperation with extra-regional actors," together with its progressive "National measures to increase sustainable energy security" and growing "Energy cooperation with intra-regional actors," Kazakhstan undeniably fulfils the fundamental prerequisites necessary for fostering sustainable development and building a green economy. Above all, the green investment surge facilitated by FDI inflows from the European Union and China aligns well with Tokayev's vision to pursue a new level of economisation of foreign policy to stimulate a low-carbon economic transition.

The European Union has set an ambitious target of becoming the first carbon-neutral continent by 2050 and it is already the largest investor in Kazakhstan. The European Union's carbon border adjustment mechanism, which requires non-member countries to implement more stringent climate rules from 2026 onwards, has compelled the Tokayev government to accelerate the process of decarbonising seven essential sectors of the economy between 2023 and 2030: 1) energy; 2) agriculture and forestry; 3) industry; 4) utilities; 5) coal industry; 6) waste management; and 7) transport. By engaging in a collaborative effort with the World Bank through the Partnership for Market Readiness programme since 2014, Kazakhstan has significantly bolstered its capacity for carbon neutrality by implementing the valuable short- to medium-term policy recommendations provided [214]. The start of one of the world's largest green hydrogen project in Kazakhstan in 2021, through a partnership between the Republic and Svevind Energy, a Swedish-German renewable energy company, signified a significant shift in the European private sector's investment focus towards technology-driven energy solutions rather than traditional petroleum-based ventures. This move supports the Republic's identity re-invention through the rapid uptake of renewable energy.

The significance of China's extensive infrastructure diplomacy through the BRI in 2013 and its subsequent introduction of the "Green BRI" in 2017 cannot be underestimated. The slogan "to build a community of a shared future for humanity" signifies commitment to fostering global environmental governance and promoting green development principles among countries involved, such as neighbouring Kazakhstan. This commitment aligns with the United Nations' Sustainable Development Goals and the Paris Climate Agreement. In addition to investing in Kazakhstan's fossil fuel sector, Chinese corporations have been funding solar and wind projects in the Republic. In 2021, a Chinese firm undertook the development of Central Asia's largest wind farm near the city of Zhanatas in the Zhambyl region of southern Kazakhstan. This signature project, funded by the AIIB, showcased China's commitment to supporting Kazakhstan's renewable energy transition and enhancing its electricity infrastructure [175]. Following China's announcement in the same year that it was ending its investment in overseas coal, supporting renewable energy development in the Republic could be a critical next step for the two neighbouring

countries to reform the nature of their energy relations and move towards cooperation in low-carbon development and new energy infrastructure.

Russia and the United States, on the other hand, do not provide the same degree of practical support to Kazakhstan's identity re-invention with respect to renewable energy, but they remain key contributors to human capital development in the Republic through education and other means of technology transfer and knowledge sharing, even after the withdrawal of the American military forces from Afghanistan in 2021 and the outbreak of war between Russia and Ukraine in 2022. However, renewable energy has not been significantly featured in Russia's quest for recognition in Kazakhstan, nor has it been considered a profitable industry as opposed to petroleum production by the United States. USAID's efforts to forge the CAREM and regional energy programmes such as "Power the Future," "Power Central Asia" and Central Asian Clean Energy Forum so far have predominantly focused on hosting technical workshops that promote the use of world-best practices and modern technologies for the development and integration of renewable energy sources. No renewable energy developer or financier from the United States has been found to directly participate in Kazakhstan's renewable energy auctions since its launch in 2018 [194].

Regarding ventures to broaden the sources of FDI inflows to facilitate a speedy renewable energy transition, in accordance with the Concept of the Foreign Policy for 2020-2030, Tokayev's decision to shift foreign policy priorities from individual countries to regional and multilateral cooperation serves not only as compensation for the seemingly inadequate renewable energy investment from Russia and the United States but also as a means of strengthening Kazakhstan's position to forge cooperation with and attract funding from regional and international organisations. Optimal resonance effects created with like-minded countries in Central Asia and neighbouring regions to tackle prevalent development challenges, such as the advancement of renewable energy and the reduction of GHG emissions, could also potentially enable the Republic to seek alternative energy transition pathways or consolidate partnerships. As declared by the delegation of Kazakhstan during the COP26 in 2021, setting up the Regional Climate Hub of Central Asia could be crucial to unite the efforts of the five Central Asian countries in achieving cooperative low-carbon economic growth [23]. The fourth Consultative Submit of the Leaders of Central Asian States in July 2022 marked the continuation of the ideas previously discussed and highlighted by the presidents of the five countries that signed the Regional Green Agenda Program for Central Asia. At the COP28 in 2023, Central Asian countries showcased a shared regional perspective on urgent global climate challenges in the "Green Projects Pitching" side event, advocating for a cooperative approach: five countries, one region, one vote [73].

From this perspective, Kazakhstan's high ratio scores for "Renewable energy potential" and "Energy cooperation with extra-regional actors," together with its progressive "National measures to increase sustainable energy security" and growing "Energy cooperation with intra-regional actors" are considered instrumental in promoting a "technocratic" approach to its renewable energy-oriented foreign affairs strategies, predominantly characterised by scientific and technological collaborations. The European Union and China are forecast to be two of the most influential vectors

in the Republic's multi-vector foreign policy that drive renewable energy transition, while the Central Asian vector is key for the Republic to project its re-invented identity for green partnerships at intra- and extra-regional levels. Cooperation with "second-tier" countries in neighbouring regions is also forecast to increase in Kazakhstan's foreign energy relations. During his address at the General Debate of the seventy-seventh session of the United Nations General Assembly in 2022, Tokayev expressed Kazakhstan's willingness to engage in collaborative efforts with all pertinent stakeholders, emphasising the values of inclusivity, multilateralism and goodwill [16]. This indicates that the foreign policy options available to Kazakhstan have not become restricted because of renewable energy transition, nor by the open hostility between the West and Russia [330]. However, the technocratic approach might imply that the human deficiencies rooted at the core of the regime and across the Republic should not be taken as primary obstacles to Kazakhstan's renewable energy transition. Hence, the Republic's reform priorities might not have centred on enhancing "Human capital," "Ruling elite's change competency to pursue renewable energy transition," or "Foreign policy resilience to renewable energy transition." This implies that a legacy of petroleum politics that favours elite interests and associated patronal practices might still be reflected in Kazakhstan's multi-vector foreign policy.

3.2.2 Kazakhstan's contribution to global energy security

Theoretical contribution

According to the Kazakhstan 2050 Strategy, Kazakhstan was described as "one of the key elements of global energy security" associated with its world-class oil and natural gas reserves, which formed the backbone of the Republic's foreign affairs strategies to forge reliable partnerships and mutually beneficial cooperation worldwide [76]. This neoliberal position built on Kazakhstan's favourable geo-related factors implies that Kazakhstan's contribution to global energy security is primarily tied to the upstream process of exploration and production, in addition to Nazarbayev's constructivist approach to state-building, based on the Republic's possession of hydrocarbon resources. As of 2023, Kazakhstan's overall engagement in midstream and downstream activities, ranging from storage, processing, transportation, refining and distribution to final sale, has been enhanced due to various geo-related strategic and logistic considerations. However, external state and non-state actors have retained the majority of these segments because the Republic still lacks the human capital and infrastructure to establish a presence in the global energy supply and value chains [143]. Nevertheless, such cooperation in a globalised world in the format of interdependence produces benefits for all parties involved, with customer satisfaction and value creation opportunities being some of the main components of global energy security. Accordingly, while Kazakhstan as an upstream producing country gains diplomatic capacity and achieves economic growth with its fossil fuel revenues and extraction, the midstream and downstream operations solve global consumers' demands for gasoline, liquefied petroleum gas, kerosene, diesel and a variety of other energy sources. Being

the second largest non-OPEC crude producer in the OPEC+ group, Kazakhstan's commitment to following the supply quotas decided by the cartel in accordance with global demand represents another layer of its contribution to global energy security, which could be understood through either neorealism's external balancing for maximum relative profit, neoliberalism's coordination in supply and value chains for absolute gains, constructivism's identity re-invention that configures national interests, or a combination of the three international relations theories at different degrees.

Concerning global energy security in the context of renewable energy, the abundance and self-replenishing qualities of renewable energy sources have led to shifts in energy security planning across different organisational, national, regional and international levels. This has resulted in a departure from the longstanding reliance on petroleum-based interdependence. In a hypothetical all-renewable energy world, petroleum-consuming countries in the present time can transform into renewable energy producers of the future, petroleum-producing countries can become consumers of renewable energy, and petroleum transit countries can become new players in renewable energy. According to the data patterns illustrating the correlation between the Energy Architecture Performance Index and the Global Sustainable Competitiveness Index (see Figure 2), a notable disparity exists in the global transition towards low-carbon energy systems. This disparity is characterised by distinct groups of frontrunners, improvers and laggards, each exhibiting varying degrees of access to renewable energy technologies and global competitiveness. These attributes establish the framework for fostering interdependence between countries in the emerging new energy order, which is characterised by three mechanisms outlined by the IEA and IRENA: 1) electrification of everything [181, 185]; 2) technology transfer [182, 186]; and 3) solutions for critical raw materials and rare earth elements [253]. To implement the multilateral decarbonisation process while achieving energy security, it is essential to advocate for this type of interdependence and interrelatedness. This process can be facilitated by collaborative adjustments within the evolving energy supply and value chains, in conjunction with the support framework for financial, technical and capacity-building assistance enshrined in the Paris Climate Agreement. This transition implies the essentiality of neoliberalism's win-win measures and constructivism's deliberation, along with favourable geo-related factors, in creating norms [248].

It is noteworthy that the remarkable growth in renewable energy over the past decade has also enabled the multi-faceted concept of energy democracy to transform some of the frontrunners by democratising how energy is produced and consumed. The rise of the four Ds of energy democracy – Distributed power, Decentralisation, Democracy from ownership and Disruptive technology – looks set to challenge the corporate, centralised fossil fuel economy and give former energy customers the chance to take charge of their energy future [272]. Among the frontrunners and some improvers, vehicles, buildings and devices have already begun to be powered by electricity from a massively expanded cross-border electricity grid, which is sourced from a variety of energy types from multiple facilities accountable to different stakeholders in various countries that can go both ways between producers and consumers, as opposed to the unidirectional model that advantages traditional electric

utilities. The concept presented transcends the theoretical boundaries of neoliberalism by establishing an environment conducive to economic democracy, thereby dismantling the prevailing power concentration within the unaccountable elite. Speculation has arisen that energy security requires a new definition in the context of an all-renewable energy world, as the focus of the discourse will progressively shift towards the masses who actively participate as energy producers, distributors, owners, sharers and collective users [269].

Although Brazil has not reached this level of energy democracy, it exemplifies these emerging trends to a substantial degree. The country's engagement in the complex webs of energy interdependency with specific neighbouring countries and extra-regional actors illustrates the diversification of energy sources and technologies, which enhance cooperative energy security and resilience against extreme weather, worsening environmental conditions, and various sudden events and surprises in South America. Taking into account the differences between Brazil and Kazakhstan in terms of the theoretical compositions of their respective renewable energy-oriented foreign affairs strategies (see Figure 3), the high degree of theoretical relevance of neoliberalism and constructivism found in the case study on Brazil provides a reference point for forecasting that increased interdependence in the form of renewable energy supply and value chains could contribute to global energy security in the context of renewable energy. As the post-petroleum world is to be streamlined by electrification of everything, technology transfer and solutions for critical raw materials and rare earth elements, Kazakhstan's re-invented identity has to be associated with these three different spheres of development. The key is to turn this enormous renewable energy potential into usable, value-added energy products for consumers worldwide. Being an improver in renewable energy transition, Kazakhstan's favourable geo-related factors indicate that solutions for critical raw materials and rare earth elements are a short- to medium-term strategy, whereas technology transfer and electrification of everything are medium- to long-term objectives.

Neorealism, in comparative terms, appears to have a low degree of theoretical relevance with respect to global energy security in the context of renewable energy, which indicates the deliberate norm in contemporary world politics where energy issues are increasingly being considered in parallel with climate change mitigation and social justice rather than projection of power.

Practical implications

Kazakhstan embarked on a path to keep up with global decarbonisation trends and address climate change in 2012 by announcing the Kazakhstan 2050 Strategy. As an improver positioned in the lower mid-range among one hundred and fifteen countries in 2022/23, the Republic heavily relies on renewable energy technologies that are mainly imported from foreign countries, and local value addition and adoption remain at a very minor scale. Kazakhstan's poor ratio scores in "Ruling elite's change competency to pursue renewable energy transition," "Foreign policy resilience to renewable energy transition," "Electricity infrastructure" and "Human capital" reflect

the Republic's incompetence to substantially adopt a low-carbon course to state-building (see Figure 4). In line with the Concept of the Foreign Policy for 2020-2030, Tokayev's foreign policy priority is to enhance international cooperation and attract premium overseas capital for Kazakhstan's engineering and instrumentation, education, petrochemicals manufacturing and non-ferrous metallurgy [9]. Tokayev aspires to equip Kazakhstan with new capabilities in the global supply and value chain of renewable energy to maintain relevance in global energy security.

Following the outbreak of war between Russia and Ukraine in February 2022, increased investment in renewable energy and zero-carbon fuels worldwide have been made as a means of insulating against unreliable suppliers and volatile fossil fuels. Kazakhstan has been increasingly affected by the risks and opportunities associated with the accelerated reshaping of the global energy sector towards renewable energy. The European Union's target to reduce the bloc's dependency on Russian natural gas by two-thirds in 2022 and eliminate its dependence entirely by 2030 has caused complications in Kazakhstan's energy relations with Russia because of pipeline politics. As Western sanctions on Russia can last for decades, the Republic's petroleum sector and economic prospects are confronted with enduring challenges.

To be safeguarded from being dragged into a deep and prolonged recession, Kazakhstan needs to develop a pragmatic approach based on its high ratio scores for "Renewable energy potential," "National measures to increase sustainable energy security" and "Energy cooperation with extra-regional actors" to cope with the structural changes in global energy interdependence characterised by electrification of everything, technology transfer and solutions for critical raw materials and rare earth elements in the renewable energy industry. Although Kazakhstan aspires to be significantly featured in midstream and downstream operations rather than an upstream supply chain partner to the manufacturing sector in the European Union and China, progress towards high cost value-adding activities has not been convincing when considering the Republic's dubious track record with manufacturing technologies for renewable electricity generation, distribution and utilisation [30]. As of 2023, a joint venture between Kazakhstan's Kazakh Invest National Company JSC and the Swedish-German renewable energy firm Svevind, which was agreed in 2021 to develop a giant green hydrogen project using 45 GW of wind and solar energy capacity, was among the Republic's latest attempts to break into the renewable energy industry [17].

Against this backdrop, Kazakhstan's "Renewable energy potential" in terms of critical raw materials and rare earth elements is perhaps the most feasible investment for both national and international developers and financiers, supported by the ongoing extractive industry since the Soviet era. With sixteen critical raw materials having significant geological potential within its territory, including considerable reserves of lithium, chromium and silicon that are essential for their application in batteries, wind turbines and solar cells, the Republic can be featured in the global supply and value chains of renewable energy significantly in the short- to medium-term future [293]. However, ESG standards must be carefully observed to safeguard the environment and the population for a green economy.

Similar to critical raw materials and rare earth elements, petrochemicals can be found in contemporary energy infrastructure, such as photovoltaic modules, windmill vanes, power cells and electric car components. This makes Kazakhstan's competence in petroleum engineering relevant to manufacturing renewable energy technologies. With global and national oil companies from Saudi Arabia to China beginning to heavily invest in petrochemicals, it is projected that petrochemicals will contribute to more than a third of the overall increase in global oil demand by 2030, and this proportion is expected to rise to nearly half by 2050 [144]. In 2021, Russia's SIBUR Holding, Kazakhstan's national welfare fund Samruk-Kazyna and KazMunayGas entered into a framework agreement to explore potential collaboration within the petrochemical sector. This agreement demonstrates the Republic's aspiration to establish a formidable foothold in the international petrochemical market by investigating an alternative application of oil and natural gas sourced from the Tengiz Field in Atyrau. With the appropriate allocation of resources to technologies that enable deep processing of oil and natural gas, Kazakhstan can secure a prominent position in the global industrial, supply and value chains of low value-added petrochemical products, thereby making a valuable contribution to global energy security [358].

There is little doubt that international joint ventures and partnerships, alongside university education and vocational training, are crucial means of enhancing the population's technological and managerial expertise to shift towards higher value-added activities with respect to the renewable energy technology industry. They serve as a countermeasure to reduce the hampering effect of Kazakhstan's low ratio scores for "Ruling elite's change competency to pursue renewable energy transition," "Foreign policy resilience to renewable energy transition" and "Human capital." As the Concept of the Foreign Policy for 2020-2030 advocates the transfer of advanced foreign technologies to Kazakhstan as a foreign policy priority [9], having the great powers actively engaged with renewable energy transition, technological development and economic diversification is a catalyst that magnifies the Republic's contribution to global energy security in the context of renewable energy. However, the successful transfer of technological "know-how" and "know-why" from these countries cannot be achieved without supportive policies that foster the adoption of renewable energy technologies while ensuring a harmonious balance between environmental sustainability, economic viability and human resource development. To encourage and qualify more people to work in industries across the global supply and value chains of renewable energy technologies, corresponding medium- to long-term measures in human capital development are as important as licencing agreements and FDI from foreign technology developers. Their significance is especially pronounced in Kazakhstan's efforts to align itself with the frontrunners in renewable energy transition.

Electrification of everything has been an ongoing process that refers to replacing the fossil fuel economy with wind, solar, hydro, nuclear, electric vehicles, energy storage systems, heat pumps and a masterfully designed electricity grid that allows two-way transfer of energy. A key issue for Kazakhstan in this regard lies in its poor ratio score for "Electricity infrastructure," which reflects the Republic's high-carbon electricity, inefficient electricity transmission networks and electricity deficit. To overcome these

shortcomings, apart from intensifying human capital development through technology transfer and adoption of renewable energy technologies and nuclear energy, modernisation of the electric grid to incorporate new generation into the existing national power system and cross-border electricity transmission to access low-carbon electricity produced by neighbouring countries are essential steps. The CAPS and CASA-1000, which are designed to interconnect the installed generating capacities of Central Asia and the Indian subcontinent as an energy cluster, could facilitate electrification and turn every country therein into the centrepiece of a super grid that interconnects all regions of the continental area spanning Europe to Asia. However, in the absence of a common electricity market within a region-building framework, despite renewed attention from the great powers regarding the strategic importance of this endeavour, conflicting interests between these extra-regional actors, combined with inadequate multilateral coordination among the participating Central Asian and South Asian countries, could make energy regionalism highly cumbersome and asymmetric.

Following the withdrawal of American troops from Afghanistan and the Taliban's return to power in 2021, construction of the CASA-1000 was put on hold, and Pakistan's attitude towards the electricity interconnection project wavered, especially when its national generation capacity was boosted by the completion of five new Chinese-funded coal-fired power plants. Rather than building a power transmission line of over one thousand two hundred kilometres in length to import hydroelectric power from Kyrgyzstan and Tajikistan, Pakistan's decision in 2022 to purchase inexpensive coal from Afghanistan and to reciprocate by trading electricity signifies a pragmatic approach towards achieving energy and economic security for both countries [50]. This exemplifies that energy cooperation in certain Central and South Asian countries takes place exclusively within the framework of receiving and providing energy resources, neglecting the crucial aspects of sustainability [291].

Nevertheless, as of 2023, considering the West's lukewarm security commitment in the region and Russia's aggressive approach to the post-Soviet space, the five Central Asian countries' caution about resurgent Russian expansionism has prompted a re-formulation of their respective multi-vectoral approaches to foreign policy that tilt between the great powers in response to the new security challenges. As a readily available platform of cooperation among Central Asian countries, the CAPS can facilitate various region-based order-making and order-maintenance practices for proactive or even collective security action, including but not limited to energy security. This move implies significant growth of the Central Asian vector, as projected by optimism from the perspective of neoliberalism in the intra-regional context. However, considering the outdated electricity infrastructure and uneven low-carbon transition across Central Asia, the region could still take a few decades to collectively achieve electrification of everything. For Kazakhstan, while playing an active role in the CAPS might imply few immediate benefits in terms of decarbonisation and energy resilience before the completion of its own nuclear power plant(s), deepening regional integration and cooperation with neighbouring countries in Central Asia could comprise either a cooperative win-win neoliberal arrangement or an external-balancing neorealist strategy for the region as a whole to gain more strategic independence.

Overall, Kazakhstan's contribution to global energy security in the context of renewable energy is hampered by local and regional challenges. Despite the clear advantages of abundant critical raw materials and rare earth elements, as well as a competent petrochemical industry, the Republic's limited human capital inhibits its ability to engage in value-added manufacturing and services for the renewable energy sector. Not to mention the lack of attention to the development of clean and low-carbon energy with a focus on electricity utilisation at both national and regional levels. Kazakhstan's ambitious green hydrogen project may provide a boost, but it will take up to ten years to progress from planning and financing to delivering hydrogen energy to global markets. Thus, Kazakhstan's role as one of the key elements of global energy security in the context of renewable energy is forecast to be tied to its "renewable energy potential" and "energy cooperation with extra-regional actors" for any tangible and timely impacts, similar to its role in the global fossil fuel supply and value chains, where its contribution is most notable in the upstream process of exploration and production. Through a rejuvenated CAPS that incorporates smart grid technologies for integrating diverse sources of renewable energy and nuclear energy, Kazakhstan, alongside other Central Asian countries, can contribute to global energy security by exporting low-carbon electricity in the medium- to long-term. Furthermore, significant advancements in human capital growth can act as a catalyst for all related development.

3.3 Challenges, Opportunities and Recommendations

With renewable energy transition interwoven with climate science, pandemic measures, economic rebound, great power politics and energy market volatility caused by Russia's war in Ukraine since 2022 and the Israel-Hamas War since 2023, notable changes in the energy order were observed in the following aspects: 1) the United States emerged as an oil and natural gas producer that supplied Europe's energy demand [66]; 2) OPEC and the OPEC+ alliance restored production cuts during the worst of the pandemic recession, taking advantage of rising oil prices while being cautious about market uncertainty [329]; 3) China recorded an unprecedented surge in its crude oil imports and the approval of new coal-fired power capacity in 2023; 4) increasing costs of essential raw materials and challenges in managing supply chain logistics jeopardised the European countries' targets for renewable energy and creating new high-quality jobs [61]; and 5) Russia's oil exports have been adjusted towards other buyers without a serious disruption to its short-term production [149]. Thus, it is not surprising that, according to the report *Net Zero Economy Index 2022* produced by PricewaterhouseCoopers, progress on decarbonisation among the G20 countries since 2021 has fallen alarmingly short of what is required to restrict the increase in global warming to 1.5ºC above the levels observed during the pre-industrial era in accordance with the Paris Climate Agreement [127].

Although Kazakhstan's petroleum exports are not subject to sanctions, the Republic's reliance on Russia's pipeline network and Russian ports has led to the development of a roadmap to increase tanker shipments across the Caspian Sea in the coming years [87]. In addition to considering the construction of the Trans-Caspian Gas

Pipeline, which Russia opposes due to the 2018 Convention on the Legal Status of the Caspian Sea [328], to mitigate the adverse impacts of sanctions on Russian Export Blend Crude Oil imposed by the European Union, Kazakhstan's state-owned oil and natural gas company KazMunayGas and other domestic petroleum firms have rebranded the oil they export through the CPC from Russian ports to Kazakhstan Export Blend Crude Oil starting from July 2022 to ensure the continuity of exports [151]. Assuming that the Russo-Ukrainian war had never occurred, Kazakhstan's position as a key element of global energy security should have been consolidated due to the growth in global energy demand in association with a strong post-pandemic recovery.

It is noteworthy that the alignment between Kazakhstan and improvers such as China and India in their aim to achieve carbon neutrality between 2060 and 2070, rather than the earlier targets pursued by most of the frontrunners in the Global North, opens up avenues for extensive and mutually advantageous cooperation. This collaboration spans diverse domains, such as the sustainable use of fossil fuels, energy efficiency, the manufacturing of renewable energy technologies and the modernisation of infrastructure. The extended timeframe provides ample room for both the Republic and these specific improvers to effectively fulfil their respective pledges while maximising the potential for joint progress. Since different countries have different levels of access to renewable energy technologies and different timeframes to reach carbon neutrality, it can be speculated that a notion of "hybrid diplomacy" that merges specific features of the broad tactics of petroleum politics and renewable energy-oriented foreign affairs strategies could become a foreign policy approach for Kazakhstan to act in response to various energy issues at national, regional and international levels.

One has to be aware that, with 2030 being the year when a total of fifty-seven countries – including all European Union member countries, the United States and China – are scheduled to hit peak emissions [245], the strong demand for fossil fuels in the early 2020s might not merely fill a momentary gap but serve to reinforce the trend towards geopolitical rebalancing based on the decline of fossil fuels and the rise of renewable energy. This scenario is supported by OPEC's publication titled *World Oil Outlook 2045*, in which a long-term forecast based on the 2021 data was illustrated: the demand for oil worldwide will rise from 82.5 million barrels per day to 104.4 million barrels per day from 2021 to 2026, but the pace of oil consumption will diminish after 2026 because of the extensive transition to renewable energy by developed countries in their industrial and transportation infrastructures. The demand for oil will reach a plateau after 2035 [148]. Countries that are currently at the forefront of renewable energy equipment manufacturing and other enabling technologies are expected to reap significant long-term benefits. On the contrary, Kazakhstan, as a fossil fuel producing country and an improver in renewable energy transition, might increasingly feel at risk of jeopardising its political, economic, social and energy security when the costs of a speedy renewable energy transition fall mostly on the most vulnerable. Thus, a hybrid approach to energy diplomacy appears to be a feasible foreign policy option that would enable the Republic to strengthen its resilience against uncertainty caused by new patterns of energy interdependence and unforeseen energy security concerns. This speculation is consistent with the first global stocktake

presented by the COP28, which urges a gradual transition away from fossil fuels to achieve net-zero emissions by 2050, in line with scientific evidence. However, this decision text also contains several ambiguous terms that could be manipulated by the fossil fuel sector to maintain production activities [74].

In accordance with Kazakhstan's high ratio scores for "Renewable energy potential," "National measures to increase sustainable energy security" and "Energy cooperation with extra-regional actors," as well as its recent improvement in "Energy cooperation with intra-regional actors," the Republic has considerable potential for three opportunities embedded in the Concept of the Foreign Policy for 2020-2030: advancing energy regionalism; positioning itself as a hub for the green agenda; and prioritising diplomacy centred on uranium, critical raw materials and rare earth elements.

3.3.1 Opportunity (I): Energy regionalism

Energy regionalism denotes collaborative endeavours and integration initiatives led by political actors and encompasses both state and non-state entities across different territorial units. These initiatives govern energy relationships and deliver collective energy-related benefits [257]. Extensive energy cooperation among a cluster of countries in a distinct geographic region is undeniably facilitated by the presence of material components such as complex and territorial pipeline systems, advanced electricity generation and distribution technologies, and efficient transportation infrastructure such as railroads and ports. However, it is crucial that social institutions also play an equally significant role in this process. These social institutions encompass a range of factors, including laws, regulations, the norms, values, and preferences of consumers and other relevant actors, as well as the discursive practices that shape energy infrastructure. By fostering relational networks, these social institutions contribute to the development of interdependence among territorial entities [258]. Energy regionalism is also widely acknowledged as a mechanism in response to the intermittent nature of renewable energy when increased cooperation with neighbouring countries through interconnections can improve overall grid stability.

In regions such as Central Asia, where the absence of a shared interpretation of energy security can be attributed to unequal distribution of energy resources, a Soviet-built resource-sharing mechanism in the format of the CAPS has long been regarded as a foundation for energy regionalism. During the Soviet period, energy interdependence was the most pragmatic solution for maintaining the stability and reliability of energy supplies for energy security and economic and social development. Kyrgyzstan and Tajikistan supplied hydroelectric power to Kazakhstan, Turkmenistan and Uzbekistan in the summer, and electricity generated from fossil fuel-fired thermoelectric power plants was supplied in reverse to cover the heating needs of Kyrgyzstan and Tajikistan in the winter.

The spill-over induced by this energy interdependence could be observed in the post-Soviet era through the formation of the Central Asian Union in 1994 by Kazakhstan, Kyrgyzstan and Uzbekistan, with Tajikistan as an observer in 1996. However, momentum was drastically hampered by a combination of factors originating in intra-

regional mistrust and extra-regional geopolitical pull since the mid-2000s, making coordinated action between the five Central Asian countries inviable in the absence of powerful extra-regional actors and international organisations. The lack of efforts invested by the five countries into the Central Asian vector of their respective multi-vector foreign policy subsequently relegated intra-regional relations in favour of the great power vectors, worsening the economic asymmetries between them and leaving many shared practical issues unresolved. The breakdown of the CAPS in 2009, with Uzbekistan no longer affiliated with the shared electricity ring, not only symbolised the failure of energy regionalism but also characterised the controversial transitional period across Central Asia since the collapse of the Soviet Union, labelled as "Central Asia 1.0."

"Central Asia X.0" refers to a concept developed by esteemed political scientist Farkhod Tolipov of Uzbekistan that serves as a framework for understanding regional affairs in Central Asia. According to Tolipov, "Central Asia 2.0" began in 2016 when Mirziyoyev became president of Uzbekistan. Under his leadership, Uzbekistan emerged from self-isolationism and re-engaged with other Central Asian countries by hosting the 2017 International Conference on Ensuring Security and Sustainable Development in Central Asia in Samarkand [333]. Following the 2019 CAREC Energy Ministers' Dialogue in Tashkent, which revived the CAPS as a bilateral electricity trading platform, the Central Asian region and the nearby Caucasus, the Indian subcontinent and Mongolia took a significant stride towards establishing a regional energy market to meet the rapid economic expansion of the broader region and the surging need for electricity [123]. The bond between the five Central Asian countries was further strengthened by various world events in the early 2020s, highlighted by the Taliban's return to power in Afghanistan after the withdrawal of American troops in August 2021 and Russia's invasion of Ukraine in February 2022. With these new geopolitical realities, there has been a strong appeal for the five Central Asian countries to assert a consolidated position as an energy cluster to promote preferential electricity agreements on a multilateral basis for intra-regional development while coordinating a common strategy to prevent separatism and invasion [344, 345]. Central Asian energy regionalism, whether in the context of a common electricity market or as a prerequisite for future regional integration, is seen as a viable foreign policy option that provides a safety net of market measures to safeguard shared energy benefits in the region amidst great power competition, renewable energy transition and associated geopolitical changes. This approach implies that the Central Asian vector is featured more prominently in the respective multi-vector foreign policies of the five countries, making the CAPS a neoliberal platform. The CAPS aggrandises the fulfilment of region-building and region-securing by actively seeking a collective solution to address mutual concerns regarding energy resilience, capital inflows and green development after years of limited cooperation between them.

Since Central Asia 2.0 represents new regional relations between the five countries in the middle of a new type of geopolitics through new types of connectivity, Tolipov suggests six fundamental aspects that have evolved from particular conceptual frameworks of the preceding transformational modalities, delineating their modified status quos and interactions: 1) no longer transition period; 2) no longer post-Soviet; 3)

no longer newly independent; 4) no longer Eurasian; 5) no longer Great Game; and 6) no longer at the periphery [333]. Tolipov's "5+0" concept further elaborates on Central Asia 2.0, presenting "Central Asia's Five" as an emerging identity in the international system guided by a "structurally closed but functionally open" principle reflective of the notion of brotherhood, age-old ties and good neighbourliness of the peoples of the five Central Asian countries that have significantly contributed to surmounting tensions, settling problems and promoting integration efforts [334]. In this connection, the Kazakhstan-Uzbekistan rivalry in Central Asia 1.0 was replaced with shared responsibility for security and stability in the region and a collective stance for the interests of the five Central Asian countries from within for peaceful development in Central Asia 2.0. Given the swift development of their economies and populations, the potential for mutual understanding and cooperation between Kazakhstan and Uzbekistan can serve as a safeguard for the region, preventing it from falling under the exclusive influence of a single dominant global power amidst the multi-faceted impacts of external actors during geopolitical shifts. The fourth Consultative Summit of the Leaders of Central Asian States in July 2022 was of major symbolic importance when the presidents of the five Central Asian countries exhibited their determination to enhance security cooperation and explore synergies in their efforts to pursue mutually beneficial partnership schemes in a pragmatic way.

From Kazakhstan's perspective, its foreign policy goal of being "a leading state in the Central Asian region," as well as its diplomatic priority to strengthen "the existing formats of interaction of Central Asian states with external partners," does not contradict the notion of Central Asia 2.0 [9]. In fact, the Republic's aspiration to become Central Asia's most innovative economy is crucial to receiving funding from non-state international and regional economic and financial actors, which helps bring mutual benefit to the region as a whole. The renowned mechanism of the AIFC, in particular, could direct investments to create a sizeable renewable energy market in Uzbekistan in accordance with its denser population. Similarly, AIFC can attract FDI to modernise the CAPS and establish it as a financially viable energy cluster. By possessing such capability with respect to financial resources, Kazakhstan is indeed well-positioned to assume a pivotal role in effectively coordinating with countries that possess abundant hydrocarbon and hydropower reserves to address energy concerns within and beyond the Central Asian region. A cross-border automated generation control pilot project launched by KEGOC with its counterpart in Kyrgyzstan since 2021 precisely exemplified this unique characteristic when the project produced an impetus to improve the CAPS with the prospects of a win-win opportunity for Kazakhstan's thermal power plants and Kyrgyzstan's hydropower plants to achieve cooperative energy security [212]. With renewable energy, nuclear energy, hydrogen fuel production, new energy infrastructure, new value-added energy services and emissions reduction targets increasingly being incorporated into the region's energy portfolio, a new type of interdependence between Central Asian countries is anticipated to prompt energy regionalism in the medium- to long-term.

3.3.2 Opportunity (II): Central hub for the green agenda

To pursue a notion of hybrid diplomacy that merges specific features of the broad tactics of petroleum politics and renewable energy-oriented foreign affairs strategies, Kazakhstan's prospects to assert its global presence with minimal disruption and maximum goodwill in the domain of its multi-vector foreign policy rest not only on its role as one of the key elements of global energy security but also on its rapport with a host of countries regardless of their political stances, its logistics location in association with eight international transit automobile corridors and its position in renewable energy transition as an improver alongside the majority of the world. Taking into account Kazakhstan's proposal to create the Regional Climate Hub of Central Asia to unite the efforts of the five Central Asian countries in achieving low-carbon economic growth cooperatively during the COP26 in 2021 [23], this notion of setting up a hub often embeds the flexibility to involve countries outside the region due to the region's expertise in multi-vector foreign policy. At the General Debate of the seventy-seventh session of the United Nations General Assembly in 2022, when Tokayev urged member countries of the United Nations and the global business community to enhance their dedication towards increased climate finance [86], he implied that Kazakhstan was capable of expanding international cooperation and solidarity in the fight against climate change. By citing the report *Our Common Agenda* by the United Nations Secretary General António Guterres (2017-) [207] in his speech, Tokayev also demonstrated Kazakhstan's support for Guterres' suggestions on how to address future generations' concerns and aspirations and enhance multilateral cooperation. Under Tokayev's leadership, the Republic has witnessed remarkable progress in enhancing its physical infrastructure and establishing institutional support to embrace effective strategies for addressing various development challenges. These include carbon mitigation, renewable energy development and ecological restoration. By collaborating with the international community, the Republic possesses the necessary attributes to emerge as a central hub for promoting the green agenda. This vision is further reinforced by the national development project Green Kazakhstan, which is bolstered by the AIFC's mechanisms for green finance and green innovation [359]. Tokayev's 2023 proposal to launch the Just Energy Transition Partnership in Kazakhstan, first at the General Debate of the seventy-eighth session of the United Nations General Assembly [16] and again at the COP28 [90], to ensure equitable funding to address climate change in developing economies enhanced the Republic's position in this regard. The Republic's collaboration with France to co-host the One Water Summit during the 2024 United Nations General Assembly, along with its plan to organise a Regional Climate Summit in 2026, implies a similar agenda.

At national level, Green Kazakhstan is one of the Ten National Development Projects adopted by Tokyaev on October 13, 2021. Developed by the Ministry of Ecology, Geology and Natural Resources in parallel with the Strategy on Achieving Carbon Neutrality until 2060, the Republic has prioritised greening its economy and environmental protection through a focus on four key areas: "Taza Kazakhstan" focuses on improving the quality of atmospheric air, managing waste effectively and

preserving the ecosystems of water bodies within the Republic; “Unemdi Kazakhstan” aims to increase productivity by promoting the efficient use of water and enhancing energy efficiency; “Tabigat” involves an ambitious plan to plant two billion trees and restore the populations of rare and endangered animal species; and “Ecologia Bolashagy” is dedicated to raising the level of environmental education and fostering a culture of environmental awareness among the population [22].

It is significant that the Ten National Development Projects operate in a format similar to that of a joint venture in which the state, local governing bodies and private investors pool resources to accomplish specific tasks [20]. With Tokayev’s open-door policy to foreign investment in the aftermath of the January riots in 2022, attracting FDI to support environmental protection and sustainable socio-economic development in Kazakhstan has become a strategic priority. Chinese investors, in this context, are probably among the pioneers of investmenting in environmentally friendly projects dating back to 2015 when the Intergovernmental Framework Agreement on strengthening cooperation in the fields of industrialisation and investment between Kazakhstan and China was signed. Fifty-five joint Kazakh-Chinese projects worth USD$27.6 billion have been listed since then, including nine renewable energy projects, two projects that manufacture solar panels and electric cables, and a combined heat and power project that increases energy efficiency. In addition, there are projects that reduce air and water pollution, support plant-based agricultural businesses and develop the Belt and Road Market Segment in the Astana International Exchange (AIX) under the AIFC to support connectivity and infrastructure development [125]. Other notable investors include international and regional economic and financial organisations, such as the EBRD, the ADB, the Eurasian Development Bank and the World Bank, as well as European Union agencies, such as the Regional Indicative Program and the Investment Facility for Central Asia. By joining hands in the third-party market cooperation model that connects Chinese enterprises and their peers in developed countries [313], these parties help promote a new investment trend outside the fossil fuel sector in Kazakhstan, responding to the green agenda set out by the relevant national development projects of the Republic and opening up possibilities for further cooperation opportunities under the Paris Climate agreement between different state and non-state actors inside and outside of the Central Asian region [359].

To economise foreign policy, Tokayev took the initiative to leverage the expertise and resources of the Kazakh Invest National Company JSC. This national investment promotion agency, which operates under the Ministry of Foreign Affairs, is entrusted with the responsibility of implementing various state support measures to attract foreign investments into Kazakhstan’s economy. However, to foster the growth of green finance in Kazakhstan and Central Asia, the AIFC-GFC was established as an entity within the AIFC with the main purpose of providing support for projects that prioritise environmental sustainability, energy efficiency and low-carbon practices. This initiative spans the entire region and aims to promote environmentally friendly activities. With regulatory cooperation between Central Asian countries being discussed since 2021 and the agreement to create the Bishkek GFC under the auspices of the AIFC-GFC signed during the tenth meeting of the Kazakhstan-Kyrgyzstan

Intergovernmental Council in 2022 [27], the vision of using green financing tools to support joint environmental initiatives in the region is not only a logical reflection of Kazakhstan's agenda of achieving carbon neutrality by 2060 but also an acknowledgement of the advantages of establishing a climate hub among Central Asian countries that seeks collaboration with extra-regional partners and donors for joint sustainable development projects, in which the transfer of green technologies and green investments are to play key roles. Given Kazakhstan's extensive extra-regional relations, founded on Central Asia's proliferation and overlapping of regional organisations, initiatives and memberships, the AIFC-GFC has the potential to become a pivot point for the facilitation of technology transfer and knowledge exchange for renewable energy advancement between countries. Although it has been reported that Kazakhstan's oil exports through pipelines leading to Russia and China are expected to remain critical for its state-building, the Republic has continued re-inventing itself by resonating with other economies through a hybrid approach to energy diplomacy in response to the growth of renewable energy markets. By leveraging its soft power initiatives focused on climate, environment and renewable energy, the Tokayev government can effectively advance its foreign policy interests, given its status as both a petroleum producer and a green advocate. These efforts can also attract other countries to cooperate with Kazakhstan, thereby creating new diplomatic prospects and fostering trade and investment opportunities.

3.3.3 Opportunity (III): Diplomacy centred on uranium, critical raw materials and rare earth elements

Although Tokayev asserted that Kazakhstan possesses the necessary scientific capabilities and proficient experts to establish an industrial cluster dedicated to the extraction of green hydrogen energy at the Eighth Summit of the Organization of Turkic States in 2021 [71], the Republic's role in the global nuclear order is by far more significant in the short- to medium-term. With "cooperation with foreign partners and donors on the rehabilitation of territories of the former Semipalatinsk nuclear test site" in the Concept of the Foreign Policy for 2020-2030 [9], given the extensive nuclear testing conducted on its territory during the Soviet period, Kazakhstan's uranium deposits and nuclear-related activities remain a sensitive historical issue. After the Cold War, under Nazarbayev's leadership, Kazakhstan voluntarily renounced its vast nuclear arsenal. This provided a rare occasion in which Russia and the United States cooperated to transfer nuclear warheads and other weapons from the nascent Kazakhstan to Russia while the Semipalatinsk test site and other facilities were dismantled. Nazarbayev's decision was a laudable choice that was codified in the 2006 Treaty on the Central Asia Nuclear-Weapon-Free Zone, signed in Semipalatinsk. The fact that Central Asia does not have any nuclear weapons or nuclear facilities in operation even today can be attributed to this decision made in the early 1990s.

Given the potential of nuclear energy to serve as a green energy solution for billions of people, it is crucial to understand that the repercussions of the Soviet nuclear weapons program in Kazakhstan were not exclusively negative. Less publicised is the implication

that in its pursuit of an advanced nuclear industry, Kazakhstan has benefitted from the infrastructure and expertise that have grown as a direct result of the Soviet period. The National Atomic Company Kazatomprom JSC not only possesses essential nuclear facilities, mining complexes and technological and scientific expertise in uranium but also leverages Kazakhstan's nuclear history and resources to establish connections and forge agreements with other countries. In 2017, the IAEA inaugurated the LEU Bank storage facility at the Ulba Metallurgical Plant in Oskemen (also known as Ust Kamenogorsk) of the East Kazakhstan region. This facility represented the IAEA's confidence in the Republic's stability, political commitment to non-proliferation and well-organised management of the uranium industry. Kazakhstan clearly acknowledges the diplomatic value of hosting the LEU bank [347]. Assuming that renewable energy lacks the overall efficiency to supply the entire country and would not be able to meet the growing needs in the short- or medium-term, many believe that nuclear energy is an essential complement to the deployment of renewable energy. One winner from a larger future reliance on nuclear energy could be Kazakhstan.

In early 2022, a few weeks before the Russian invasion of Ukraine, under the European Commission's new rules, certain nuclear projects could be labelled sustainable "transitional activities" because they were designed to help phase out dirty fossil fuels [201]. This move enabled many member countries of the European Union to achieve energy security and their respective zero-carbon targets in the face of the energy crisis related to energy supply chain disruptions since the COVID-19 pandemic. France, for example, plans to build fourteen new "Evolutionary Power Reactors" by 2050 and renovate its existing reactors to extend them beyond fifty years. Faced with soaring energy prices and energy security challenges, several Eastern European countries, such as Poland, which is still heavily dependent on coal and gas, are also turning to nuclear energy. Outside the European Union, Japan, where the Fukushima nuclear disaster occurred in 2011, has already restarted half of its thirty-five nuclear power plants and has stated that nuclear energy must be part of its energy matrix if carbon neutrality is to be achieved by 2050. Great Britain, Russia and India have also planned the construction or reactivation of nuclear power plants. However, as of 2023, China had been the global leader in hosting nuclear new build projects, with fifty-six reactors in operation with a total capacity of around 53 GW and twenty-three reactors under construction [244]. These countries agree with the IEA and the IPCC recommendations that reducing global GHG emissions require electrifying homes and industries. To boost the percentage of electricity in the global energy matrix, they also advocate the use of all sources of decarbonised electricity production to maintain grid reliability. The IEA's 2021 report *Net Zero by 2050* warns that neglecting to make prompt decisions regarding nuclear energy could result in increased expenses for achieving a net-zero emissions pathway and could also heighten the risk of failing to meet the objective [181], a pressing appeal that resulted in the Declaration to Triple Nuclear Energy at the COP28 [65]. As the world's largest producer and seller of natural uranium, uranium diplomacy can make Kazakhstan a meaningful contributor to both global energy security and carbon neutrality.

At first glance, uranium diplomacy could be perceived as conflicting with emerging renewable energy-oriented foreign affairs strategies because of the environmental aspects of uranium mining and nuclear waste disposal. However, a more thorough analysis uncovers that Kazakhstan's uranium exports serve to enhance other countries' efforts to achieve energy diversification in terms of multiple sources and types of energy to run their economies and public services, which does not necessarily undermine global renewable energy development. Taking into account the worst drought in 2022 in Europe and China, which put unexpected strain on the energy supply due to reduced water levels for hydroelectric power generation, cooling purposes in thermal and nuclear power plants, and transporting fossil fuels via waterways, it is evident that energy security cannot be guaranteed without adequate diversification across various energy sources and types when countries are faced with all forms of climate crises and subsequent disruptions in the energy supply chain. As of 2022/23, of the thirty-two countries in which nuclear power plants are operating, a substantial number are either in the frontrunner cluster or ranked in the upper mid-range of renewable energy transition (see Figure 2).

Kazakhstan's advantage in using critical raw materials and rare earth elements as foreign policy instruments is indisputable, especially when Western countries desperately seek these crucial materials from nominally independent providers other than China and Russia. Having already proposed in this dissertation that critical raw materials and rare earth elements could be a short- to medium-term strategy for the Republic to contribute to global energy security in the context of renewable energy, it is important to acknowledge that China's success in this industry has been attributed to its fundamental inclination to overlook or dismiss ESG standards. In the past decade, the European Union has attempted to increase extraction and processing within its borders to ensure reliable, secure and sustainable access to critical raw materials and rare earth elements. However, a more developed environmental awareness impedes the attainment of tangible outcomes, as the traditional process of obtaining these crucial minerals begins with the clearing of trees and grass, followed by the removal of the topsoil of the earth. Moreover, the extraction process itself requires the use of substantial quantities of carcinogenic toxins, including sulphates, ammonia and hydrochloric acid. Reports have revealed that the processing of a single tonne of rare earths yields an astonishing two thousand tonnes of toxic waste [254].

In 2005, China's State Council acknowledged that the exploitation of rare earth elements has resulted in significant harm to surface vegetation, including soil erosion, pollution, acidification and a decline in crop productivity, with some cases even leading to the complete elimination of output [42]. Although a campaign was initiated in 2009 to eradicate unauthorised facilities within the rare earth sector across China, a dispute between China and Western governments emerged in 2010 when the Chinese government opted to decrease its export quotas by 40 percent. The United States, the European Union and Japan voiced their opposition, contending that these restrictions violated WTO trade regulations. China defended its restrictions on exports by emphasising its commitment to resource conservation and environmental protection. In 2014, a verdict was reached by a panel within the WTO, which ascertained that

China had contravened international trade laws by imposing restrictions on the export of rare earth elements. As a result, China complied and abolished its export controls in 2015 [72]. It was not until 2019 that high-end processing was introduced, following the new guidelines issued by the Ministry of Industry and Information Technology to clean up the industry and reduce waste discharges [43].

While broadening international cooperation to attract premium overseas capital in non-ferrous metallurgy has been regarded as one of the priorities in the field of economic diplomacy according to the Concept of the Foreign Policy for 2020-2030, third-party market cooperation could become a strategy for Kazakhstan to ensure a new level of economisation of its foreign policy, gain possession of high-end technology and develop best practices. With the BRI's growing emphasis on transparency, rule-based governance, inclusivity and binding commitments through increased collaboration with developed countries and international financial institutions, a strong accountability system in the format of third-party market cooperation has emerged [313]. This system incentivises synergistic partnerships between national and international experts who draw upon their respective areas of expertise in competitive production, advanced technology, sustainable economic growth and ecological conservation to bolster the long-term viability and environmental sustainability of infrastructure projects. Thus, high-end processing can be implemented by default at the earliest opportunity with respect to the production of environmentally friendly and economically viable critical raw materials and rare earth elements in Kazakhstan for the global market. Transparency among multiple stakeholders could also be facilitated by the same framework to effectively manage fiscal risks and combat corruption.

A notion of hybrid diplomacy that merges specific features of the broad tactics of petroleum politics and renewable energy-oriented foreign affairs strategies is anticipated to encounter complexities. Two specific challenges are evident: the perpetual dilemma between energy nationalism and cooperative energy security; and the absence of energy democracy.

3.3.4 Challenge (I): Energy nationalism

In the context of international relations, nationalism borders on jingoism. While retaining one country's identity in the international arena is of utmost importance to ensuring that it is not taken advantage of by other countries, excessive nationalism could lead to hostilities between neighbouring countries and protectionist trade policies. Regionalism, on the other hand, is cooperation between neighbouring countries in a specific geographic region to achieve harmonious trade, military and geopolitical ties. Maintaining balance between these two approaches has been problematic in Central Asian countries. The failure of the Central Asian Union, Central Asian Economic Community and Central Asian Cooperation Organization demonstrated the fluctuation of their energy relations since the 1990s, together with their struggles to create meaningful regional relationships and maintain their respective national sovereignty.

Energy nationalism is born out of the understanding that not all international energy partners will be safe to work with. It is characterised by three themes: 1) energy independence, in which the rejection of reliance on foreign energy sectors is emphasised; 2) national imaginaries, in which a nation's resources and technologies are portrayed as belonging to "the nation;" and 3) anthropocentric dualism, in which equality between members of a nation in terms of energy resources is built on not only us-vs-foreigners but also human-vs-nature [241]. With the urgent need to address affordability and supply security, many countries are likely to embrace energy nationalism. Russia's invasion of Ukraine presented European policy-makers with a crucial opportunity to reframe climate change policies by advocating decreased dependence on Russian fossil fuels and transitioning to domestic renewable energy sources. Some countries might even revive previous carbon-centric programmes to ensure their national energy security. The consequences of climate change have also led countries that are dependent on hydroelectric power to safeguard their electricity reserves by discontinuing electricity exports. In times of instability, solidarity among neighbouring countries, allies and trade partners could be questioned as to whether a cooperative approach to energy security and decarbonisation is compatible with a country's objective of reducing electricity prices for consumers.

Although energy regionalism has been deemed a promising prospect for sustainable development in Central Asia, the region comprises countries that are both members and non-members of the Eurasian Economic Union. Thus, the regulation of the CAPS, the adaptation of technical standards and the duration of negotiations are pivotal factors shaping the landscape of energy regionalism. In addition, the entire Central Asian region has been affected by poor electricity infrastructure. Without substantial grid modernisation, power grid failure in one country could jeopardise the electricity supply of all countries connected by the same grid. This was exemplified by a huge power outage that hit Kazakhstan, Uzbekistan and Kyrgyzstan on January 25, 2022, when a short circuit in the power system of Uzbekistan occurred [158].

From the perspective of neorealism, it can be argued that when countries are interconnected with transnational energy systems, not only are their national sovereignty and national security called into question, but energy security risks caused by the unpredictability of other countries cannot be ruled out. Taking into account the periodic political upheavals in Kyrgyzstan, the problematic Karakalpakstan region in Uzbekistan, Turkmenistan's neutrality, and the intricacies in the Fergana region stemming from the disputes surrounding land and water rights among Kyrgyzstan, Tajikistan and Uzbekistan, there are plenty of clear indications that Central Asia might not be an ideal region for energy regionalism despite the existence and functionality of the CAPS. Even Kazakhstan's much lauded stability and predictability could no longer be regarded as imperturbable after experiencing the worst unrest in January 2022. Moreover, land use and water access could become contentious issues as Central Asian countries face a growing population and the need for food, water and housing. The quest for energy security may result in the deployment of extensive renewable energy and other low-carbon energy generation technologies, influencing vast areas of land

and river networks. This can exacerbate territorial and transboundary river disputes between neighbouring countries.

In this connection, to achieve energy regionalism, it is vital to have multilateral rules and regulations that harmonise the interests and policies of the stakeholders, infrastructure resilience that allows for flexibility and creativity, and political stability that provides a conducive environment for dialogue and action. However, their inconsistent availability among Central Asian countries has cast doubt on their potential to become a regional grouping and an energy cluster. It is notable that some Central Asian countries continually waver between national energy independence and cooperative energy security.

In 2014, Kazakhstan announced its Concept for the Development of the Fuel-Energy Complex by 2030, which made no reference to importing hydroelectric power from Kyrgyzstan and Tajikistan as a means of ensuring reliable electricity supply in the Republic. Instead, the document stressed the necessity of enhancing energy self-sufficiency to secure national energy security [7], indicating that local resources and infrastructure development were vital for meeting domestic electricity demand. Therefore, on a theoretical level, although Kazakhstan's restructuring initiatives in renewable energy and nuclear energy can bring shared benefits to other Central Asian countries, the possibility of energy nationalism cannot be dismissed, especially given factors such as escalating geopolitical tensions, the exploitation of energy vulnerabilities by external actors, conflicts related to energy infrastructure projects and the erosion of trust due to energy-related corruption.

3.3.5 Challenge (II): Absence of energy democracy

The issue of democracy as a necessary element of climate change mitigation and decarbonisation efforts has received increasing attention from the international community. The concept of energy democracy, which gained prominence in the 2010s as a catchphrase, is commonly employed in policy papers and academic writings concerning energy governance and the shift towards renewable energy in the European Union. It serves as a link between the transformation towards renewable sources and the redistribution of political and economic influence, wealth and ownership, with the aim of establishing a fairer and more balanced global society. The logic behind this is a direct result of the process of decentralising the energy supply due to increases in electricity generation from various renewable sources, in which access to energy becomes democratised with a larger number of less specialised actors involved in energy supply chains, countering the long-standing dominance of the fossil fuel industry [273]. The political cultures and historical legacies of Central Asian countries, characterised by terms like "personal dictatorships," "authoritarian presidentialisms," and "neopatrimonial" and "sultanistic" regimes, are subjects of ongoing speculation. Their acute socio-economic conditions also raise questions about their preparedness to adopt political reform through the rapid implementation of renewable energy. Depending on feasibility, their ties with Western countries might be tightened with a

rebranded vector that considers energy democracy, counterbalancing the influence of communist China and autocratic Russia.

Taking into account the vested interests of Kazakhstan's ruling elite and oligarchs in amassing an enormous amount of personal wealth – one hundred and sixty-two people were reported to have owned 50 percent of the Republic's wealth in 2019 [124] – through their direct or indirect control over the Republic's natural resources, the Tokayev government has been faced with the fact that investing in renewable energy goes beyond simply replacing energy technologies. Renewable energy transition in the Republic involves substantial transformations in the political, societal and economic systems. These changes are particularly significant because they challenge the existing structures of concentrated wealth and dependence on fossil fuel rents that were established over Nazarbayev's three-decade rule. The notion of Tokayev's "Listening State," mentioned in his Address to the Nation in September 2019 [78] and again in the Concept of the Foreign Policy for 2020-2030 in 2020 [9], prompts optimism about his proactive stance to build a harmonious state through a constant dialogue between his government and society while ensuring that the interests of the state, business and each citizen on the external perimeter are promoted and protected. However, it is important to consider the large-scale protests in Kazakhstan in January 2022, which signified not only an attempted coup or intra-elite conflict with the involvement of external terrorist groups but also the complex issue of fuel subsidy cuts that aimed to allow the market to set energy prices. Over the years, the government has allocated substantial amounts of taxpayer money to provide annual benefits, tax breaks and other forms of financial support to both local and foreign fossil fuel companies. The primary aim of these subsidies has been to protect fuel consumers from the unpredictable nature of the market. However, these financial incentives granted to the fossil fuel industry have inadvertently trapped the entire population in a state of reliance on coal, oil and natural gas. Consequently, this reliance has hindered the overall competitiveness of renewable energy sources. In other words, the Kazakhstan government's long-standing fuel price controls, designed to ensure fuel affordability and support social security, are not resilient to the shift towards renewable energy. This policy framework, although easier to implement than other welfare-enhancing policies, allows the privileged few, such as the ruling elite and fossil fuel oligarchs, to profit financially. Thus, renewable energy does not enter an level playing field with fossil fuels but finds itself faced with high financial costs and an uphill struggle to deliver profit and affordability against the fossil fuel industries that the Kazakhstan government has been subsidising both directly (via government incentives) and indirectly (by not punishing polluters). Renewable energy developers and financiers, whether local or foreign, may feel apprehensive about this situation, as it could result in a significant delay in the realisation of profits from their investments.

In this connection, Tokayev's green ambition, as outlined in the Strategy on Achieving Carbon Neutrality until 2060, is confronted with multiple constraints. Balancing public and corporate interests before making any decision about energy is crucial, as well as avoiding the risk of triggering mass uprisings or retaliation from oligarchs if the interests of these two clusters are disproportionately addressed. While

Tokayev's firm commitment to democratic principles was demonstrated through the nationwide constitutional referendum in June 2022, Kazakhstan has not yet reached the stage where democratic reform resonates with the four Ds of energy democracy in association with renewable energy transition, and vice versa. Despite having a resolute barrier against nepotism, paternalism, corruption and compradors in place to mark a comprehensive transformation of the entire state model [85], the adoption of compact, community-based or community-managed renewable energy projects along with feed-in tariffs as a means to address structural inequality and promote economic inclusivity at the grassroots level is at odds with the Republic's existing political, societal and economic systems. These systems remain heavily dependent on fossil fuels and are dominated by the vested interests of fossil fuel stackholders, impeding the transition to renewable energy sources.

The absence of energy democracy can also be observed in Kazakhstan's diplomacy on uranium, critical raw materials and rare earth elements. This has been manipulated by Kazatomprom JSC, which is entitled to obtain subsoil use agreements through direct negotiation with the Kazakhstan government. It remains to be seen how Tokayev's "Listening State" will be implemented in response to the increasing demand for nuclear power plants, driven by the need for pragmaticism in achieving energy security and carbon neutrality. In 2021, Tokayev emphasised the global reliance on nuclear energy in developed countries. He disregarded any misplaced fears or phobias associated with nuclear energy and stressed the importance of continuing efforts to educate the public. While he recognised the importance of proceeding cautiously in the construction of nuclear power plants, he also highlighted the urgency of not delaying this crucial endeavour [81]. The proposal faced opposition from environmental activists and experts within the Republic and received disapproval on various social media platforms. This resistance can be attributed to several factors, including the complex nuclear legacy left by the Soviet Union in Kazakhstan, concerns over the economic and environmental viability of the nuclear energy sector, and the potential strengthening of ties with Russia if Russian resources and expertise are utilised for relevant projects. Energy experts in Central Asia, who also considered Uzbekistan's nuclear power programme, have been quoted as saying that the disposal of heat from nuclear power plants is a major concern because this heat could accelerate desertification by melting Tian Shan glaciers and evaporating the Syr Darya and Amu Darya basins [340].

Acknowledging the strong sentiments associated with nuclear energy, certain countries have sought to engage their citizens by voting on pertinent policies. Sweden held a national referendum in 1980, followed by Italy in 1987 and Switzerland in 1990, to determine public opinion on the continuation or cessation of nuclear power plant operations. However, despite the conciliatory nature of Tokayev's diplomatic language, his statement in 2021 indicated a departure from his previous stance in 2019 regarding a referendum on nuclear energy. This shift highlighted the limited opportunities for public participation in Kazakhstan's decision-making process on energy issues, thus underscoring the absence of avenues for public input. This is notably true when considering that certain features of nuclear power are indeed incompatible with decentralised and democratic forms of self-governance but require large state subsidies

and centralised planning. By examining various compartments that are often found in nuclear power development, such as: 1) a regime of experts to manage, maintain and decommission [242]; 2) a centralised power grid [310]; 3) large states to fund and secure them; and 4) a stable political environment to keep the waste safe for at least the next ten thousand years, they imply that the public ought to put their trust in the political institutions [275]. As of 2023, with the possibility of a national referendum on the nuclear power plant issue resurfacing in Kazakhstan [89], the level of trust in the government's decision-making process remains uncertain, as it must contend with the public's increasing demand for accountability and transparency.

On this basis, although clean energy transition in Kazakhstan could proceed – through a combination of renewable energy and nuclear energy – by adopting a narrow and technocratic approach that focuses on merely reducing GHG emissions and substituting technologies, the Republic might find itself having limited policy resonance and action alignment with the frontrunners in renewable energy outside the sphere of technology adoption. Nevertheless, for the time being, energy democracy remains an ideal and an ongoing undertaking, even for countries at the forefront of renewable energy transition. It encompasses both a conceptual vision of a just and sustainable world with minimal carbon emissions and a gradual process aimed at achieving this vision. Among the member countries of the OECD and the European Union, legislation has been increasingly streamlined to transfer renewable electricity production to local communities for environmental and social co-benefits. Against the backdrop of global carbon neutrality aspirations, Kazakhstan's lack of progress in substantial transformations in the political, societal and economic systems associated with renewable energy on the domestic front can prove to be a deficiency in its renewable energy-oriented foreign affairs strategies. A failure in identity re-invention can consequently hamper the Republic's ability to foster energy democracy-related partnerships with Western countries.

3.3.6 Recommendation (I): A technocratic approach

The history of Kazakhstan's current Ministry of Energy and Ministry of Ecology, Geology and Natural Resources, which have changed names and swapped functions many times since independence, reflects how policy-makers in Kazakhstan recognise the importance of having the right combination of personnel and expertise from various ministries to form relevant departments and units that cope with national and global concerns regarding conventional energy, renewable energy, environmental protection and climate change. However, despite the Republic's advancement from a rating of "highly insufficient" to "insufficient" in terms of climate policies between 2021 and 2024, as indicated by the Climate Action Tracker [197], its commitment to actively and responsibly participating in the international arena regarding renewable energy transition, environmental protection and climate change mitigation is persuasive. Thus, it is critical to determine whether there has been a substantial representation of scientific and engineering experts from universities, research institutions and think tanks involved in the Republic's decision-making. Taking into account that Kazakhstan

and the frontrunners have different starting points in their respective renewable energy transition and are currently at different stages and proceeding at different paces, achieving carbon neutrality by or around mid-century implies the necessity for Kazakhstan to take some drastic target-based measures on the basis of technocracy.

In his book *Between Two Ages: America's Role in the Technetronic Era*, Brzezinski described how the scientific elite can use technology and behavioural science to alter population behaviour and determine the direction of society [226]. This concept was exemplified by Margaret Thatcher, the former Prime Minister of the United Kingdom (1979-1990) and a chemist by profession who advocated the global endorsement of the Montreal Protocol. Ever since its finalisation in 1987, the Montreal Protocol has demonstrated remarkable innovation and effectiveness, making it the pioneering treaty to attain global ratification from all countries worldwide to eliminate the chemicals responsible for ozone depletion. The rationale behind technocracy lies in the belief that scientist-politicians, as exemplified by Thatcher's scientific background, can devise a comprehensive structure that fosters the diversification of a fossil fuel-intensive economy and facilitates the development of international alliances in the context of energy, environment and climate resilience.

Technocracy represents a mode of governance in which political authority is vested in technocrats, who are scientists and technical experts. These individuals are tasked with making decisions that prioritise the welfare of the public. In this context, the significance of competence, public spirit and key performance indicators outweighs personal charisma or popularity-driven competitions. Its practice was notable during the height of the Great Depression in the 1930s, when scientists and engineers in the West were called upon to play a key role in helping the economy heal from the effects of the crisis. The responses of the United States and the United Nations to significant demographic risks in the 1970s were marked by a similar approach. During this period, both entities actively advocated population planning policies, including the widespread distribution of contraception, in various developing countries. Technocracy fundamentally aims to address two pivotal questions that persistently challenge the global community: 1) how should governments respond to crises; and 2) how to manage subsequent changes that impact a large populace?

Since 2020, driven by the need to address the public health threats of the COVID-19 pandemic, the technocratic mode of governance around the world has been on the rise. Medical-scientific experts are now more trusted and considered legitimate sources of advice and instruction than elected politicians. Pharmaceutical companies, which have made remarkable progress in developing highly efficient COVID-19 vaccines at an unprecedented pace, have gained the spotlight. Simultaneously, other companies have made significant advancements in the use of AI and innovative computer hardware for drug discovery and single-cell genomics. Likewise, efforts to combat climate change, in which technology is the nexus between humans and nature, are handled by technical experts who identify where climate pollution originates and act on the most efficient pathways to carbon neutrality, such as through renewable energy transition and the electrification of transportation, on specific timelines. Big tech companies are now considered more capable of solving a deadly pandemic or climate

emergency, as decades of government regulation have demonstrated a fallacy – that is, being too slow, inefficient and lacking in expertise – when solving difficult problems. In times of crisis, unlike politicians who often focus on preserving the status quo and spending their political capital on party politics, technocrats dismiss the disorderliness of the market and traditional politics. Instead, they prioritise the prevalence of technical discourses rooted in scientific data, objective methodologies or AI-assisted decision-making as the primary means of addressing the issues at hand [261]. This feature was exemplified in 2022, when European countries experienced a panic of energy shortage due to both the Russo-Ukrainian war and severe drought. To address energy consumption, experts proposed a variety of strategies for supermarkets to adopt. These included optimising lighting systems, upgrading air conditioning and ventilation units, enhancing refrigeration systems and utilising thermal energy or residual heat. By providing scientific explanations, researchers have aimed to persuade major supermarket companies to actively participate in the efforts towards energy conservation [243]. Characterised by its high efficiency and practical approach, this machine-like system enables the identification of problems based on evidence, facts and reason, as opposed to being influenced by ideological beliefs.

The findings of this dissertation imply the necessity of a hybrid approach to energy diplomacy that merges specific features of the broad tactics of petroleum politics and renewable energy-oriented foreign affairs strategies for Kazakhstan to consolidate the unaligned energy interests and uneven renewable energy transition across multiple intra- and extra-regional actors. To achieve this, from a technocratic perspective, the Republic's development trajectory has to be streamlined in alignment with its long-term targets with respect to the NDCs under the Paris Climate Agreement and membership of the OECD without considering the volatile political and economic scenarios of the world. While top-down measures to intensify the use of renewable energy to build a green economy are already ongoing, the continuation of petroleum trade and the development of a nuclear energy programme to enhance national economic and energy security are indisputable. Opportunities associated with energy regionalism, the formation of a hub for the green agenda and the enactment of a diplomacy centred on uranium, critical raw materials and rare earth elements are within the domain of technocracy. In particular, engineers hold a pivotal position in energy systems, assuming the roles of designers, builders and operators. Their profession revolves primarily around technical expertise and practical implementation, where values and emotions may not find a distinct place [268]. Although environmental and social co-benefits appear to be undermined at first, technocracy is fundamental for Kazakhstan to re-invent an identity associated with renewable energy transition in the long term. Over time, with a stronger human capital base emerging through education and cutting-edge research in local universities in partnerships with institutions worldwide in delivering climate-smart solutions of tomorrow, the growth of renewable energy and its subsequent benefits are anticipated to displace those of fossil fuels and be incorporated into political, societal and economic systems, leading to a higher degree of policy resonance and action alignment with the frontrunners inside and outside the sphere of technology adoption.

3.3.7 Recommendation (II): A social justice approach

In accordance with the theoretical framework formulated by geo-related factors, neorealism, neoliberalism and constructivism in this dissertation, the guiding principles of international relations appear to be stability, predictability and order at the cost of social justice. In this connection, numerous countries are discovered to be duplicating the same inequities of the fossil fuel-based economy and interconnected energy dynamics that generate and sustain pre-existing groups of beneficiaries and victims as they strive for clean energy and climate remedies. The history of dam construction for hydroelectric power, despite being categorised as a renewable energy source, has had profound global implications. This has resulted in the displacement of millions of people across numerous regions, thereby worsening existing inequalities in accessing the benefits associated with hydroelectric power. Similarly, solar energy involves the energy-intensive production of photovoltaic cells and solar panels, which heavily rely on mining of rare earth elements. This mining process often leaves behind risks and damages, while the installation of solar arrays necessitates the utilisation of inhabited lands, whether by humans or other species. With human displacement associated with renewable energy development triggered debate on interlinkages between sustainable energy access and migration, the political underpinnings and implications of modern patent systems have also caused controversies over innovation governance and public interest because the benefits and harms are not equally shared. In general, individuals who reap the rewards of cleaner energy sources, diminished emissions resulting from the elimination of fossil fuels and the employment and innovation prospects that follow this shift are considered winners. Conversely, the losers are those who endure hardships or face barriers in accessing such opportunities. Assuming that the massive protests across Kazakhstan in January 2022 were prompted by the government's policy to remove price caps on liquefied petroleum gas, they mirrored the 2018 carbon tax on petroleum products in France when a wider anti-government movement known as the "yellow vests" was triggered. The price signal intended to encourage the public to be aware of their carbon footprints turned out to make the masses of both countries victims of energy decarbonisation, leading to a genuine reckoning of pre-existing and forthcoming social injustice and structural inequity.

The idea of encouraging the participation of small- and medium-sized local companies, potential investors, executive bodies, farmers, financial organisations and others in the local renewable energy sector has been introduced in Kazakhstan through the implementation of feed-in tariffs and auctions. However, as mentioned above, the Republic's contemporary political, societal and economic systems are overwhelmingly sustained by oil rents. Thus, using energy diversification, which refers to using different energy sources, suppliers and transportation routes, to reduce structural inequity and spread wealth into local communities is still in its infancy. With Kazakhstan's infrastructures for alternative energy sources, such as solar and wind, often built as megaprojects and characterised by highly financialist ownership structures, engineers involved do not typically view renewable energy as a type of energy at a local or

community scale. Rather, they see renewable energy engineering as a national means of reducing energy deficit and accomplishing the Kazakhstan 2050 Strategy. This demonstrates that new energy projects in the Republic lack appropriate structures for public participation, lack opportunities to meaningfully engage local and community actors, and are at risk of continual centralisation of sociopolitical and economic power. Therefore, it is imperative to acknowledge that the redistribution of power and the pursuit of a just and equitable future cannot be taken for granted during the transition to renewable energy. To ensure a successful shift towards clean energy, deliberate attention must be paid to the political, societal and economic changes that accompany this transformation. Deliberately creating awareness about the inequities stemming from the embodied energy of fossil fuel combustion can serve as an additional catalyst and motivation to accelerate the implementation of electrification and renewable energy solutions. Wendt's *Social Theory of International Politics* delves into the significance of deliberation in the sphere of political constructivism. His conclusive argument posits that political constructivism is propelled by a well-crafted collection of political principles derived from appropriately conducted deliberations [236].

Many countries have faced criticism for their current energy and climate change policies, as they have been accused of placing excessive emphasis on deterministic technological solutions and economic impacts, and neglecting the human dimension. While there is little doubt that climate issues are pressing and could be addressed through technocratic and technological means, social justice has been increasingly asserted among non-governmental organisations and citizens' groups in the West since the beginning of the twenty-first century, acting as a catalyst for numerous scholars to incorporate the concept into the academic domain. The renewable energy sector has made notable progress in addressing social justice concerns by integrating them into the fabric of renewable energy engineering since the 2010s. As a field with immense potential for building a sustainable future, renewable energy engineering has actively embraced the inclusion of diverse social justice considerations in the planning, execution and sustainability of renewable energy technologies. Energy research, particularly within the domain of social science, has also paved the way for the development of an emerging field known as "energy justice." This field not only highlights the potential for social justice in the context of energy transition but also sheds light on injustices perpetuated by various energy policies [274]. It is noteworthy that activists have been employing the concepts of energy justice and energy democracy without differentiation for years to refer to "governance principles of a just, progressive and sustainable energy system [270]" but academicians would rather regard energy democracy as "one of the means through which energy justice can be achieved [271]."

The concept of energy justice theory introduces ethical evaluations regarding the potential ramifications of decisions made regarding energy policy, its development and distribution, energy security and climate change on both present-day individuals and future generations in the coming decades. Andreas Goldthau and Benjamin K. Sovacool are credited with writing the first academic paper that introduced the concept of energy justice. Their article "The Uniqueness of the Energy Security, Justice, and Governance Problem," published in 2012, encompassed a specific section that delved into the

discrepancies in energy accessibility and expenses, as well as the external factors associated with energy provision under the heading of energy justice [266]. In 2013, "Advancing energy justice: The triumvirate of tenets" was published in *International Energy Law Review*, with Darren McCauley, Raphael Heffron, Hannes Stephan and Kirsten Jenkins as authors [267]. As of 2023, social scientists have achieved considerable success in aligning their research with the world's leading energy and climate authorities. Through their papers and reports, they have addressed several topics, including debunking the notion that developing countries rely on fossil fuels to alleviate poverty and documenting efforts to obstruct climate policy. By establishing a connection between justice, energy security and social concerns, these efforts have paved the way for novel possibilities and tools that lay the foundation for a policy agenda promoting renewable energy transition while ensuring sustainable development.

In this connection, besides the allocation of costs and benefits of various energy-related technological alternatives within society, the French experience in 2018 unveiled the essentiality of a much more participatory, transparent and equitable design to comprehensively prevent future discontent on the part of those who suffer from the repercussions of energy transition policy [276]. In the United States, policy-makers have increasingly recognised the disproportionate challenges faced by communities of colour. These challenges include higher utility bills, increased exposure to air and water pollution, and increased vulnerability to natural disasters. To address these issues, there has been a growing emphasis on developing energy policies that prioritise racial and social justice. This involves the promotion of decentralised energy development, such as microgrids, to assist vulnerable populations in mitigating the social, economic and health burdens caused by the current energy system. By reimagining the existing energy infrastructure, society can create opportunities for these communities to partake in the social and economic benefits offered by alternative energy sources [277]. Social justice appears to have created a niche for policy resonance and action alignment between countries in the international community to tackle challenges in renewable energy transition and carbon neutrality. The loss and damage fund established at the COP27, along with its implementation since the COP28, may be viewed as a preliminary sign that the concept of justice have become more pronounced in multilateral negotiations.

Serikkali Brekeshev, Kazakhstan's former Minister of Ecology, Geology and Natural Resources (2021-2023), recognised the crucial role of a just transition in achieving a low-carbon economy. When addressing the first Central Asian Forum in 2021 under the topic of Regional Cooperation and Ways of Joint Efforts on the Way towards Carbon Neutrality, he was quoted as saying, "it is clear that planning and transitioning to green growth should address issues such as social and gender-related ones, educating the population, future development of new professions and skills, including to disabled people…. Socially just transition is one of the governing principles of decarbonisation [195]." Since the protests in early January 2022 ended, Tokayev has discussed reforms in the social sector, which refer not only to supporting vulnerable groups of the population but also to being a key way of stimulating dialogue and interaction between the state and society. He stressed that the state and business should make better efforts to promote even and fair development in all regions, from cities and

single-industry towns to rural districts [82]. Although there was no specific mention of energy justice, the idea of promoting the creation of inclusive and sustainable societies across Kazakhstan is evident. In his 2022 speech at the General Debate of the seventy-seventh session of the United Nations General Assembly, Tokayev reaffirmed his commitment to building a Just Kazakhstan, mentioning that the Republic has undertaken extensive political and economic reforms on a grand scale [86]. However, the means by which the Republic can achieve this objective, whether through domestic measures and local resources or through collaboration with other countries and international organisations, remains uncertain. Although the Ten National Development Projects approved by Tokayev in 2021 were designed to attract foreign investors, no project on the list was initiated by the Ministry of Justice or the Ministry of Labour and Social Protection of the Population. The implication is that the broad goals of inclusion and fairness might be left to other ministries that do not specialise in relevant matters.

Nevertheless, whether viewed as a sequential process or a parallel development alongside technocracy, energy justice holds increasing significance in the context of Kazakhstan's renewable energy transition. This will not only benefit the Republic's engagement with the international community in a post-petroleum world order but also position it as a hub for the green agenda and attract the frontrunners in renewable energy transition to participate. Given these goals, it is crucial for energy policy-makers to integrate energy innovations with valuable social and energy justice research. Similarly, diplomacy centred on uranium, critical raw materials and rare earth elements must consider compliance with ESG standards. Failure to do so will result in an inability to account for the extensive environmental costs associated with the production of these crucial materials, which can negatively affect the population's quality of life. Following a constitutional reform in 2022 that deliberately moved Kazakhstan away from neopatrimonial and authoritarian practices, it is expected that Tokayev and his successors will demonstrate a higher level of social justice competence in addressing issues arising from renewable energy transition.

Conclusion

A new energy order, defined by the dual imperatives of energy security and climate action, has emerged. This dissertation offers an in-depth analysis of Kazakhstan's foreign policy formulation, drawing attention on the prospects of renewable energy as a driving force behind Kazakhstan's foreign affairs strategies. This section concludes the dissertation by summarising the key research findings in relation to the aim and questions and discussing the value and contribution thereof. It also reviews the limitations of this dissertation and proposes opportunities for future research.

Overall findings in relation to the aim of the dissertation. The aim of this dissertation is to bridge the gaps in current knowledge and recent literature concerning renewable energy development by analysing Kazakhstan's foreign policy in the context of discernible trends in the global energy landscape, taking into account the Republic's internal and external conditions and its pivotal contributions to global energy security. From the perspective of Kazakhstan as a key element of global energy security in terms of petroleum production and an improver in renewable energy transition, the primary research question guiding this dissertation is "how could Kazakhstan boost its diplomatic capacity and global presence in the upcoming energy order in which renewable energy is prioritised?"

The mixed methods research (MMR) methodology adopted in this dissertation encompasses a survey of international relations theories, a case study examining Brazil's transition to renewable energy and a correlation analysis of relevant data sets. By integrating qualitative and quantitative research methods, this dissertation establishes a solid knowledge base on the topic, facilitating the development of a realistic and credible forecasting model.

The selection of Brazil as a case study yields significant insights into renewable energy transition, addressing the relevance of theories revolving around geo-related factors, neorealism, neoliberalism and constructivism in this dissertation. Brazil's diverse, clean energy portfolio presents eight key indicators that streamline the examination of renewable energy as a foreign policy instrument: 1) Renewable energy potential; 2) Ruling elite's change competency to pursue renewable energy transition; 3) Foreign policy resilience to renewable energy transition; 4) National measures to increase sustainable energy security; 5) Electricity infrastructure; 6) Human capital; 7) Energy cooperation with intra-regional actors; and 8) Energy cooperation with extra-regional actors. These indicators extracted from the case study, when considered alongside the four international relations theories, suggest that foreign relations in the context of renewable energy are shaped by a series of logical interactions between different criteria embedded in these theories. Despite its vulnerabilities to natural disasters, climate change and human mismanagement, Brazil's foreign policy underscores its global leadership in low-carbon energy and provides a roadmap to examine Kazakhstan's navigation in renewable energy transition.

The Energy Architecture Performance Index developed by the World Economic Forum and the Global Sustainable Competitiveness Index developed by SolAbility

Sustainable Intelligence have a positive linear correlation. This correlation is observed across more than one hundred countries from 2014 to 2022/23 and is calculated using Pearson's *r* formula. Besides illustrating the positive impacts of renewable energy on interstate relations, this correlation signifies the emergence of new patterns of energy interdependence, which are observed during a globally uneven low-carbon transition. It is important to note the formation of three country clusters: frontrunners, improvers and laggards. These clusters have implications for the application of international relations theories and foreign affairs strategies, which are essential for the analysis of an energy order characterised by various types of energy cooperation and competition among countries.

Kazakhstan has not attained the requisite level of development to effectively use renewable energy as a foreign policy instrument. To accomplish this goal, the research findings suggest that the theoretical composition of the Republic's foreign policy ought to shift and adapt to the changing dynamics of energy security resulting from an uneven global transition towards low-carbon sources. When using the eight indicators as forecasting tools, it becomes clear that neorealist principles have a detrimental effect on Kazakhstan's capacity to foster change competence within its ruling elite, build resilience in foreign policy, enhance electricity infrastructure and cultivate human capital to facilitate renewable energy transition. On the other hand, geo-related factors – which consist of geographical size, geostrategic location, geographic features, energy resource geology, geopolitical reality and similar aspects – create synergistic effects with neoliberalism when considering the Republic's abundant potential for renewable energy, ambitious national measures to enhance sustainable energy security, and active energy cooperation with intra- and extra-regional actors. To seek a high degree of policy resonance and action alignment with the frontrunners in renewable energy transition, Kazakhstan is also compelled to move away from its petroleum-oriented state-building strategy and engage in foreign affairs with a re-invented identity that responds to the new energy order. This implies that constructivism, with its emphasis on deliberation, should become more prominent, coupled with the rise of a new generation of ruling elite who advocate for the use of environmentally friendly energy and carbon neutrality. This anticipated shift in the theoretical composition of Kazakhstan's foreign policy provides a glimpse into how renewable energy transition has affected the Republic's approach to foreign affairs.

From a practical perspective, President Kassym-Jomart Tokayev's vision of advancing the economisation of foreign policy to promote a transition to a low-carbon economy aligns well with the current green investment boom, largely propelled by the FDI from the European Union and China. In addition, the shift in Kazakhstan's foreign policy priorities from individual countries to regional and multilateral cooperation strengthens its ability to attract funding and establish partnerships. To facilitate the effective use of renewable energy as a foreign policy instrument, the Republic must enhance its "Energy cooperation with intra-regional actors," "Ruling elite's change competency to pursue renewable energy transition," "Foreign policy resilience to renewable energy transition," "Electricity infrastructure" and "Human capital." In the coming decades, with more regulations, standards and incentives anticipated to be

implemented to enhance local renewable energy-related industries and to narrow the gap in renewable energy development between itself and the frontrunners, Kazakhstan's foreign policy orientation could undergo changes along the hypothetical axis and bear more resemblance to Brazil's coordinated approach that achieves energy security, economic growth and environmental sustainability in theoretical and practical terms.

The research findings foster a growing sense of optimism surrounding Kazakhstan's prospects of boosting its diplomatic capacity and global presence in the context of renewable energy but the ultimate outcome is subject to the Republic's level of engagement in global energy supply and value chains, which are increasingly streamlined by electrification of everything, technology transfer and solutions for critical raw materials. Kazakhstan has anticipated opportunities to take a leading role, particularly in forging energy regionalism in Central Asia, forming a hub for promoting the green agenda and employing a diplomatic approach centred around uranium, critical raw materials and rare earth elements. However, there are challenges related to cross-border interconnections in Central Asia due to the unpredictability of other countries connected to the same grid and the ageing electricity infrastructure, which can pose energy security risks. Furthermore, renewable energy adoption is much more than a substitution of energy technologies. While it is vital to leverage national projects and innovative financial tools to support the green agenda on various scales, it is equally important to acknowledge the profound impact of decentralised energy systems on political, societal and economic systems. For Kazakhstan to implement a diplomacy centred on uranium, critical raw materials and rare earth elements, apart from having a target to enhance the international community to achieve energy diversification in response to climate uncertainties and energy supply chain disruptions, it should not compromise on ESG standards. In this regard, a pragmatic pathway can involve a target-based technocratic approach, where scientist-politicians play a pivotal role in driving the adoption of renewable energy transition in conjunction with market forces to fulfil all commitments under the Paris Climate Agreement. Ideally, the pursuit of social justice is integrated into the development of a clean energy future, either in a sequential process or in parallel.

Kazakhstan's foreign relations in the context of renewable energy are anticipated to rely on its renowned multi-vectoral approach due to its favourable geo-related factors. However, the evolution and final patterns of these relations depend on the Republic's effectiveness in transitioning from leverage-seeking to consolidation when faced with divergent energy interests and uneven progress in renewable energy transition among various intra- and extra-regional actors. With President Tokayev's commitment to clean energy and green technologies offering a positive outlook for Kazakhstan, it is speculated that a hybrid diplomatic approach, combining elements of petroleum politics and renewable energy-oriented foreign affairs strategies, will most likely be adopted as a foreign policy approach for Kazakhstan to address a wide range of energy issues at the national, regional and international levels in the short to medium term.

Contribution to the field. Through a comprehensive exploration of Kazakhstan's foreign relations in the context of renewable energy, it is notable that the energy debate is increasingly focused on new factors. Due to the recent transformation of the global energy sector from fossil-based systems to zero-carbon technologies to mitigate climate change and tackle environmental and ecological crises, longstanding assumptions about energy security and international relations are altered when global supply and demand are redefined. Using a MMR methodology that incorporates features of four types of data analysis, current knowledge regarding the internal and external circumstances that drive renewable energy to the forefront of foreign policy-making has undergone a notable expansion. This indicates that any country can be analysed in a similar manner, regardless of whether it is a petrostate or holds geostrategic importance for the great powers. Frontrunners, improvers and laggards in renewable energy transition alike may also consider the results of this research to review their current foreign affairs strategies with respect to their targets to reach carbon neutrality.

In this regard, this study provides awareness to policy-makers of the unaligned energy interests and uneven renewable energy transition across the globe, as well as the foreseeable changes, opportunities and challenges at national, regional and international levels as the world moves towards a carbon-neutral future. Moreover, it equips political entities and institutions with the knowledge to handle renewable energy transition not only as a substitution for energy technologies but more importantly as a movement for energy democracy and social justice, which is attached to an international dimension and crucial to a country's identity re-invention. This implies the creation of internal conditions conducive to sustainable development and the external promotion of policy resonance and action alignment for effective and efficient renewable energy-oriented foreign affairs strategies.

Limitations. However, this dissertation has several limitations. The first limitation is that the literature on foreign relations in the context of renewable energy is scarce, not to mention the insignificant presence of renewable energy in Kazakhstan's foreign policy-making and diplomatic activities. The second limitation is that the significant contrasts between different forms of renewable energy sources, such as solar, wind, hydroelectric power, biofuels and green hydrogen, have not been given due attention in this dissertation. Thus, the specific implications of each of these renewable energy sources on energy relations between Kazakhstan and other countries might have been disregarded.

The third limitation is that the case study on Brazil was more like an overview due to time constraints. Some key aspects and events that marked turning points may have been overlooked. Thus, the model that incorporates Brazil's experiences in renewable energy transition and the eight indicators for forecasting might have been misrepresented. The fourth limitation is that forecasting in this dissertation did not involve any metric data, computational modelling or machine learning to determine the probability of various outcomes. Incapable of specifying when and how progressive change will occur and estimating the scale of the impact, forecasting is difficult to be 100 percent realistic.

Lastly, world events and their effects are beyond the control of any individuals, international organisations or countries, and the speculative nature of this research design leaves the possibility of residual confounding. The once advocated post-COVID-19 green recovery, the energy crisis in 2021 and Kazakhstan's Bloody January in 2022 were all impactful events that drastically made their contradictory marks on this dissertation. Moreover, the economic impact of the Russo-Ukrainian conflict, Western sanctions on Russia, Russia's retaliatory measures and the Gaza conflict have imposed constraints on the accuracy of research findings regarding implications, opportunities, challenges and recommendations.

Recommendations for future research. During this research, the dissertation author identified four underexplored aspects for which future research is recommended.

The first aspect is to conduct the same research in the context of a specified form of renewable energy. A narrowed scope – by focusing specifically on solar, wind, hydroelectric power, biofuels, green hydrogen, or any other form – helps simplify data collection, improves the accuracy of research findings and produces precise information for policy-makers in Kazakhstan to make decisions on energy security and associated diplomatic activities.

The second aspect is to discuss the prospects of energy regionalism in Central Asia in association with "Central Asia's Five" and "Central Asia 2.0" amidst the emergence of new geopolitical realities and new types of connectivity. Taking into account the social, economic and environmental benefits of becoming an energy cluster that promotes electrification and exports low-carbon electricity, energy interdependence produces an appealing direction for the region as a whole. It is worth discovering whether the five Central Asian countries possess the potential and criteria to first seek policy resonance and action alignment, then function together as an energy cluster, and eventually become a regional bloc.

The third aspect is to examine how a country can capitalise on its dual role as a petroleum producer and proponent of a fossil-free future while simultaneously establishing a prominent international presence with minimal disruption and maximum goodwill. This is a challenging issue faced by all petrostates as they are obliged to cut emissions, adjust production to maintain equilibrium between the security of demand and supply, and diversify their economies simultaneously. The mechanism of the proposed hybrid approach to energy diplomacy, which merges specific features of petroleum politics and renewable energy-oriented foreign affairs strategies requires a detailed study.

The fourth aspect explores the relevance of technocracy in times of energy and climate crisis in international relations. The rise of technocracy on a worldwide scale is observed through the promotion of different energy-saving measures by governments to the public in response to energy supply shortage. With tech trends, tech threats and tech companies increasingly interwoven with world politics and global security, it is crucial to explore the relevance of technocracy to and the involvement of technocrats in international relations.

A closing summary. The oil crisis of the 1970s marked a turning point in international relations studies, as it brought the politics of energy to the forefront of

scholarly attention. This dissertation examines the conditions prevalent in the early 2020s, during which the adoption of renewable energy sources, integration of sustainable technologies and promotion of decarbonisation within national economies have become pressing imperatives. These measures are essential for all countries to ensure energy security and achieve carbon neutrality. Kazakhstan, a vast country endowed with ample conventional and renewable energy resources, is no different in its pursuit of ambitious goals to tap into its renewable energy potential and attain carbon neutrality by 2060. This effort necessitates a shift in the Republic's foreign policy approach, accompanied by the development of new diplomatic capabilities. Taking into account a host of internal and external conditions that are crucial to the formulation of renewable energy-oriented foreign affairs strategies, the hurdles of transition faced by the Republic were found to be mostly related to internal constraints. Yet, being attractive to the great powers and other new players to assert their ambitions regarding renewable energy, opportunities are available for Kazakhstan and Central Asia as a whole to transition to becoming a key exporter of low-carbon electricity, critical raw materials and rare earth elements. Synergistic effects can be produced, but the results are subject to the Republic's capabilities to consolidate the divergent interests of these external actors. Analysing Kazakhstan's foreign relations in the context of renewable energy will thus unveil how its renowned multi-vector foreign policy will evolve in association with its new role in global energy security, implying the necessity to intensify the Republic's engagement in cooperative ventures and identity re-invention. While Tokayev's commitment to clean energy and green technologies offers a positive outlook, a hybrid approach to energy diplomacy that merges specific features of the broad tactics of petroleum politics and renewable energy-oriented foreign affairs strategies could be a short- to medium-term external strategy for Kazakhstan to recognise the unaligned energy interests and uneven renewable energy transition across multiple intra- and extra-regional actors.

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Appendix A – Data Sets from the World Economic Forum [159] and the Solability Sustainable Intelligence [129] for 2014

No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index	No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index
1	Norway	75	53.4	63	Indonesia	52	46.1
2	New Zealand	73	51.2	64	Philippines	51	39.4
3	France	72	50.3	65	Venezuela	51	45.7
4	Sweden	72	54.1	66	Algeria	50	42.1
5	Switzerland	72	52.0	67	Cyprus	49	42.2
6	Denmark	71	51.6	68	Guatemala	49	41.9
7	Colombia	70	45.9	69	India	48	38.0
8	Spain	67	45.9	70	Sri Lanka	48	39.2
9	Costa Rica	67	49.4	71	Malaysia	48	45.9
10	Latvia	66	46.9	72	Bolivia	48	44.7
11	United Kingdom	66	43.8	73	Kyrgyz Republic	47	42.7
12	Romania	66	45.4	74	Belarus	47	47.7
13	Austria	66	51.3	75	Vietnam	47	42.3
14	Canada	66	50.4	76	Nicaragua	46	40.5
15	Germany	65	52.0	77	Ukraine	46	42.2
16	Portugal	65	45.9	78	Malta	46	41.7
17	Ireland	65	49.9	79	Morocco	46	36.9
18	Peru	65	46.0	80	Cameroon	46	41.5
19	Finland	65	53.6	81	Egypt, Arab Rep.	46	39.1
20	Slovak Republic	64	46.8	82	Namibia	46	36.3
21	Hungary	64	45.7	83	Ghana	45	43.4
22	Brazil	64	48.2	84	Uzbekistan	45	44.7
23	Uruguay	64	48.9	85	China	45	48.3
24	Paraguay	63	43.6	86	Libya	45	40.5
25	Slovenia	63	49.2	87	Macedonia, FYR	45	38.7
26	Australia	63	47.0	88	United Arab Emirates	44	39.1
27	Luxembourg	63	51.6	89	Honduras	44	34.1
28	Russian Federation	62	45.8	90	Qatar	44	42.8
29	Czech Republic	60	47.0	91	Saudi Arabia	44	45.9
30	Belgium	60	45.4	92	Zambia	44	40.8
31	Iceland	60	56.2	93	Nigeria	44	38.0
32	Chile	60	43.4	94	Trinidad and Tobago	44	37.2
33	Netherlands	60	47.1	95	Botswana	44	37.3
34	Lithuania	60	49.1	96	Pakistan	43	33.3
35	Estonia	59	49.4	97	Cote d'Ivoire	43	38.9
36	Mexico	59	43.4	98	Iraq	42	32.3
37	United States	59	46.8	99	Senegal	42	38.4
38	Japan	58	53.3	100	Turkmenistan	42	39.7
39	Kazakhstan	58	44.2	101	Brunei Darussalam	42	44.8
40	Poland	58	47.2	102	Iran, Islamic Rep.	42	36.9
41	Israel	58	43.7	103	Nepal	42	46.4
42	Greece	58	42.8	104	Bosnia and Herzegovina	42	40.5
43	Croatia	58	46.7	105	Kuwait	42	40.0
44	El Salvador	57	39.9	106	Mozambique	42	40.3
45	Bulgaria	57	43.0	107	Eritrea	41	32.3
46	Argentina	57	45.9	108	Syrian Arab Republic	41	34.4
47	Turkey	57	40.5	109	Kenya	41	38.6
48	Panama	56	42.3	110	Republic of Moldova	40	42.1
49	Italy	56	46.4	111	Oman	39	44.2
50	Ecuador	56	44.5	112	Jamaica	39	39.6
51	Korea, Rep.	55	47.6	113	Ethiopia	39	41.8
52	Azerbaijan	55	39.7	114	Bangladesh	38	37.4
53	Congo, Rep.	55	41.4	115	Jordan	38	37.9
54	South Africa	54	40.9	116	Haiti	38	32.9
55	Thailand	53	40.5	117	Mongolia	37	43.4
56	Albania	53	39.6	118	Bahrain	37	32.4
57	Dominican Republic	53	45.2	119	Togo	37	37.7
58	Georgia	53	41.9	120	Cambodia	36	41.8
59	Armenia	53	44.4	121	Tanzania	36	41.7
60	Tunisia	53	40.3	122	Benin	35	38.8
61	Tajikistan	52	42.9	123	Lebanon	33	38.9
62	Singapore	52	47.4	124	Yemen, Rep.	32	30.0

Appendix B – Data Sets from the World Economic Forum [160] and the Solability Sustainable Intelligence [130] for 2015

No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index	No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index
1	Switzerland	80	53.0	64	Cyprus	59	42.0
2	Norway	79	54.6	65	Algeria	59	42.2
3	France	77	50.4	66	South Africa	58	38.2
4	New Zealand	76	50.9	67	Malta	58	45.2
5	Spain	76	46.4	68	Sri Lanka	58	37.0
6	Sweden	76	55.5	69	Morocco	57	37.4
7	Denmark	75	52.7	70	Cameroon	56	41.3
8	Austria	75	52.5	71	Serbia	56	42.8
9	Colombia	74	45.2	72	Guatemala	56	40.0
10	Portugal	73	45.8	73	Ukraine	56	41.4
11	Costa Rica	72	47.3	74	Brunei Darussalam	56	40.9
12	United Kingdom	72	44.9	75	Republic of Moldova	55	41.6
13	Albania	72	39.9	76	Indonesia	54	45.2
14	Slovenia	71	50.8	77	Vietnam	54	41.2
15	Uruguay	71	46.5	78	Uzbekistan	54	43.0
16	Ireland	71	50.8	79	Cote d'Ivoire	54	39.6
17	Finland	71	54.4	80	Malaysia	54	44.6
18	Hungary	71	45.0	81	Qatar	54	42.9
19	Germany	71	52.8	82	Nicaragua	54	40.9
20	Latvia	70	48.5	83	Macedonia, FYR	54	38.7
21	Croatia	70	47.9	84	Bolivia	53	44.0
22	Paraguay	70	44.4	85	Venezuela	53	43.6
23	Brazil	70	47.3	86	Belarus	53	46.8
24	Belgium	69	45.9	87	Kyrgyz Republic	53	42.9
25	Canada	69	49.9	88	Zambia	53	40.0
26	Netherlands	69	46.7	89	China, People's Rep.	53	47.2
27	Romania	69	44.8	90	Trinidad and Tobago	52	36.2
28	Iceland	69	56.1	91	Ghana	52	42.5
29	Luxembourg	69	52.8	92	Iraq	52	31.4
30	Slovak Republic	69	49.3	93	Turkmenistan	52	37.9
31	Peru	68	45.9	94	Libya	51	40.0
32	Japan	67	52.1	95	India	51	37.7
33	Azerbaijan	67	38.7	96	Syrian Arab Republic	50	29.7
34	Chile	67	42.1	97	Jamaica	50	36.8
35	Congo. Rep.	67	40.6	98	Honduras	50	34.1
36	Czech Republic	67	48.6	99	Botswana	50	39.5
37	United States	66	45.5	100	United Arab Emirates	49	38.7
38	Australia	66	46.4	101	Oman	49	43.5
39	Russian Federation	66	46.3	102	Bosnia and Herzegovina	49	40.1
40	Lithuania	65	49.3	103	Mozambique	49	40.5
41	Greece	65	42.4	104	Senegal	49	36.6
42	Poland	65	46.8	105	Kenya	49	37.9
43	Italy	65	45.9	106	Egypt, Arab Rep.	48	37.9
44	Singapore	65	46.0	107	Kuwait	48	39.7
45	Israel	65	43.5	108	Jordan	47	37.1
46	El Salvador	64	39.1	109	Eritrea	47	33.0
47	Argentina	64	45.1	110	Togo	47	37.1
48	Georgia	64	44.0	111	Pakistan	47	31.8
49	Tajikistan	64	42.0	112	Saudi Arabia	47	45.9
50	Armenia	64	43.2	113	Bahrain	46	33.9
51	Panama	63	44.4	114	Nigeria	46	36.8
52	Bulgaria	63	43.8	115	Lebanon	46	39.6
53	Korea, Rep.	63	45.7	116	Bangladesh	45	37.4
54	Turkey	63	40.8	117	Nepal	45	44.7
55	Mexico	62	41.4	118	Iran, Islamic Rep.	44	34.6
56	Estonia	62	49.7	119	Haiti	44	32.5
57	Ecuador	61	44.4	120	Benin	44	38.9
58	Kazakhstan	61	43.1	121	Cambodia	43	40.5
59	Philippines	60	39.0	122	Ethiopia	42	41.8
60	Thailand	60	40.0	123	Tanzania	42	41.7
61	Tunisia	59	38.3	124	Mongolia	41	43.7
62	Dominican Republic	59	38.2	125	Yemen	40	27.8
63	Namibia	59	39.2				

Appendix C – Data Sets from the World Economic Forum [161] and the Solability Sustainable Intelligence [131] for 2016

No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index	No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index
1	Switzerland	80	54.4	65	Tunisia	61	42.2
2	Norway	79	59.4	66	Namibia	61	42.2
3	Sweden	78	60.9	67	Cyprus	60	41.2
4	Denmark	77	56.0	68	Ecuador	60	43.1
5	France	77	51.8	69	Guatemala	59	37.3
6	Austria	76	53.8	70	Serbia	59	44.0
7	Spain	75	46.9	71	Malta	58	45.2
8	Colombia	75	46.7	72	Nicaragua	58	41.4
9	New Zealand	75	53.5	73	Ukraine	58	44.6
10	Uruguay	74	47.3	74	Ghana	58	44.0
11	Portugal	74	48.9	75	Macedonia	58	43.2
12	Finland	73	56.2	76	South Africa	58	36.5
13	Slovenia	73	54.8	77	Vietnam	57	42.4
14	Costa Rica	73	47.4	78	Bolivia	57	45.8
15	United Kingdom	72	51.0	79	Republic of Moldova	57	43.5
16	Ireland	72	53.9	80	Cameroon	57	43.4
17	Latvia	71	51.0	81	Algeria	57	40.4
18	Croatia	71	51.0	82	Honduras	56	36.5
19	Germany	71	52.1	83	Kenya	55	40.9
20	Slovak Republic	71	51.8	84	Bosnia and Herzegovina	55	45.1
21	Hungary	71	47.3	85	Uzbekistan	55	44.6
22	Paraguay	70	46.7	86	Malaysia	55	47.4
23	Luxembourg	70	53.8	87	India	55	36.9
24	Romania	70	47.7	88	Zambia	55	39.8
25	Albania	70	43.8	89	Belarus	55	49.2
26	Iceland	70	56.0	90	Egypt, Arab Rep.	55	38.2
27	Peru	70	48.0	91	Botswana	55	38.9
28	Argentina	70	46.2	92	Jamaica	54	37.8
29	Italy	70	46.6	93	Sudan	54	37.5
30	Brazil	70	46.9	94	Kyrgyz Republic	54	44.3
31	Czech Republic	69	50.8	95	China	53	47.2
32	Canada	69	50.8	96	Brunei Darussalam	53	46.5
33	Netherlands	69	48.2	97	Venezuela	53	43.9
34	Belgium	69	48.4	98	Mozambique	53	42.0
35	Lithuania	68	51.8	99	Cambodia	53	39.2
36	Azerbaijan	67	40.1	100	Zimbabwe	53	33.2
37	Poland	67	49.2	101	Pakistan	52	35.3
38	Greece	67	45.2	102	Cote d'Ivoire	52	42.5
39	Singapore	67	44.7	103	Senegal	52	39.2
40	Chile	67	44.6	104	Bangladesh	51	36.9
41	Turkey	66	43.0	105	Libya	50	39.0
42	Bulgaria	66	44.8	106	Iraq	50	33.4
43	Korea, Rep.	66	46.9	107	United Arab Emirates	50	41.5
44	Mexico	66	44.2	108	Jordan	49	38.5
45	Japan	66	52.0	109	Trinidad and Tobago	49	40.5
46	Tajikistan	65	42.7	110	Nigeria	49	39.3
47	Panama	65	43.9	111	Togo	49	37.9
48	Russian Federation	65	46.6	112	Mongolia	49	45.3
49	El Salvador	65	39.8	113	Nepal	49	43.6
50	Indonesia	65	45.0	114	Ethiopia	49	43.2
51	Israel	65	45.1	115	Kuwait	48	42.1
52	United States	65	47.6	116	Qatar	48	44.2
53	Australia	64	49.1	117	Turkmenistan	47	38.0
54	Congo, Rep.	64	44.7	118	Haiti	47	32.6
55	Georgia	64	47.1	119	Tanzania	47	42.2
56	Estonia	64	53.6	120	Iran, Islamic Rep.	46	37.5
57	Morocco	64	38.1	121	Saudi Arabia	46	40.4
58	Armenia	63	43.8	122	Oman	45	44.1
59	Sri Lanka	63	39.0	123	Eritrea	44	32.7
60	Philippines	63	42.0	124	Benin	44	38.7
61	Cuba	63	45.8	125	Lebanon	44	39.8
62	Kazakhstan	62	46.2	126	Yemen, Rep.	42	28.6
63	Dominican Republic	62	41.4	127	Bahrain	37	37.6
64	Thailand	61	41.6				

Appendix D – Data Sets from the World Economic Forum [162] and the Solability Sustainable Intelligence [132] for 2017

No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index	No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index
1	Switzerland	80	55.3	64	Thailand	61	41.2
2	Norway	79	58.2	65	Tunisia	61	44.3
3	Sweden	78	60.5	66	Namibia	61	41.7
4	Denmark	77	57.2	67	Cyprus	60	42.3
5	France	77	52.9	68	Ecuador	60	43.4
6	Austria	76	54.8	69	Guatemala	59	40.3
7	Spain	75	48.1	70	Serbia	59	46.8
8	Colombia	75	46.6	71	Malta	58	48.1
9	New Zealand	75	53.6	72	Nicaragua	58	43.6
10	Uruguay	74	47.9	73	Ghana	58	44.5
11	Portugal	74	48.9	74	Macedonia, FYR	58	44.3
12	Finland	73	57.4	75	South Africa	58	39.2
13	Slovenia	73	53.7	76	Vietnam	57	43.9
14	Costa Rica	73	47.1	77	Bolivia	57	45.9
15	United Kingdom	72	51.9	78	Republic of Moldova	57	46.9
16	Ireland	72	55.4	79	Cameroon	57	43.2
17	Latvia	71	54.2	80	Algeria	57	41.0
18	Croatia	71	53.4	81	Kenya	55	43.7
19	Germany	71	53.4	82	Bosnia and Herzegovina	55	46.2
20	Slovak Republic	71	53.0	83	Uzbekistan	55	43.3
21	Hungary	71	47.8	84	Malaysia	55	46.7
22	Paraguay	70	48.2	85	India	55	40.6
23	Luxembourg	70	53.6	86	Zambia	55	41.0
24	Romania	70	49.7	87	Belarus	55	48.9
25	Albania	70	46.6	88	Egypt, Arab Rep.	55	38.7
26	Iceland	70	57.6	89	Botswana	55	39.0
27	Peru	70	49.2	90	Jamaica	54	37.3
28	Argentina	70	45.4	91	Sudan	54	40.7
29	Italy	70	49.0	92	Kyrgyz Republic	54	45.2
30	Brazil	70	47.6	93	China	53	48.9
31	Czech Republic	69	52.7	94	Brunei Darussalam	53	47.2
32	Canada	69	51.4	95	Venezuela	53	44.3
33	Netherlands	69	49.6	96	Mozambique	53	42.0
34	Belgium	69	49.9	97	Cambodia	53	40.3
35	Lithuania	68	51.8	98	Zimbabwe	53	40.4
36	Azerbaijan	67	40.2	99	Pakistan	52	36.6
37	Poland	67	51.2	100	Cote d'Ivoire	52	43.9
38	Greece	67	46.9	101	Senegal	52	41.1
39	Singapore	67	46.5	102	Bangladesh	51	38.1
40	Chile	67	44.9	103	Libya	50	37.4
41	Turkey	66	45.1	104	Iraq	50	30.2
42	Bulgaria	66	47.2	105	United Arab Emirates	50	41.4
43	Korea, Rep.	66	53.3	106	Jordan	49	39.5
44	Mexico	66	44.7	107	Trinidad and Tobago	49	39.6
45	Japan	66	52.8	108	Nigeria	49	41.3
46	Tajikistan	65	43.8	109	Togo	49	41.7
47	Panama	65	44.4	110	Mongolia	49	42.4
48	Russian Federation	65	47.5	111	Nepal	49	43.9
49	El Salvador	65	40.5	112	Ethiopia	49	45.1
50	Indonesia	65	44.7	113	Kuwait	68	41.2
51	Israel	65	47.2	114	Qatar	48	41.6
52	United States	65	49.2	115	Turkmenistan	47	38.9
53	Australia	64	48.2	116	Haiti	47	34.5
54	Congo, Rep.	64	43.6	117	Tanzania	47	43.2
55	Georgia	64	47.8	118	Iran, Islamic Rep.	46	40.9
56	Estonia	64	53.7	119	Saudi Arabia	46	42.0
57	Morocco	64	37.1	120	Oman	45	43.2
58	Armenia	63	43.4	121	Eritrea	44	35.1
59	Sri Lanka	63	40.2	122	Benin	44	38.3
60	Philippines	63	41.6	123	Lebanon	44	36.8
61	Cuba	63	43.0	124	Yemen, Rep.	42	31.0
62	Kazakhstan	62	45.5	125	Bahrain	37	39.6
63	Dominican Republic	62	40.5				

Appendix E – Data Sets from the World Economic Forum [163] and the Solability Sustainable Intelligence [133] for 2018

No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index	No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index
1	Switzerland	77	55.3	57	Armenia	63	43.4
2	Norway	88	58.2	58	Sri Lanka	61	40.2
3	Sweden	81	60.5	59	Philippines	62	41.6
4	Denmark	73	57.2	60	Kazakhstan	61	45.5
5	France	76	52.9	61	Dominican Republic	49	40.5
6	Austria	69	54.8	62	Thailand	58	41.2
7	Spain	71	48.1	63	Tunisia	57	44.3
8	Colombia	74	46.6	64	Namibia	48	41.7
9	New Zealand	74	53.6	65	Cyprus	64	42.3
10	Uruguay	76	47.9	66	Ecuador	69	43.4
11	Portugal	70	48.9	67	Guatemala	57	40.3
12	Finland	72	57.4	68	Serbia	51	46.8
13	Slovenia	68	53.7	69	Malta	62	48.1
14	Costa Rica	70	47.1	70	Nicaragua	48	43.6
15	United Kingdom	73	51.9	71	Ghana	52	44.5
16	Ireland	69	55.4	72	South Africa	38	39.2
17	Latvia	68	54.2	73	Vietnam	57	43.9
18	Croatia	65	53.4	74	Republic of Moldova	59	46.9
19	Germany	65	53.4	75	Cameroon	46	43.2
20	Slovak Republic	66	53.0	76	Algeria	62	41.0
21	Hungary	65	47.8	77	Kenya	46	43.7
22	Paraguay	71	48.2	78	Bosnia and Herzegovina	44	46.2
23	Luxembourg	61	53.6	79	Malaysia	68	46.7
24	Romania	67	49.7	80	India	52	40.5
25	Albania	61	46.6	81	Zambia	42	41.0
26	Iceland	74	57.6	82	Egypt, Arab Rep.	57	38.7
27	Peru	68	49.2	83	Botswana	49	39.0
28	Argentina	69	45.4	84	Jamaica	56	37.3
29	Italy	67	49.0	85	Kyrgyz Republic	37	45.2
30	Brazil	70	47.6	86	China	48	48.9
31	Czech Republic	60	52.7	87	Brunei Darussalam	69	47.2
32	Canada	68	51.4	88	Venezuela	52	44.3
33	Netherlands	71	49.6	89	Mozambique	46	42.0
34	Belgium	66	49.9	90	Cambodia	49	40.3
35	Lithuania	69	51.8	91	Zimbabwe	38	40.4
36	Azerbaijan	67	40.2	92	Pakistan	48	36.6
37	Poland	56	51.2	93	Senegal	39	41.1
38	Greece	66	46.9	94	Bangladesh	51	38.1
39	Singapore	68	46.5	95	United Arab Emirates	58	41.4
40	Chile	67	44.9	96	Jordan	52	39.5
41	Turkey	58	45.1	97	Trinidad and Tobago	58	39.6
42	Bulgaria	50	47.2	98	Nigeria	48	41.3
43	Korea, Rep.	59	53.3	99	Mongolia	47	42.4
44	Mexico	71	44.7	100	Nepal	47	43.9
45	Japan	63	52.8	101	Ethiopia	43	45.1
46	Tajikistan	46	43.8	102	Kuwait	54	41.2
47	Panama	68	44.4	103	Qatar	59	41.6
48	Russian Federation	63	47.5	104	Tanzania	44	43.2
49	El Salvador	53	40.5	105	Iran, Islamic Rep.	50	40.9
50	Indonesia	69	44.7	106	Saudi Arabia	55	42.0
51	Israel	64	47.2	107	Oman	55	43.2
52	United States	67	49.2	108	Benin	41	38.3
53	Australia	67	48.2	109	Lebanon	43	36.8
54	Georgia	64	47.8	110	Yemen, Rep.	60	31.0
55	Estonia	63	53.7	111	Bahrain	44	39.6
56	Morocco	66	37.1				

Appendix F – Data Sets from the World Economic Forum [164] and the Solability Sustainable Intelligence [134] for 2019

No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index	No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index
1	Sweden	81	60.6	59	Philippines	62	41.7
2	Switzerland	78	56.9	60	Sri Lanka	65	41.0
3	Norway	82	56.9	61	Argentina	67	45.0
4	Finland	72	59.5	62	Namibia	58	39.1
5	Denmark	72	57.0	63	Indonesia	64	45.4
6	Austria	71	54.2	64	Turkey	60	44.4
7	United Kingdom	74	52.8	65	Qatar	56	40.8
8	France	77	52.0	66	Jordan	56	37.7
9	Netherlands	71	50.5	67	United Arab Emirates	55	44.3
10	Iceland	75	57.3	68	Oman	55	44.7
11	Uruguay	75	47.2	69	Republic of Moldova	61	46.5
12	Ireland	71	53.6	70	Guatemala	59	39.5
13	Singapore	68	47.8	71	Kenya	53	43.4
14	New Zealand	73	53.9	72	Tunisia	59	42.5
15	Luxembourg	64	54.5	73	Ghana	54	42.9
16	Portugal	71	51.1	74	El Salvador	55	40.2
17	Germany	66	53.5	75	Poland	57	51.9
18	Japan	67	51.1	76	India	53	39.5
19	Lithuania	72	50.6	77	Bulgaria	54	49.2
20	Estonia	64	54.9	78	Dominican Republic	56	40.8
21	Costa Rica	75	48.8	79	Russian Federation	61	46.7
22	Belgium	67	51.3	80	Trinidad and Tobago	54	39.6
23	Latvia	69	54.4	81	Bolivia	60	47.1
24	Slovenia	69	53.8	82	China	48	48.5
25	Spain	71	48.5	83	Kazakhstan	61	44.9
26	Chile	67	45.9	84	Tanzania	51	42.7
27	United States	66	49.1	85	Honduras	50	36.2
28	Malta	70	46.6	86	Egypt, Arab Rep.	55	38.6
29	Italy	70	49.9	87	Kuwait	55	36.4
30	Israel	67	47.5	88	Tajikistan	48	43.3
31	Malaysia	68	46.4	89	Algeria	61	43.6
32	Georgia	64	48.8	90	Bangladesh	52	39.1
33	Slovak Republic	68	51.6	91	Senegal	48	40.6
34	Colombia	71	46.7	92	Bahrain	44	37.7
35	Canada	66	52.2	93	Nepal	47	45.6
36	Panama	69	45.1	94	Botswana	49	38.4
37	Mexico	69	44.4	95	Ethiopia	46	46.7
38	Albania	67	45.0	96	Nicaragua	50	41.5
39	Brunei Darussalam	67	45.5	97	Pakistan	47	38.3
40	Romania	68	50.8	98	Saudi Arabia	51	41.0
41	Hungary	66	49.2	99	Serbia	53	45.8
42	Croatia	66	54.2	100	Cambodia	46	43.5
43	Australia	64	47.6	101	Iran, Islamic Rep.	54	42.6
44	Peru	68	47.3	102	Zambia	41	37.9
45	Cyprus	66	45.8	103	Cameroon	43	44.0
46	Brazil	70	46.8	104	Bosnia and Herzegovina	46	49.2
47	Morocco	67	40.4	105	Benin	42	39.5
48	Korea, Rep.	60	50.8	106	Lebanon	42	37.3
49	Czech Republic	61	53.1	107	Ukraine	48	44.7
50	Armenia	65	43.3	108	Mongolia	45	40.5
51	Thailand	63	43.8	109	Nigeria	46	39.9
52	Ecuador	70	44.4	110	Kyrgyz Republic	37	45.7
53	Paraguay	64	48.3	111	Mozambique	43	41.0
54	Greece	67	47.4	112	Venezuela	50	42.3
55	Montenegro	56	46.4	113	Zimbabwe	37	40.2
56	Vietnam	62	44.4	114	South Africa	36	38.8
57	Azerbaijan	63	41.5	115	Haiti	35	31.3
58	Jamaica	57	39.0				

Appendix G – Data Sets from the World Economic Forum [165] and the Solability Sustainable Intelligence [135] for 2020

No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index	No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index
1	Sweden	79	62.10	59	Greece	63	49.96
2	Switzerland	77	59.44	60	Armenia	60	47.24
3	Finland	71	60.40	61	Bulgaria	59	51.56
4	Denmark	69	60.10	62	Montenegro	55	48.06
5	Norway	81	57.68	63	United Arab Emirates	56	44.52
6	Austria	70	56.67	64	Namibia	54	40.59
7	United Kingdom	72	56.12	65	Vietnam	57	45.79
8	France	74	55.51	66	Ghana	59	48.48
9	Netherlands	68	52.86	67	Turkey	57	46.30
10	Iceland	74	60.73	68	Bolivia	64	50.01
11	Uruguay	75	51.99	69	Poland	57	52.84
12	Ireland	69	56.75	70	Indonesia	61	47.44
13	Singapore	67	50.31	71	Dominican Republic	59	45.28
14	Luxembourg	62	57.95	72	Republic of Moldova	61	49.76
15	Lithuania	71	55.86	73	Oman	54	41.62
16	Latvia	69	58.17	74	India	54	42.36
17	New Zealand	73	57.16	75	Jamaica	54	42.50
18	Belgium	65	52.12	76	Guatemala	58	41.61
19	Portugal	69	54.97	77	Trinidad and Tobago	58	40.75
20	Germany	64	54.57	78	China	50	50.83
21	Estonia	64	59.38	79	Kenya	47	46.52
22	Japan	64	52.47	80	Russian Federation	63	49.94
23	Slovenia	66	55.90	81	Tajikistan	49	44.75
24	Spain	67	51.83	82	Jordan	46	39.52
25	Colombia	72	47.40	83	Algeria	61	41.10
26	Italy	68	51.60	84	Egypt, Arab Rep.	52	38.94
27	Costa Rica	72	52.60	85	Honduras	51	42.17
28	Canada	67	51.28	86	Saudi Arabia	54	44.05
29	Chile	65	50.57	87	Bangladesh	54	43.29
30	Israel	66	48.90	88	Kazakhstan	59	47.10
31	Hungary	66	52.88	89	Tunisia	53	41.88
32	United States	66	51.66	90	Bahrain	46	41.30
33	Slovak Republic	66	54.93	91	Cambodia	49	45.86
34	Malta	65	50.86	92	Tanzania	47	43.39
35	Romania	68	54.49	93	Kuwait	52	41.15
36	Australia	66	50.21	94	Pakistan	46	36.10
37	Croatia	66	57.18	95	Nepal	45	49.41
38	Malaysia	64	47.04	96	Nicaragua	50	44.09
39	Peru	69	49.92	97	Ethiopia	47	47.02
40	Panama	66	46.27	98	Zambia	47	41.09
41	Georgia	61	51.23	99	Botswana	45	42.21
42	Czech Republic	61	55.16	100	Serbia	50	50.72
43	Paraguay	68	49.70	101	Iran, Islamic Rep.	55	45.35
44	Azerbaijan	67	45.07	102	Ukraine	50	46.69
45	Ecuador	72	46.58	103	Bosnia and Herzegovina	47	50.46
46	Cyprus	63	47.56	104	Senegal	39	43.00
47	Brazil	69	49.05	105	Kyrgyz Republic	42	46.61
48	Korea, Rep.	59	51.35	106	South Africa	47	39.91
49	Brunei Darussalam	66	47.04	107	Zimbabwe	41	42.55
50	Mexico	64	46.36	108	Mongolia	45	43.78
51	Morocco	61	41.84	109	Mozambique	47	43.71
52	Albania	63	47.43	110	Benin	41	40.78
53	Thailand	61	47.59	111	Venezuela	55	44.75
54	Qatar	60	40.91	112	Cameroon	40	45.97
55	Sri Lanka	65	46.25	113	Nigeria	46	40.93
56	Argentina	68	48.06	114	Lebanon	36	37.93
57	Philippines	62	44.70	115	Haiti	35	35.54
58	El Salvador	61	44.72				

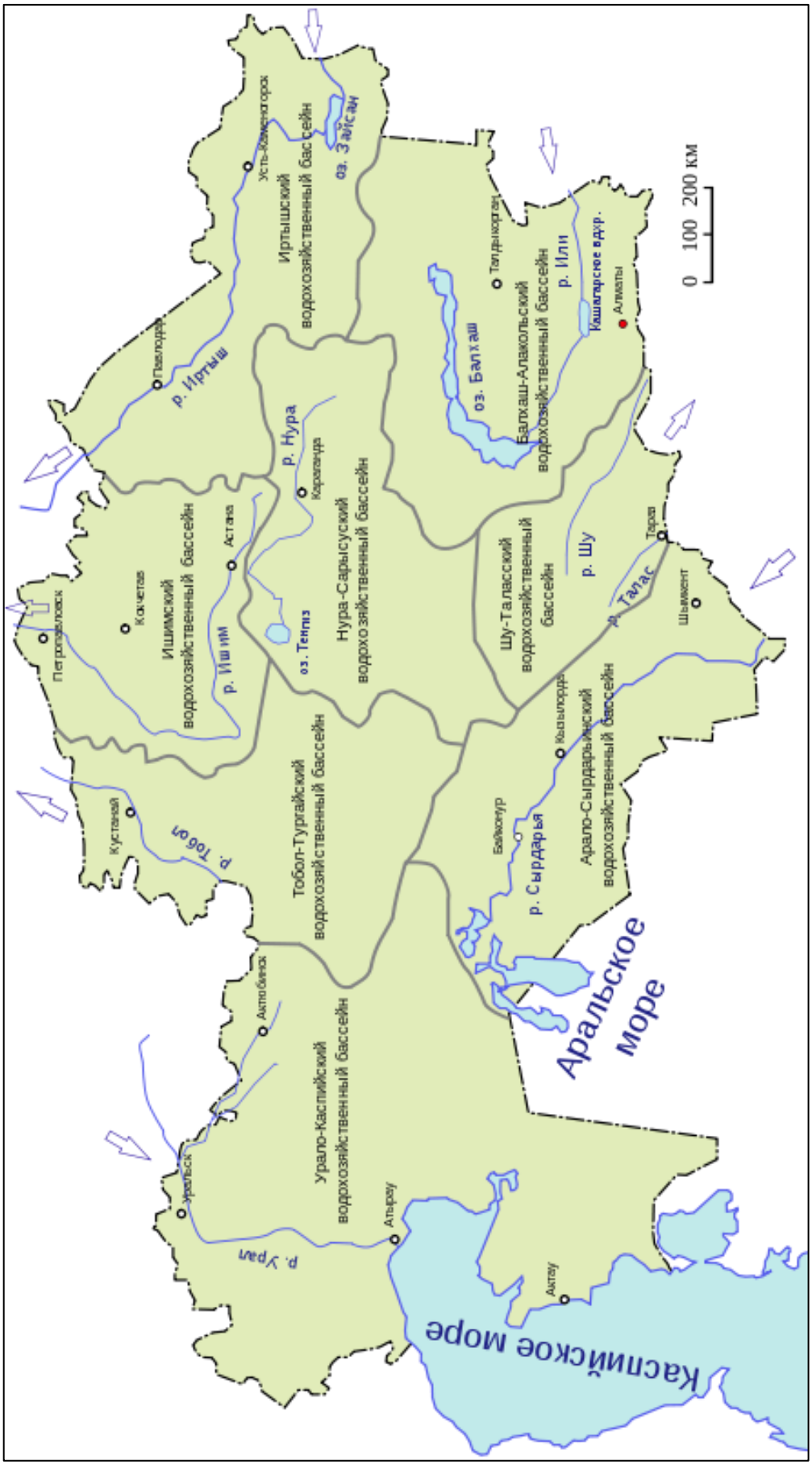
Appendix H – Data Sets from the World Economic Forum [166] and the Solability Sustainable Intelligence for 2021 [136]

No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index	No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index
1	Sweden	84.4	61.2	59	Namibia	57.7	43.1
2	Norway	82.7	59.8	60	El Salvador	64.4	45.1
3	Denmark	74.8	60.2	61	Kenya	60.3	44.8
4	Switzerland	79.9	60.4	62	Poland	63.7	51.2
5	Austria	75.2	56.6	63	Turkey	60.9	45.8
6	Finland	73.5	60.7	64	United Arab Emirates	55.6	43.9
7	United Kingdom	75.8	54.6	65	Vietnam	61.0	42.2
8	New Zealand	76.5	54.9	66	Morocco	64.9	43.1
9	France	77.6	56.8	67	Philippines	66.5	42.0
10	Iceland	75.0	59.8	68	China	55.4	51.4
11	Netherlands	71.2	53.9	69	Sri Lanka	67.1	48.1
12	Latvia	73.1	53.5	70	Bolivia	70.1	49.3
13	Uruguay	78.3	51.3	71	Indonesia	67.8	46.5
14	Ireland	70.2	57.6	72	Jordan	51.7	41.0
15	Lithuania	72.6	53.0	73	Russian Federation	66.0	49.2
16	Estonia	67.8	56.1	74	Oman	55.5	42.1
17	Spain	69.7	52.7	75	Tajikistan	55.7	43.1
18	Germany	67.4	56.6	76	Egypt, Arab Rep.	58.6	41.0
19	Portugal	71.6	54.8	77	Guatemala	60.9	39.1
20	Belgium	67.8	53.0	78	Dominican Republic	59.4	45.2
21	Singapore	67.1	49.3	79	Algeria	66.2	39.6
22	Canada	70.0	50.6	80	Tanzania	57.0	41.7
23	Croatia	71.8	55.1	81	Saudi Arabia	57.4	42.3
24	United States	70.7	52.0	82	Brunei Darussalam	57.8	46.7
25	Albania	74.5	49.9	83	Kazakhstan	64.1	45.8
26	Costa Rica	73.0	52.4	84	Serbia	59.4	49.7
27	Italy	71.2	51.7	85	Trinidad and Tobago	61.6	38.6
28	Israel	71.2	48.2	86	Jamaica	53.0	41.5
29	Colombia	71.4	48.7	87	India	58.2	40.9
30	Brazil	74.9	48.8	88	Tunisia	57.5	41.4
31	Slovenia	70.8	54.3	89	Honduras	58.1	40.0
32	Hungary	71.0	50.8	90	Republic of Moldova	64.3	46.0
33	Georgia	67.4	48.6	91	Ukraine	58.1	47.3
34	Chile	68.2	50.4	92	Nepal	52.2	45.5
35	Australia	68.8	49.3	93	Cambodia	58.4	43.0
36	Paraguay	73.8	49.5	94	Kyrgyz Republic	52.3	46.4
37	Japan	65.6	55.3	95	Zambia	51.0	38.7
38	Romania	70.3	52.3	96	Nicaragua	56.8	42.8
39	Malaysia	68.5	47.3	97	Bangladesh	59.1	42.3
40	Luxembourg	62.1	53.9	98	Bosnia and Herzegovina	54.6	47.0
41	Malta	68.4	51.7	99	Iran, Islamic Rep.	55.9	42.5
42	Peru	73.6	50.3	100	Cameroon	56.6	44.9
43	Slovak Republic	68.3	53.1	101	Nigeria	57.1	39.6
44	Azerbaijan	69.5	40.7	102	Kuwait	51.5	40.2
45	Czech Republic	68.2	52.9	103	Ethiopia	53.0	43.4
46	Mexico	67.7	44.9	104	Pakistan	56.2	36.7
47	Argentina	74.3	48.6	105	Botswana	53.9	42.9
48	Ecuador	71.9	49.1	106	Senegal	51.2	42.7
49	Korea, Rep.	63.3	53.2	107	Mozambique	55.6	36.8
50	Panama	63.7	48.7	108	Bahrain	42.9	37.2
51	Cyprus	64.5	47.5	109	Benin	53.0	39.2
52	Montenegro	62.2	46.8	110	South Africa	55.5	39.2
53	Qatar	61.5	39.3	111	Venezuela	60.3	47.6
54	Greece	66.7	49.6	112	Lebanon	42.7	35.7
55	Thailand	64.0	45.0	113	Mongolia	51.5	41.6
56	Ghana	69.3	46.9	114	Haiti	46.7	36.7
57	Armenia	63.6	47.4	115	Zimbabwe	39.2	38.6
58	Bulgaria	60.5	49.6				

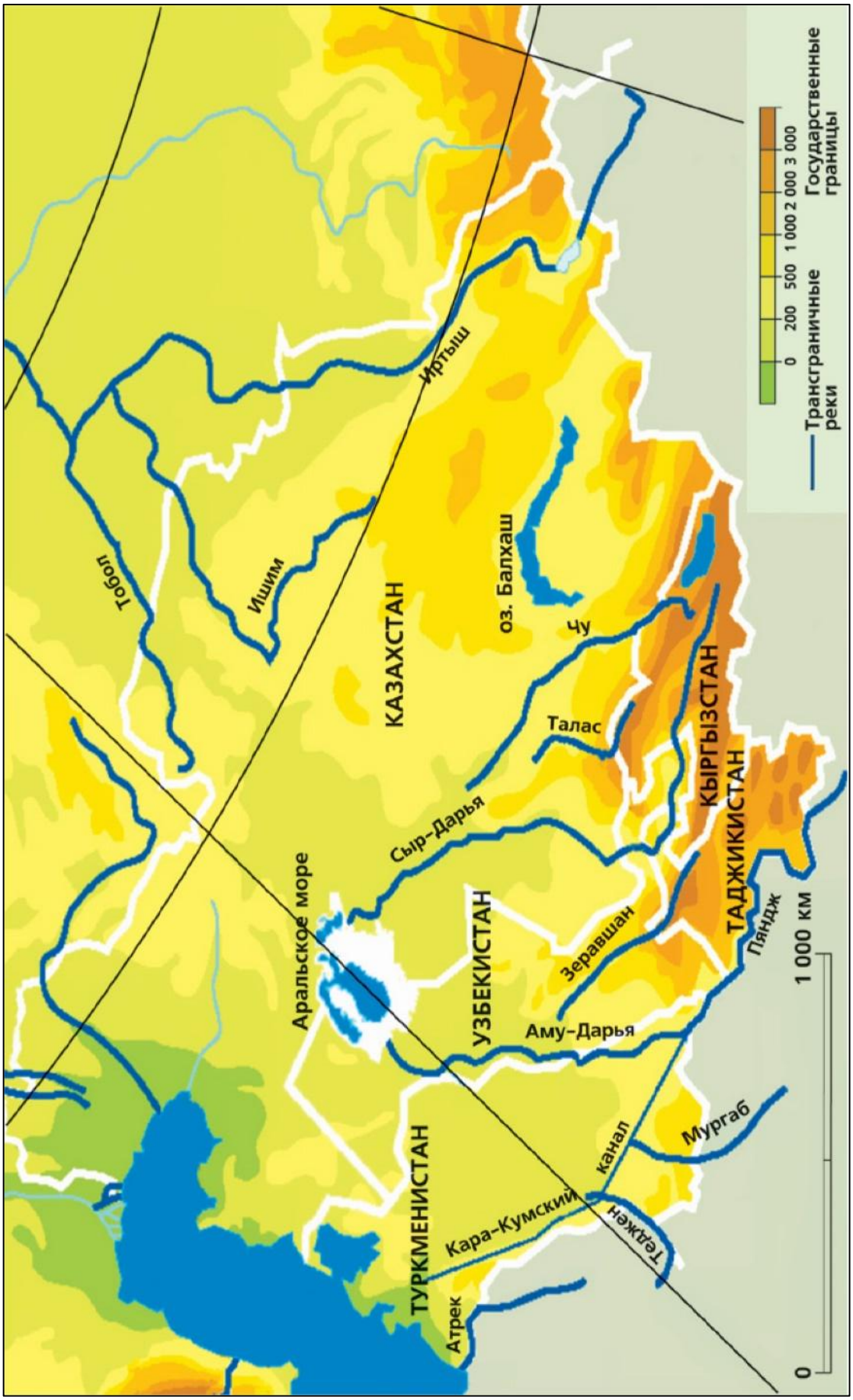
Appendix I – Data Sets from the World Economic Forum [167] and the Solability Sustainable Intelligence for 2022/2023 [137]

No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index	No.	Country	Energy Architecture Performance Index	Global Sustainable Competitiveness Index
1	Sweden	81.0	60.7	59	Namibia	63.3	38.8
2	Norway	77.3	57.6	60	El Salvador	72.1	42.8
3	Denmark	73.7	58.1	61	Kenya	65.9	41.3
4	Switzerland	75.7	58.3	62	Poland	63	51.2
5	Austria	69.2	55.9	63	Turkey	58.9	45.1
6	Finland	68.9	59.3	64	United Arab Emirates	58.7	43.1
7	United Kingdom	67.7	56.4	65	Vietnam	60.3	44.2
8	New Zealand	68.2	52.3	66	Morocco	60.7	40.3
9	France	73.3	56.3	67	Philippines	61.5	41.9
10	Iceland	73.9	57.1	68	China	65.0	51.1
11	Netherlands	65.7	53.9	69	Sri Lanka	63.5	40.4
12	Latvia	69.0	55.4	70	Bolivia	66.0	43.8
13	Uruguay	71.5	50.6	71	Indonesia	67.3	45.7
14	Ireland	61.3	55.6	72	Jordan	58.4	38.5
15	Lithuania	62.0	54.2	73	Oman	58.6	38.6
16	Estonia	74.2	54.5	74	Tajikistan	66.4	38.7
17	Spain	65.1	51.7	75	Egypt, Arab Rep.	62.5	37.5
18	Germany	64.6	54.8	76	Guatemala	65.2	37.6
19	Portugal	66.7	54.8	77	Dominican Republic	55.4	41.6
20	Belgium	59.6	51.7	78	Algeria	64.8	37.2
21	Singapore	51.2	48.5	79	Tanzania	51.4	41.3
22	Canada	66.7	52.5	80	Saudi Arabia	62.0	40.8
23	Croatia	67.0	53.4	81	Brunei Darussalam	55.0	40.5
24	United States	68.4	51.2	82	Kazakhstan	61.1	43.5
25	Albania	71.6	47.7	83	Serbia	61.1	46.4
26	Costa Rica	74.5	49.9	84	Trinidad and Tobago	56.8	37.0
27	Italy	63.9	52.8	85	Jamaica	50.4	38.3
28	Israel	67.3	49.3	86	India	61.4	39.3
29	Colombia	65.6	46.6	87	Tunisia	58.1	38.6
30	Brazil	68.9	47.1	88	Honduras	59.6	40.0
31	Slovenia	68.0	56.3	89	Republic of Moldova	55.7	45.0
32	Hungary	68.8	47.7	90	Ukraine	63.2	46.9
33	Georgia	64.0	44.5	91	Nepal	58.2	43.6
34	Chile	63.4	47.3	92	Cambodia	59.9	39.8
35	Australia	63.1	50.6	93	Kyrgyz Republic	61.7	44.0
36	Paraguay	72.9	45.5	94	Zambia	56.7	35.9
37	Japan	65.6	56.2	95	Nicaragua	57.1	41.6
38	Romania	65.8	49.4	96	Bangladesh	56.8	39.7
39	Malaysia	70.0	43.1	97	Bosnia and Herzegovina	60.3	44.8
40	Luxembourg	61.5	53.3	98	Iran, Islamic Rep.	61.6	37.1
41	Malta	61.5	48.5	99	Cameroon	65.4	39.8
42	Peru	70.7	47.8	100	Nigeria	58.4	38.7
43	Slovak Republic	64.9	52.7	101	Kuwait	51.3	36.9
44	Azerbaijan	69.6	37.8	102	Ethiopia	61.1	38.8
45	Czech Republic	66.2	52.4	103	Pakistan	55.2	34.8
46	Mexico	64.9	41.6	104	Botswana	54.9	37.5
47	Argentina	63.1	46.9	105	Senegal	53.8	40.1
48	Ecuador	67.8	45.1	106	Mozambique	58.1	37.0
49	Korea, Rep.	60.3	55.9	107	Bahrain	52.0	35.4
50	Panama	66.2	47	108	South Africa	52.2	37.6
51	Cyprus	61.7	46.1	109	Venezuela	64.3	39.7
52	Montenegro	62.4	45	110	Lebanon	50.1	34.5
53	Qatar	58.2	38.9	111	Mongolia	56.3	43.1
54	Greece	60.3	49	112	Zimbabwe	50.7	37.4
55	Thailand	62.3	44.7	113	Yemen	56.3	33.9
56	Ghana	63.1	41.2	114	Macedonia, FYR	61.4	44.0
57	Armenia	60.0	43.1	115	Angola	64.0	37.2
58	Bulgaria	62.8	47.2				

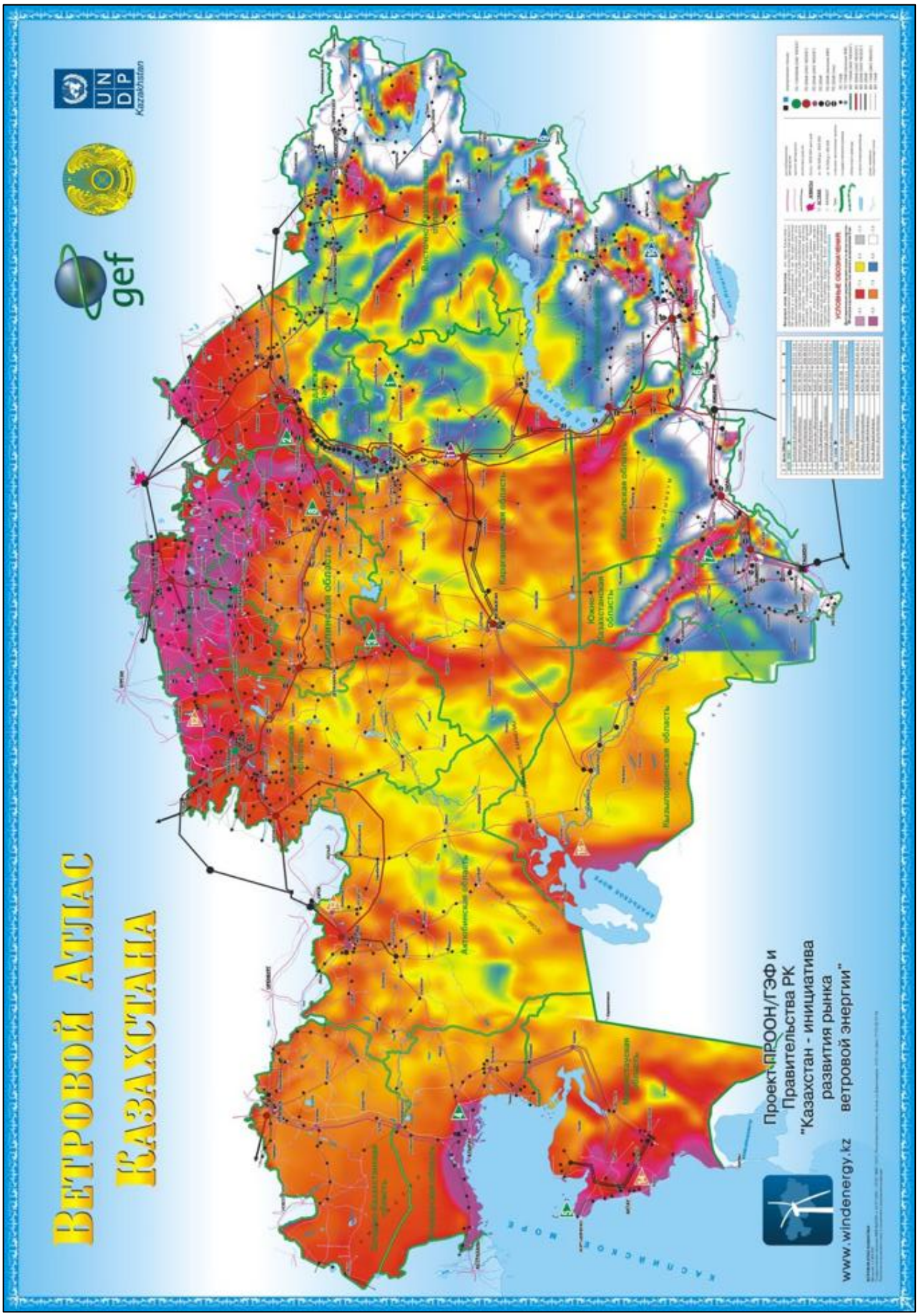
Appendix J – Major rivers in Kazakhstan [112]



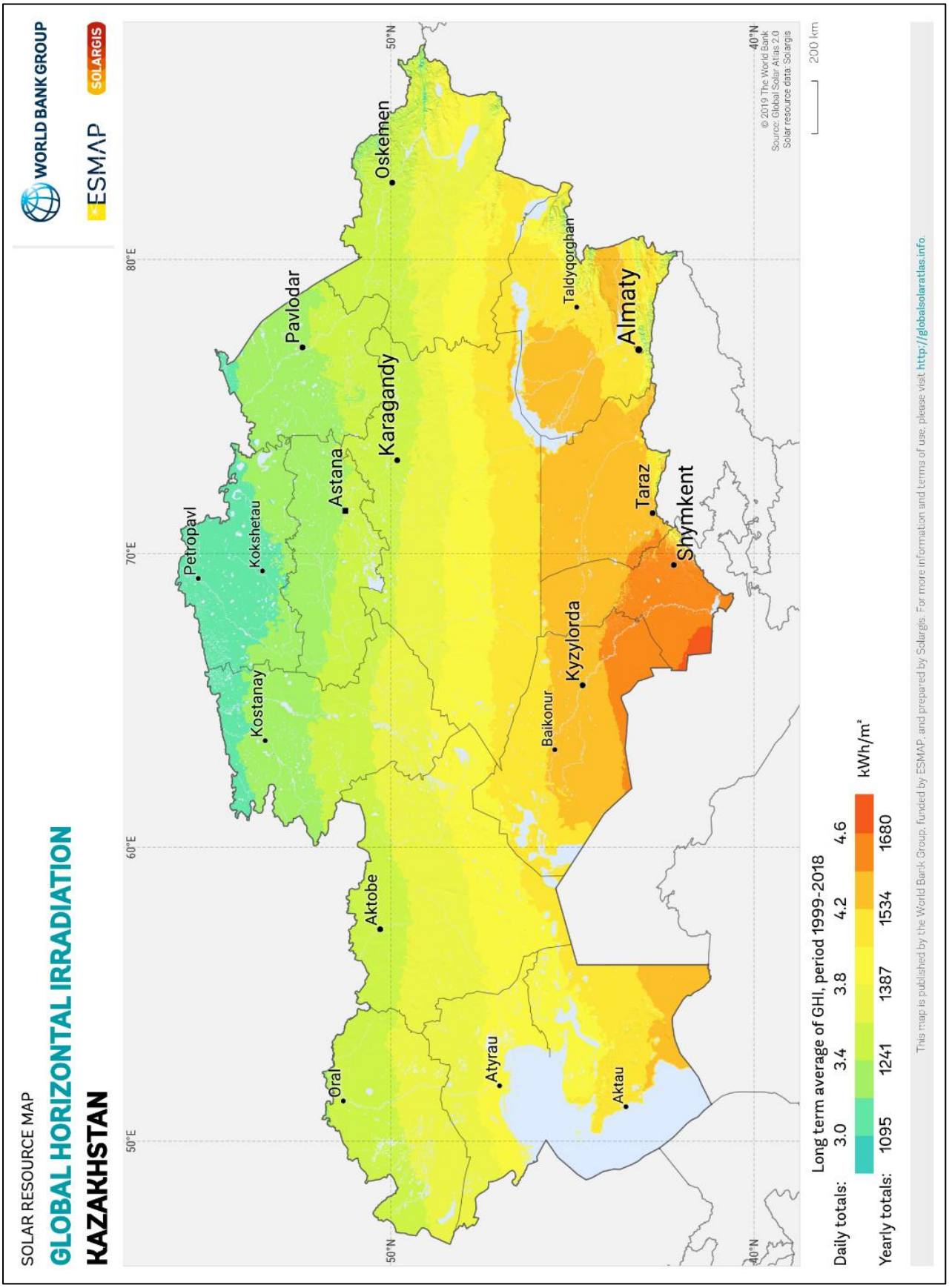
Appendix K – Transboundary rivers in Central Asia [108]



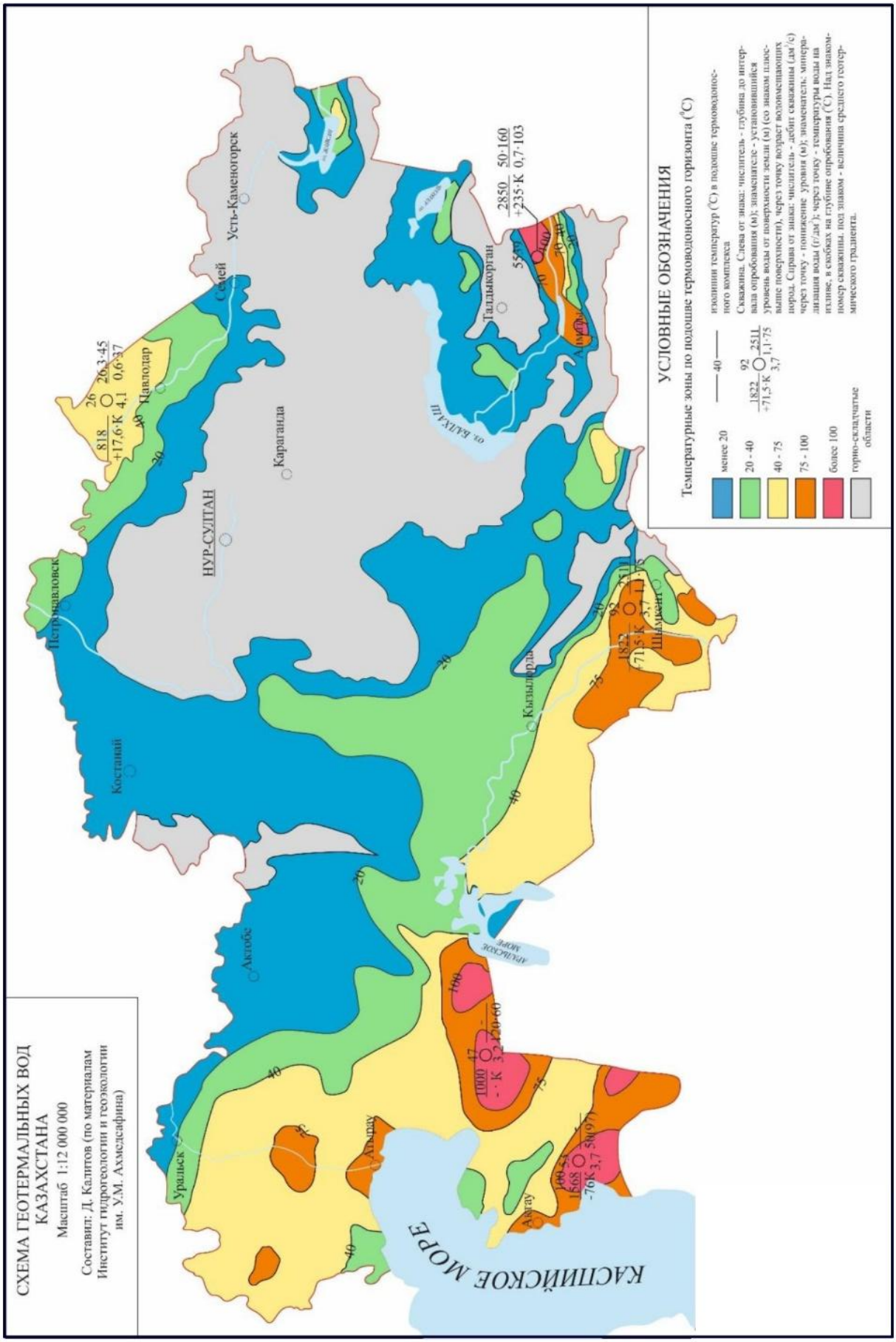
Appendix L – Wind atlas of Kazakhstan [113]



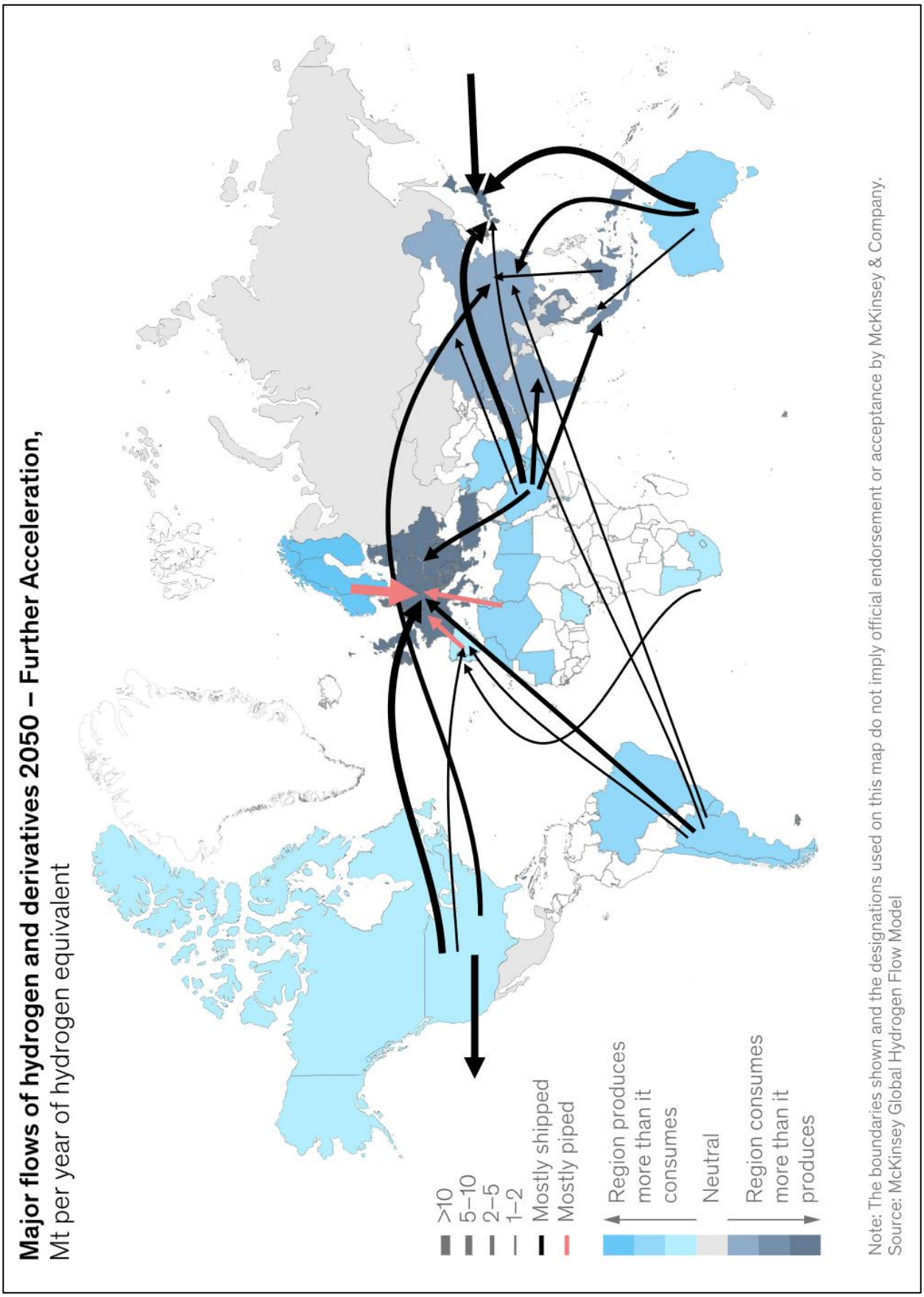
Appendix M – Solar atlas of Kazakhstan, horizontal irradiation [111]



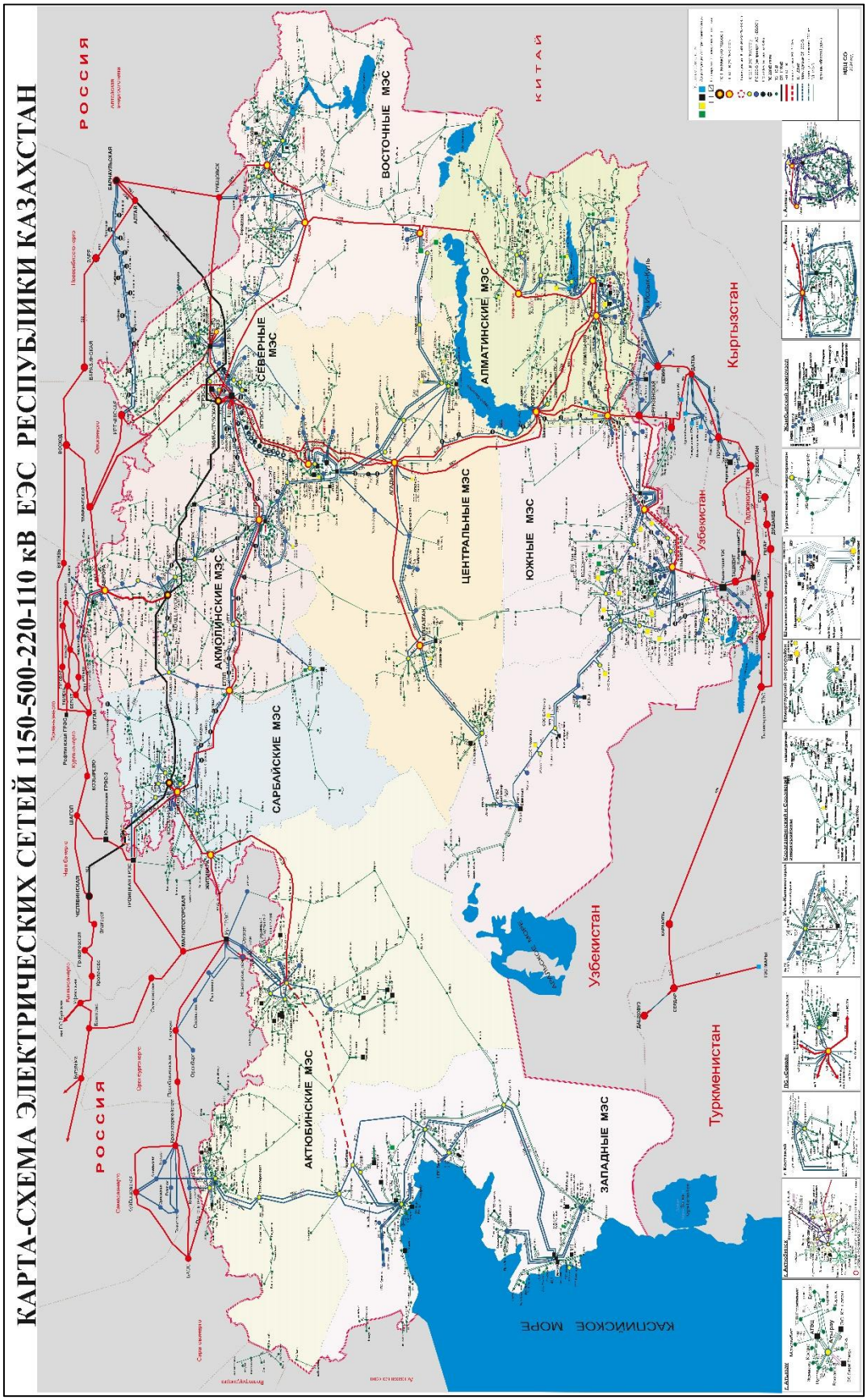
Appendix N – Geothermal water in Kazakhstan [351]



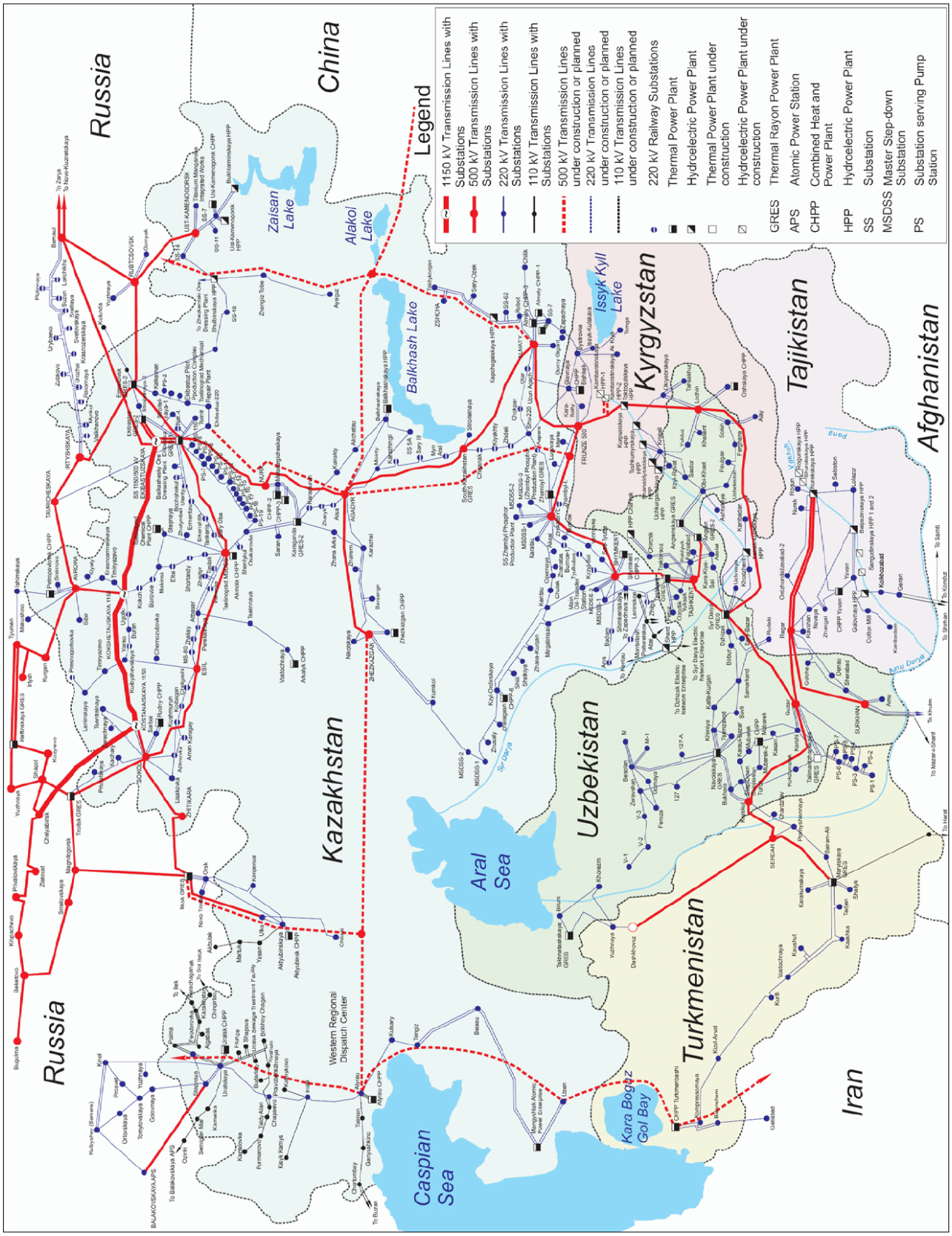
Appendix O – Major Flows of Hydrogen and Derivatives 2050 [190]



Appendix P – Electrical networks 1150-500-220-110 kV UPS of Kazakhstan as of 2024 [114]



Appendix Q – The Central Asian Power System [105]



Appendix R – The Central Asia-South Asia Power Transmission Project CASA-1000 [170]