Visiting Fellow Program

The Governance of Transnational Energy Infrastructures in the CAREC region

March 2024

Mirza Sadaqat Huda

The Governance of Transnational Energy Infrastructures in the CAREC region

Mirza Sadaqat Huda

March 2024

Disclaimer

Under the Visiting Fellow Program, the Central Asia Regional Economic Cooperation (CAREC) Institute issued research contracts in 2021 to encourage scholars conduct research on CAREC integration topics and undertake comparative analysis between (sub)regions to draw lessons for promoting and deepening regional integration among CAREC members, particularly as anticipated in the CAREC 2030 strategy and stated operational priorities.

This report is authored by Mirza Sadaqat Huda, Lead Researcher at the Climate Change in Southeast Asia Programme, ISEAS - Yusof Ishak Institute.

The views expressed in this report are the views of the author and do not necessarily reflect the views or policies of the CAREC Institute, its funding entities, or its governing council. The CAREC Institute does not guarantee the accuracy of the data included in this report and accepts no responsibility for any consequences of its use. The terminology used may not necessarily be consistent with the CAREC Institute official terms.

The People' s Republic of China is referred to in brief as China in this report.

By making any designation of or reference to a particular territory or geographic area, or by using country names in the report, the author(s) did not intend to make any judgment as to the legal or other status of any territory or area. Boundaries, colors, denominations, or any other information shown on maps do not imply any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries, colors, denominations, or information.

For additional queries, please email contact@carecinstitute.org

Abstract

Over the last decade, the regional integration agenda facilitated by the Central Asia Regional Economic Cooperation Program (CAREC) has been significantly buttressed by concrete progress in the development of transnational infrastructures. Of particular importance to regional integration as well as energy transition are projects that aim to transfer gas and electricity from Central to South Asia. Regional interconnections through energy infrastructure is important towards the achievement of low-carbon energy generation in the CAREC region, which is linked to the broader goal of limiting global warming to 1.5°C above pre-industrial levels. While transnational energy projects have economic and environmental benefits, they can also lead to significant governance challenges, which can be addressed through existing regional mechanisms.

This paper undertakes a review of the potential governance challenges of transnational energy projects in the CAREC region and provides policy recommendations on addressing them. The paper provides a conceptual overview of energy governance and cross-border energy infrastructures. It undertakes case studies on two transnational energy projects: 1) The Turkmenistan–Afghanistan–Pakistan–India (TAPI) gas pipeline; and the 2) The Central Asia South Asia Electricity Transmission and Trade Project (CASA-1000). These case studies are used to highlight potential social, environmental and political challenges of cross-border energy projects. The paper examines energy interconnections in diverse parts of the world and international guidelines on infrastructure development to identify best practises in regional energy governance. It then places these policy mechanisms within the political and socio-economic realities of Central Asia.

The findings of the paper point towards the need for a greater level of engagement among policymakers in the CAREC region on addressing the governance challenges of cross-border energy interconnections.

Key words: Energy Transition; Global Energy Governance; Energy Infrastructure; Central Asia; South Asia; Central Asia Regional Economic Cooperation.

Table of Contents

Contents

List of Figures

List of Tables

Abbreviations

Asian Development Bank (ADB)

Baku–Tbilisi–Ceyhan (BTC) pipeline

Caspian Development Advisory Panel (CDAP)

Central Asia Regional Economic Cooperation Program (CAREC)

Central Asia Transmission Cooperation Association (CATCA)

Central Asia-South Asia Regional Electricity Market (CASAREM)

The Central Asia South Asia Electricity Transmission and Trade Project (CASA 1000)

Greenhouse Gas (GHG)

High Voltage Direct Current (HVDC)

Indus Water Treaty (IWT)

International Renewable Energy Agency (IRENA)

Kilometres (KM)

Kilovolt (KV)

Million Metric Tons (Mt)

South Asian Association for Regional Cooperation (SAARC)

Sustainable Development Goal (SDG)

Transit Trade Agreement (TTA)

Turkmenistan–Afghanistan–Pakistan–India (TAPI) Pipeline

Turkmenistan–Uzbekistan–Tajikistan– Afghanistan-Pakistan (TUTAP)

United Arab Emirates (UAE)

United States Agency for International Development (USAID)

1. Introduction

1.1 Rationale

Energy interconnections play an important role in global energy transition, and can have significant environmental, economic and political benefits. However, large-scale energy projects that cross multiple international borders can pose significant governance challenges. These challenges can be addressed through regional collaboration on developing governance mechanisms to oversee the development and operation of energy infrastructures.

Energy transition entails the replacement of highly pollutant fossil fuels such as coal and oil with renewable resources such as solar, wind and hydrothermal energy. While gas and hydroelectric dams have significant impacts on societies and the environment, they have an important role to play in energy transition. A report by the International Renewable Energy Agency (IRENA) proposes that meeting the 1.5 °C target will require that hydropower capacity increase 30% by 2030 as compared to 2020 levels (IRENA 2020). Although in the ideal scenario the demand for gas will decrease significantly by 2050, it plays an important role as a 'bridging fuel' in developing economies that are currently dependent on oil and coal for electricity generation. Increasing demand for clean energy in Pakistan, Afghanistan and India can potentially be met through regional cooperation with Central Asian countries which has a combined hydroelectric potential of 87.7 Gigawatts and gas reserves of 11.71 trillion cubic metres (Shadrina 2019).

Regional interconnections through energy infrastructure is important towards the achievement of low-carbon energy generation in the CAREC region, which is linked to the broader goal of limiting global warming to 1.5°C above pre-industrial levels. Currently, energy intensity in Central Asia is 0.35 (TPES/GDP toe/thousand US$), which is much higher compared to the global average of 0.2 (Tsevegjav 2020). High energy intensity has resulted in increasing levels of Greenhouse Gas (GHG) emissions. In 2019, Kazakhstan's emission levels reached 235.3 million metric tons (Mt) of CO_2, the highest in the region, followed by Turkmenistan (143.9 million Mt), Uzbekistan (138.1 million Mt), Tajikistan (7.54 million Mt) and Kyrgyz Republic (9.29 million Mt). Emission levels are also high in neighbouring South Asian countries of India (2422.2 million Mt) and Pakistan (2006.6 million Mt) (IEA 2022).

Regional cooperation on gas and hydroelectricity is expected to reduce inefficiencies in energy systems, provide access to cleaner forms of energy and result in significant decreases in GHG emissions (Huda 2019). If energy integration is advanced along with the deployment of renewable energy projects, this can result in a reduction of as much as 400 Mt of CO_2 in Central Asia (WB 2020). Energy Cooperation will thus contribute towards the commitments made by Central Asian countries to reduce their greenhouse gas emissions under the Paris Agreement, which range from 10% to 20% (Tsevegjav 2020).

In terms of economic benefits, up to $6.4 billion USD can be realized through cooperation on hydroelectricity and thermal generation between Central Asian countries. The CASA-1000 and the Turkmenistan–Uzbekistan–Tajikistan–Afghanistan-Pakistan (TUTAP) projects can add another $2.6 billion USD to regional economic benefits by increasing Central Asian trade with Afghanistan and Pakistan (WB 2016). The TAPI pipeline is expected to generate significant revenue from gas exports for Turkmenistan while also facilitating transit fees of approximately $200 to $250 million USD for Pakistan and Afghanistan. In addition to economic and environmental benefits, regional energy cooperation can also act as a peacebuilding mechanism by increasing interdependence and encouraging the resolution of conflicts (Huda and Ali 2018). This is particularly relevant in the context of territorial conflicts in Central and South Asia (Huda 2017; 2013).

While cross-border energy projects have multiple benefits, they may also create governance challenges due to their enormous impact on society, the environment and politics. Numerous examples from all over the world show that governance failures of energy projects can lead to political conflicts, human rights violations and environmental disasters (Huda 2019).

The governance challenges of Central Asia's energy projects have not been extensively examined by academics. A majority of academic literature on energy trade between the subregions of Asia focus on geopolitical issues (Kulkarni and Nathan 2016). These studies are valuable but do not extensively engage with the governance challenges of infrastructure development.

Policy reports by organizations such as the Asian Development Bank (ADB), the World Bank and the Central Asia Regional Economic Cooperation Program (CAREC) provide techno-economic rationales of regional energy interconnections in Central Asia which are essential for generating political will

for undertaking cross border cooperation (CAREC 2021). Some reports on particular cross-border energy projects highlight governance challenges, such as the TAPI Pipeline Company's assessment of the environmental and social impacts of the project (TPC 2020). While such analysis is valuable, there is a need for a broader discourse on collective governance of cross-border energy infrastructures in the CAREC region using existing regional frameworks. This may facilitate regional political consensus on the need for adopting protocols and guidelines related to cross-border energy infrastructures.

On a broader level, regional energy interconnections are only one element of infrastructure development in Central Asia. A recent study shows that sustaining economic growth in Central Asia and the Caucasus will require an investment of $1.7 trillion USD in infrastructure per year until 2030 (Samad and Abbas 2020). The realization of the six connectivity corridors envisioned by CAREC and China's Belt and Road Initiative will also require substantial investment in infrastructure (Samad and Abbas 2020). Examining policy responses to the governance challenges of energy projects can thus have some relevance for wider infrastructure development in Central Asia.

This report will address the critical issues of governance of energy infrastructures in the CAREC region. The analysis of the report is divided into six parts. The first part is the Introduction, which includes the rationale and aims and objectives of the study. The second part provides a conceptual framework, which incorporates theories of energy infrastructures and energy governance. The third section provides an overview of the energy profiles of Central Asian and South Asian countries. The fourth section undertakes case studies on the TAPI and CASA 1000 projects. The fifth section provides a conclusion, followed by policy recommendations on collaborative governance of CAREC's energy interconnections.

1.2 Aims and Objectives of Study

The aim and objectives of this study is based on the vision of the CAREC Energy Strategy 2030, which provides a long-term strategic framework for the energy sector (ADB 2019). As shown in Figure 1, CAREC's Strategy aims to achieve a reliable, sustainable, resilient, and reformed energy market based on the overarching principle of Common Borders, Common Solutions and Common Energy Future. The Strategy has three main pillars:

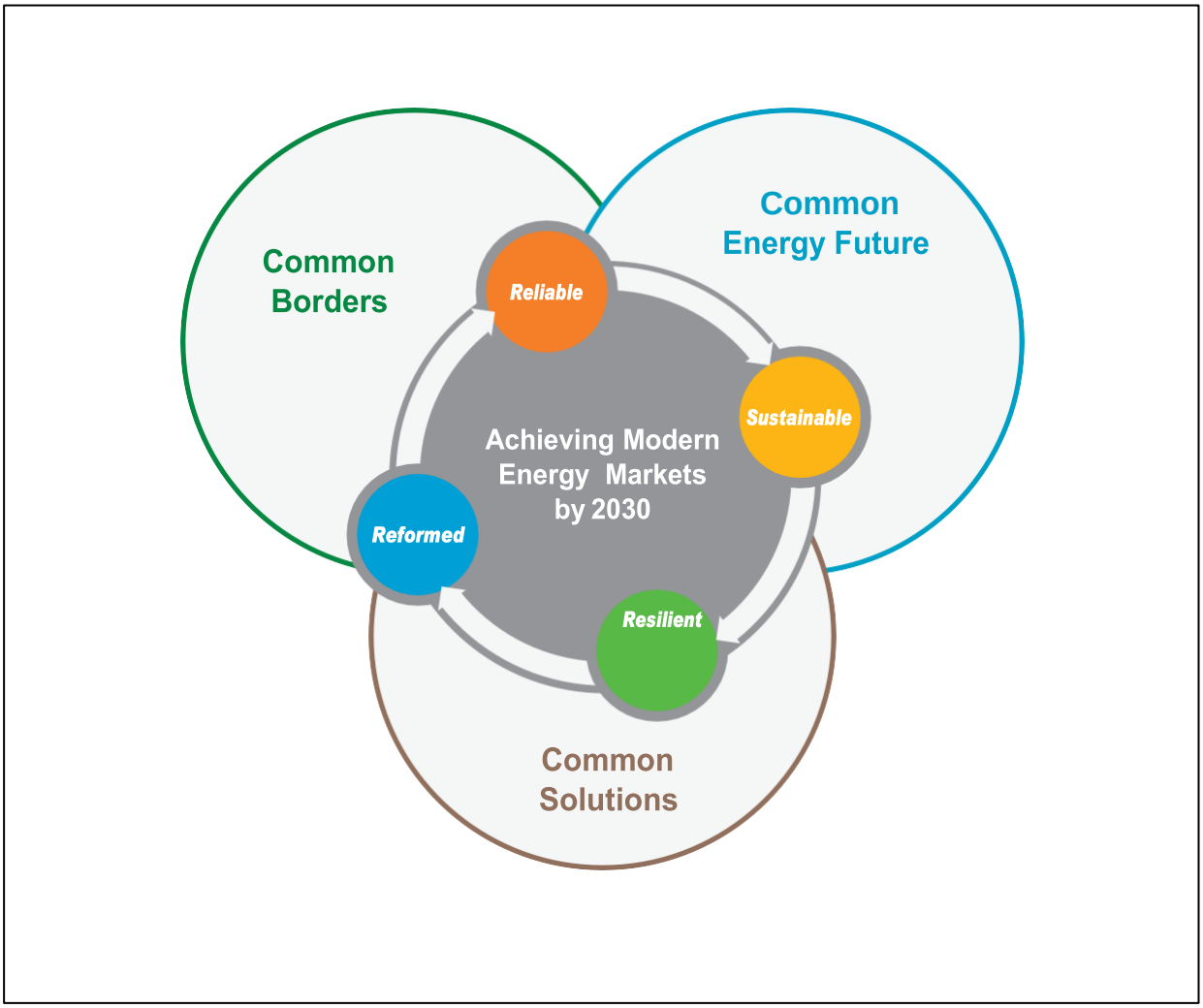
Pillar 1: Better energy security through regional interconnections.

Pillar 2: Scaled-up investments through market-oriented reforms.

Pillar 3: Enhancing sustainability by greening the regional energy system.

This study aims to contribute to Pillar 1 'Better energy security through regional interconnections'. Under Pillar 1, CAREC's Strategy puts emphasis on the timely completion of three flagship cross-border energy projects - TAPI, CASA-1000 and TUTAP. CAREC also envisions the development of the Central Asia Transmission Cooperation Association (CATCA), which will bring together the transmission system operators from the region to plan the development of a regional grid (CA REC 2019).

FIGURE 1 CAREC REGION'S ENERGY VISION 2030 [1]



Therefore, this research project has two broad objectives:

1. Document the governance challenges of regional energy interconnections in the CAREC region;

2. Provide policy recommendations on addressing governance challenges of energy interconnections.

To meet the research objectives described above, this project aims to answer two broad questions:

1. What are the political, social and environmental risks associated with the development of regional energy interconnections in the CAREC region?

2. How can these challenges be addressed?

This research project will complement CAREC's initiatives on the TAPI and CASA-1000 by systematically examining the political, social and environmental impacts of cross-border energy projects. The research will contribute towards CAREC's objective of enhancing energy trade by proposing collective governance frameworks that can address the externalities of energy cooperation.

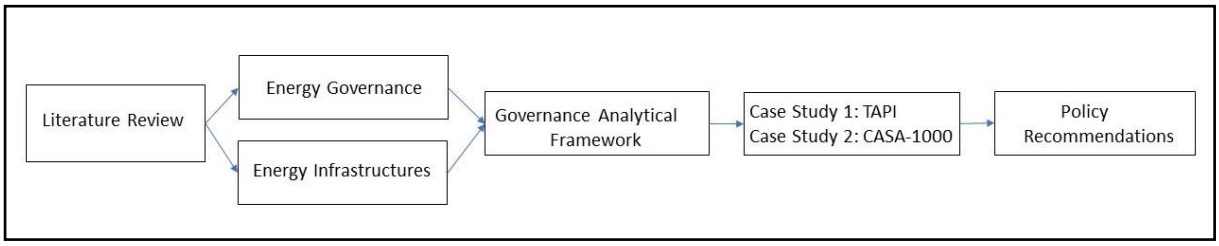
On a broader level, this project will advance the United Nations Sustainable Development Goal (SDG) 7, which is to 'Ensure access to affordable, reliable, sustainable and modern energy for all'. Currently, national energy projects in Asia are overwhelmingly dominated by coal-based power plants. This study will examine transnational energy projects that will facilitate trade in hydroelectricity and natural gas, which are environmentally less harmful than low-grade coal. Currently, Asia is home to the top three coal importers in the world. Asian countries have justified the use of fossil fuels, particularly coal, as a cost-effective means of providing access to electricity and enhancing poverty alleviation efforts. This research project will evaluate the prospects of utilizing energy sources that are affordable as well as sustainable, thereby contributing to the progress of SDG 7.

1.3 Methodology

The proposed research uses a mixed research methodology that includes literature review and case studies as illustrated in Figure 2. Literature review includes analysis of technical reports, journal articles, books, and online media. The review of literature focuses on two topics that are of relevance to the subject matter of this study - energy governance and energy infrastructures. Drawing on these two fields of literature, an analytical framework for studying the governance challenges of CAREC energy projects is developed. The analytical framework is then applied to case studies on the TAPI pipeline and the CASA 1000 project to identify governance challenges and related policy responses. The case studies highlight key areas of governance, such as construction of

energy infrastructures, future gas transmission and physical security of energy systems. Lastly, the overall analysis is distilled to present some policy recommendations on governing energy interconnections in the CAREC region.

FIGURE 2 RESEARCH METHODOLOGY



2. Conceptual Background

2.1 Global Energy Governance[2]

The generation, distribution and use of energy has multiple societal, environmental and political implications. Existing literature on energy governance provides key insights on the multitude of challenges associated with achieving the 'trilemma' of energy policy, or the development of energy systems that facilitate energy security, energy equity and environmental sustainability (Hancock and Vivoda 2014). These challenges include entrenched political and corporate interests in fossil fuels, corruption, market failures, geopolitical conflicts and social and environmental externalities of energy projects, among others (Hancock and Vivoda 2014; Andersen et al. 2017; Cherp et al. 2016; Gao 2017; Van De Graaf et al. 2016). Van De Graaf (2013) argue that the challenges to energy governance is made more complex by three global transitions: climate change and the need to decarbonize economies; geopolitical change, such as the rise of India and China as two of the world's leading energy consumers; and volatility in oil and gas markets caused by technological innovations or territorial conflicts. Scholars of energy governance propose that the modern energy systems face a large number of complex challenges that require cooperation across countries and regions (Overland and Reischl 2018; Hein and Holstenkamp 2018). Efforts to address these challenges go beyond national governments and include non-state actors, international organizations and public-private partnerships (Huda 2020; Hein and Holstenkamp 2018).

Florini and Sovacool (2009: 5239) define global energy governance as the "international collective efforts undertaken to manage and distribute energy resources and provide energy services". There is substantial debate within literature about the conceptual frames through which energy issues can be

interpreted at the international level. Some scholars emphasize on the critical issues of climate change (Huda 2024), while others focus on institutions (Nasiritousi and Faber 2021), or markets (Janardhanan and Chaturvedi 2021; Ali and Huda 2016). Such diverse framing has led to a lack of consensus on the purpose of global energy governance and particular roles and responsibilities of stakeholders. In an insightful review of existing literature, Van de Graaf and Colgan (2016) highlight five global energy governance priorities, which are: 1) Security of energy supply and demand, 2) Economic development 3) International Security 4) Environmental Sustainability and 5) Domestic Good Governance. These five goals encapsulate the governance of energy from a multitude of social, political and economic objectives.

While frameworks on global energy governance are important, they are somewhat disconnected from the topic of cross-border energy infrastructures. In the next section, a brief review of literature on governance of energy infrastructure is undertaken before a framework for studying the governance challenges of CAREC's transnational energy infrastructures is proposed.

2.2 Governance of Energy Infrastructures

Infrastructures such as transmission, generation and distribution systems are considered to be 'critical infrastructures' or assets that are essential to the national security and socio-economic well-being of a nation (Alcaraz and Zeadally 2015). Critical infrastructure is encumbered by two types of governance challenges. First, the development of infrastructure can result in environmental damages, political conflicts and human rights violations (Huda 2022). Second, once constructed, critical infrastructures need to be protected from natural hazards such as climate change or human-made threats such as sabotage (Nirandjan et al. 2022; Huda and McDonald 2016).

Literature on energy infrastructures have examined issues such as the societal implications of pipeline development (Kulkarni and Nathan 2016), geopolitics (Huda 2021a; 2023) and challenges of megaprojects (Baev and Øverland 2010). Goldthau (2014) proposes a stronger conceptual link between energy governance and energy infrastructures. He argues that energy infrastructures are socio-technical systems that should be governed across multiple regulatory levels and within the context of common pool problems of overuse. The author presents a polycentric framework for governing energy infrastructures which include multiple stakeholders and autonomous decision-making bodies that undertake collaborative governance of energy infrastructures (Goldthau 2014).

On a study of the TAPI pipeline, Huda and Ali propose that energy infrastructure projects must go beyond meeting national security interests to include perceptions of communities, international organizations and extra-regional actors. The authors highlight the policy processes by which issues such as human rights, environmental protection and energy security can be inter-linked within pipeline project proposals (Huda and Ali 2017).

A polycentric framework that provides independence to various policy units across geographic or regulatory scales can facilitates innovation, inclusion and learning in the governance of energy infrastructures (Goldthau 2014). Given that CAREC's energy projects will cross multiple international borders and national jurisdictions, the governance of energy infrastructures can be undertaken more effectively with a polycentric, rather than a centralized system.

As demonstrated in Table 1, this study incorporates Van de Graaf and Colgan's interpretation of the key goals of global energy governance with the polycentric governance framework suggested by Goldthau to appraise governance challenges of CAREC's energy projects and provide policy recommendations.

TABLE 1 AN ANALYTICAL FRAMEWORK FOR GOVERNANCE OF CAREC ENERGY PROJECTS

Goals	Scales
1. Security of energy supply and demand 2. Economic development 3. International Security 4. Environmental Sustainability 5. Domestic Good Governance	1. International 2. Regional 3. National 4. Grassroots

3. Energy profiles of Central and South Asian countries

3.1 Energy Overview of Central Asia

The rationale of energy interconnections in CAREC region is based on increasing energy demand within and outside the region, vast deposits of gas and enormous hydropower capacity, and growing interest in energy interconnections by national and international actors. As shown in Table 2, Kyrgyz Republic and Tajikistan have hydropower potential of 26 GW and 40 GW respectively, while Turkmenistan has the region's largest gas deposit, which stands at 7.5 tcm. Turkmenistan, along with Uzbekistan and Kazakhstan are among the top 20 countries in the world with the largest gas deposits (Tsevegjav (2020).

TABLE 2 ENERGY RESERVES IN CENTRAL ASIA[3]

	Kazakhstan	Kyrgyz Republic	Tajikistan	Turkmenistan	Uzbekistan
Coal (bt)	31.3	0.9	3.6	-	3.3
Gas (tcm)	2.4	0.006	0.006	7.5	1.8
Oil (bb)	30	0.04	0.01	0.6	0.594
Hydro (gw)	20	26	40	-	1.7

Table 3 demonstrates that some Central Asian countries lack diversity in their primary energy supplies, which some analysts argue can result in disruptions and energy insecurity (Hancock and Allisonn 2018). Gas generates approximately 76% and 86% of Turkmenistan and Uzbekistan's primary energy supply, while hydroelectricity is the dominant energy source in Tajikistan.

TABLE 3 TOTAL PRIMARY ENERGY SUPPLY BY SOURCE[4]

Fuel Source % (2021)	Kazakhstan	Kyrgyz Republic	Tajikistan	Turkmenistan	Uzbekistan
Coal	48.8	26.8	25	-	5.3
Gas	24.7	8.4	5.2	75.2	85.9
Hydro	1.2	28	41.4	-	0.9
Biofuels	-	-	-	-	-
Oil	24.9	36.9	28.4	24.8	7.9
Wind, Solar etc.	0.4	-	-	-	-

As shown in table 4, a majority of the populations of Central Asian countries have access to electricity. However, quality of electricity infrastructures in Central Asia are ranked low, particularly in Kyrgyz Republic and Tajikistan. Mehta et al. (2021) claim that energy infrastructures in Central Asia are obsolete and require urgent upgrading. In addition, there is much higher demand for electricity during winter than in summer, which results in persistent shortages and outages. The brunt of energy shortages is borne by rural populations, who resort to solid fuels to meet their energy needs during winter months (Mehta et al. (2021). The region's population, which is expected to increase by 1.66% annually, and economic growth rate, which ranges from 1.7% for Kazakhstan, to 0.4% for the Kyrgyz Republic, can create further pressure on the energy systems (Yormirzoev 2022).

TABLE 4 OVERVIEW OF ELECTRICITY USE IN CENTRAL ASIA[5]

	Kazakhstan	Kyrgyz Republic	Tajikistan	Turkmenistan	Uzbekistan
Electricity access 2021 (% of population)	100	100	100	100	100
Electricity infrastructure ranking 2019 (/141)	19	94	90	-	-

Therefore, within Central Asia, regional cooperation can potentially utilize the enormous resources of the region to increase electricity supplies and attract investments towards the upgrading of energy infrastructures. Energy cooperation can also facilitate the diversity of energy sources for individual countries, thereby enhancing their energy security.

3.2 Energy Overview of South Asia

Cross-border energy projects in CAREC can also provide energy to the growing economies of South Asia which do not have sufficient reserves of natural resources and suffer from severe electricity shortages (Huda 2020). As shown in Table 5, the level of electrification varies between countries. Almost 255 million people across South Asia do not have access to electricity and large segments of the population use biomass for cooking, which has severe health consequences; almost four million people worldwide die prematurely from illness attributable to household air pollution from cooking with solid fuels, among whom a large proportion are estimated to be from the South Asian countries (Zhang 2018; Huda 2020).

In addition to stunting human development, energy shortfalls undermine economic growth in South Asia, with losses amounting to as much as 86 billion in India alone (see Table 6). In addition, due to the lack of cross-border energy projects, a majority of the countries of South Asia are dependent on expensive fossil fuel imports, which increase pressure on the region's economies.

TABLE 5 ELECTRICITY ACCESS IN SOUTH ASIA[6]

Country	Total % (2021)
Afghanistan	97.7
Bangladesh	99
Bhutan	100
India	99.6

Maldives	100
Nepal	89.9
Pakistan	94.9
Sri Lanka	100

TABLE 6 IMPACT OF ELECTRICITY SHORTAGE ON GDP[7]

Country	Economic Cost (billion)	Impact of electricity shortage on GDP (%)
Bangladesh	11.2	5
India	86.1	4.1
Pakistan	17.7	6.5

The regional energy interconnections being envisioned by CAREC can benefit South Asian countries in two ways. Firstly, by facilitating trade in hydroelectricity and gas, these projects will reduce the use of highly pollutant domestic coal and expensive fossil fuels such as imported oil. Secondly, CAREC's initiative in strengthening electricity interconnections between Afghanistan and Pakistan and gas infrastructure between Pakistan and India can facilitate the development of the South Asian Association for Regional Cooperation (SAARC) electricity grid, which aims to connect the electricity systems of all eight countries of the region.

4. Governance of CAREC energy interconnections

This section will undertake case studies on the governance challenges of two under-construction energy interconnection projects in the CAREC region: 1) The TAPI pipeline and 2) The CASA-1000 project.

4.1 Case study 1: TAPI pipeline[8]

4.1.1 Overview of the TAPI

The TAPI pipeline will extend from the Galkynysh gas fields in Turkmenistan and cross Herat, Nimruz and Kandahar in Afghanistan, Quetta, Dera Ghazi Khan and Multan in Pakistan and end at the Indian border town of Fazilka. 5 billion cubic metres of gas is allotted for Afghanistan per year and 14 billion cubic metres each for India and Pakistan. The pipeline is 1,800 km long and is expected to costs $10 billion USD. Afghanistan and Pakistan will also benefit from transit fees of around $200-250 million each and the pipeline is expected to improve energy security for 1.5 billion people in Central and South Asia (BS 2015). Turkmenistan, which exported around 40 billion cubic metres (bcm) of gas in 2023, can utilize the TAPI to diversify its market and increase investment in the energy sector

(Łoskot-Strachota et al. 2024).. The TAPI is underpinned by a 30-year gas sales and purchase agreement between Turkemgaz (Turkmenistan), Afghan Gas Enterprise (Afghanistan), Inter State Gas Systems (Pakistan) and Gail (India) (ADB 2020).

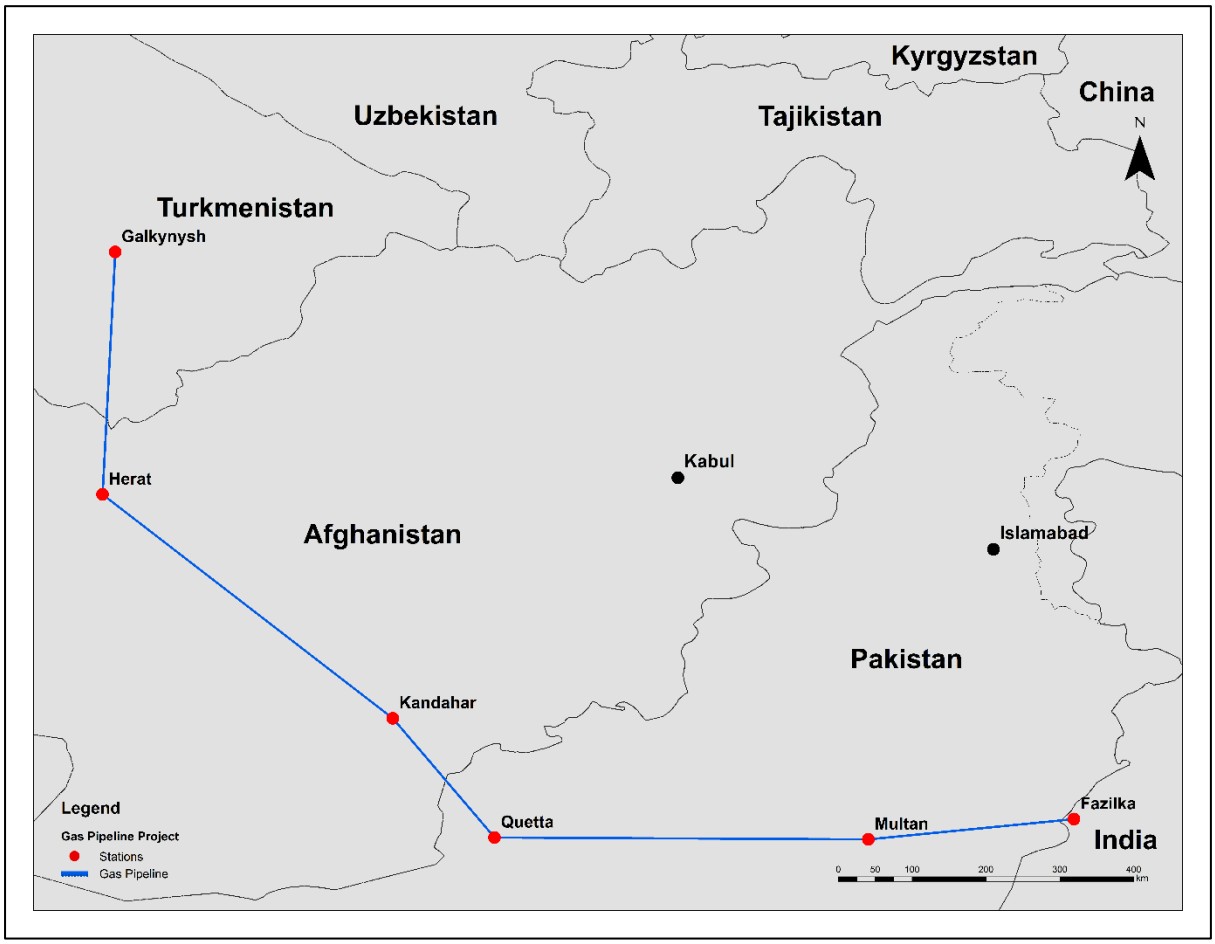
In term of funding and international support, ADB acts as the TAPI Secretariat and Transaction Advisor, and is considering providing $300 million and $100 million in loans to Turkmenistan and Pakistan, respectively, as well as a $100 million grant to Afghanistan. The remaining amount required for the project is expected to be met by the participating countries but the funding structure may change in the coming years, if additional stakeholders join the project (ADB 2020).

The TAPI project has shown progress despite several setbacks in the past. In April 2024, officials from Pakistan and Turkmenistan reiterated their commitment to expedite the completion of the Transit Trade Agreement (TTA) that will facilitate cooperation on the TAPI (Haider 2024). In the same year, Turkmenistan announced its intentions to procure infrastructures and technologies to secure the Turkmen part of the TAPI, indicating that the project is gaining momentum (NG 2024).

The ADB has acted as TAPI's secretariat since 2002 and has led the development of the legal, institutional and technical requirements of the project. Gas sales and purchase agreements were signed between Turkmenistan and GAIL (India) Ltd. and Pakistan's Inter State Gas Systems (Private) Ltd. in 2012, which was followed by agreements between Afghanistan and Turkmengas. The state gas companies of the four countries created the TAPI Pipeline Company in 2014 which will construct, fund, and operate the pipeline (Huda and Ali 2017). Tukrmengas was endorsed as the consortium leader of the TAPI Pipeline Company in August 2015 by the Steering Committee of the pipeline, which was followed by the signing of the Shareholders Agreement in December that marked the beginning of the project. TPCL commissioned a front-end engineering design (FEED) report and received bids for the supply of materials and for constructing the pipeline in Afghanistan and Pakistan. The ADB will oversee the technical, and financial aspects of the project as well as the safeguards documentation prepared by TPCL to ensure that standards required for financing are met (ADB 2020).

In December 2015, the construction of the Turkmen section of the TAPI started while an inaugural ceremony in 2018 marked the beginning of work on the project in Pakistan and Afghanistan (Huda and Ali 2017).

FIGURE 3 TAPI PIPELINE[9]



4.1.2 Governance Challenges of the TAPI

The TAPI pipeline is a complex project that requires a high level of coordination among technocrats in different countries. In addition to addressing technical issues such as the price of commodities and the compatibility of infrastructures across multiple jurisdictions, policymakers must also consider addressing challenges across the political, security, environmental and social spectrums. In the section below, I apply the five objectives of global energy governance as identified by Van de Graaf and Colgan (2016) to the socio-political context of the TAPI pipeline.

1. Security of energy supply and demand: A high level of coordination among CAREC countries is required to ensure that gas supplied by TAPI is reliable and not subject to interruptions. This can be achieved in two broad streams. First, officials of CAREC countries can undertake capacity building with international

organizations and consultants. This can take the form of training courses and workshops on gas transmission infrastructures, compressor stations and monitoring and evaluation. A greater level of coordination between the different utilities and energy ministries in CAREC can also be facilitated through conferences and secondments.

Secondly, to reduce the risk of gas disruptions, CAREC countries may consider developing a legal regime on cross-border energy infrastructures. In developing such a regime, CAREC countries can consider the Transit Protocol of the Energy Charter, which is a multilateral agreement on energy cooperation that focuses on enhancing energy security through the development of competitive energy markets.

2. Economic Development: The TAPI project bears great relevance for the economic development of the countries involved in the project. Turkmenistan is expected to earn significant revenues from exporting gas via TAPI. However, some of the countries in the region suffer from very unstable economies and ensuring that the TAPI contributes to economic development will require some level of governance on the distribution and investment of revenues.

CAREC has initiated policy discussion to enhance the positive economic impact of cross-border energy projects, but member countries need to undertake timely action in a range of areas. An increased level of governance at the national level is required to develop independent and solvent transmission businesses, and enhance private sector investment in energy. Member countries should also improve the commercialization of state utilities by enforcing energy purchase or sale contracts. A strong and independent regulation sector can also enhance the positive economic impact of the TAPI.

3. International Security: Pipelines around the world face a range of security threats, ranging from extreme weather events, sabotage and terrorist attacks. CAREC countries can undertake collaboration on governing the physical security of pipelines through two broad steps. First, member countries can utilize a range of cutting edge technologies to monitor the security of infrastructures. This can include climate modelling techniques, such as that used by the Argonne National Laboratory in the United States to predict the impact of extreme weather events on infrastructures. This will help member countries to undertake adaptation measures to protect infrastructures from the impacts of climate change.

Secondly, member countries can collaborate on securing the pipeline by employing local people to guard key areas. For example, the Baku–Tbilisi–Ceyhan (BTC) pipeline project engaged community members to guard energy infrastructures and report suspicious activities (Huda and Ali 2017). In addition to securing the pipeline, community participation can create higher levels of buy-in of cross-border projects by citizens of CAREC countries.

4. Environmental Sustainability: The TAPI pipeline will be built along national parks, biosphere reserves, game reserves and wildlife sanctuaries (TPC 2020). In multiple countries, the pipeline will pass by important water courses and areas that are home to endangered species. One of the proposed routes of the TAPI passes through the Registan-North Pakistan Sandy Desert, which is home to the restricted reptile species, 'Clark's Toad-head Agama' and a vulnerable bird species 'Asian Houbara' TPC (2020).

CAREC can address these challenges by developing of an independent monitoring body to oversee the environmental impact of the TAPI. For example, the BTC pipeline created a body called the Caspian Development Advisory Panel (CDAP) which provided advice on the economic, environmental and social impacts of the pipeline. In addition, CAREC countries can refer to the Environmental and Social Performance Standards of the International Finance Corporation to refer to best practises in the governance of TAPI's construction.

5. Domestic Good Governance: The TAPI pipeline is expected to result in involuntary resettlement and impact the livelihoods of significant numbers of people in multiple countries TPC (2020). The project may also affect agricultural land and heritage sites and increase road accidents TPC (2020). The TAPI is also expected to obstruct access to natural resources members of local communities during the construction phase. The presence of foreign workers during the construction phase may also have significant social impacts (TPC 2020).

CAREC member countries can implement a number of strategies to govern the social impacts of pipelines construction. This includes the distribution of adequate compensation and investment in local infrastructure such as roads, schools and hospitals. CAREC member countries can also actively engage with communities on the ground to understand their perceptions and preferences regarding the route of the TAPI. Research shows that cross-border energy projects that actively seek inputs from local stakeholders are more successful in governing social impacts (Huda and Ali 2017).

4.2 Case Study 2: CASA-1000 project

4.2.1 Overview of the CASA-1000

The CASA 1000 will transfer as much as 1,300 MW of hydroelectricity from the Kyrgyz Republic and Tajikistan to Afghanistan and Pakistan. As shown in Figure 5, the CASA-1000 will connect Datka in Kyrgyz Republic to Sugd in Tajikistan via a 477km 500 kV power transmission line. Regar and Santuda substation in Tajikistan will be connected via 120 km of 500 kV power transmission line. From Santuda, a 750 km High Voltage Direct Current (HVDC) power transmission line will traverse through Deh Salah and Gul Bahar in Afghanistan before reaching Nowshera in Pakistan (WB 2015).

The CASA-1000 aims to exploit seasonal variances in supply and demand - in the summer months Central Asia has excess capacity, while South Asian urban centres face energy shortages. Kyrgyz Republic and Tajikistan have their peak demand in winter, while in summer hydropower generation exceeds demand. The surplus after meeting domestic demand has incremental production costs of zero and provides a low-cost alternative to thermal-based generation in Pakistan (WB 2015). Tajikistan will provide 70 percent of electricity to the CASA-1000, while Kyrgyzstan will provide the remaining 30 percent (Kerimkhanov 2019). The project will supply 1000 MW to Pakistan and 300 MW to Afghanistan (CASA-1000 2024).

The CASA-1000 will cost 1.17 billion USD and is expected to be completed in 2025. The benefit-cost ratio of this project is estimated as 1.34 (for a discount rate of 10 percent) and the Economic Internal Rate of Return (EIRR) is 15.6 percent (WB 2013). Tajikistan and Afghanistan's annual revenues from this project may exceed 150 million USD (Kerimkhanov 2019) and 88 million USD, respectively (RECCA 2024).

The governing body of CASA-1000 is the Inter-Governmental Council (IGC), which comprises of ministerial-level representatives from the four countries involved in the project. The IGC produces key documents that are necessary for the development of the project, such as agreements between transmission companies, power purchase agreements and government guarantees. The coordination of the project is undertaken by the IGC Secreteriat, which is financed by USAID (CASA-1000 2024).

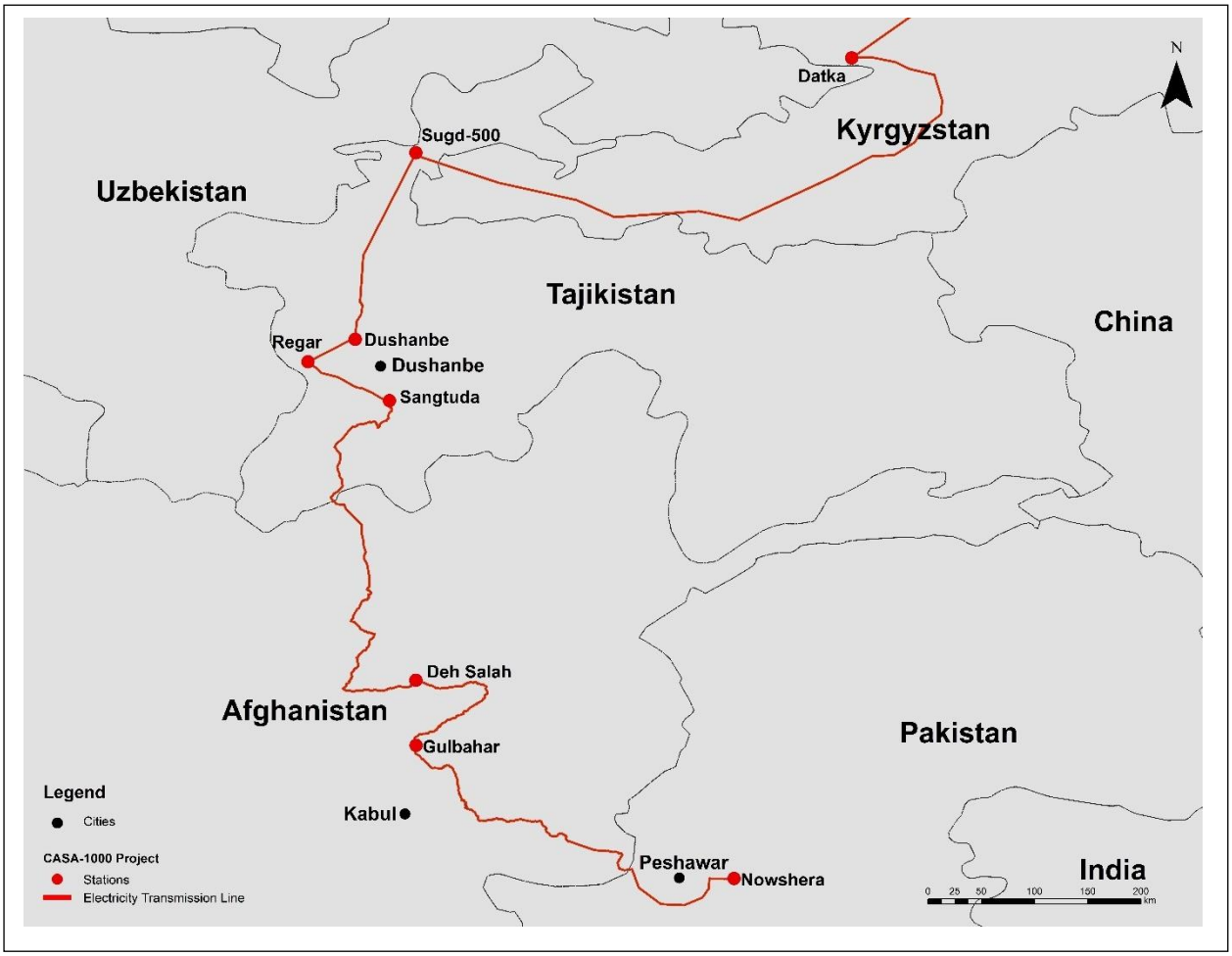
The project is the first step towards creating the Central Asia-South Asia Regional Electricity Market (CASAREM) that aims to integrate the electricity systems in the two subregions of Asia, thereby enhancing stable energy supplies

and deepening regional cooperation. The project will be compatible with and compliment other cross-border interconnection initiatives, such as the TUTAP (CAREC 2021) and existing bilateral trade arrangements, such as Uzbekistan's export of 450 MW of electricity to Afghanistan (Qooyash 2023).

The CASA-1000 project has been delayed by multiple challenges but has shown some signs of progress in recent years. In 2017, the contracts for the construction of the HVDC transmission line in Afghanistan were awarded and signed in Kabul. As of date, 18% of the Afghan portion of the CASA-1000 has been completed (Daryo 2024). However, the project was put on hold in 2021. In March 2024, the World Bank expressed its interest in reviving the project, following requests from several Central Asian countries. Progress on the project was further enhanced by a joint declaration between Kyrgyzstan, Pakistan and Tajikistan to resume construction of high-voltage transmission lines (TCA 2024).

The project receives support from multiple international institutions. The World Bank has committed or provided 1,422.5 million USD towards the CASA- 1000 (WB 2024). The ADB has provided 35 million USD to enable Tajikistan to improve the capacity of its energy sector and develop energy interconnections with Uzbekistan (ADB 2020). Other funders of the project include the Islamic Development Bank, European Investment Bank, European Bank for Reconstruction and Development, the US Government and the UK Government (CAREC 2021).

FIGURE 4 CASA-1000 PROJECT[10]



4.2.2 Governance Challenges of the CASA-1000

The CASA-1000 is not as large a project as some existing cross-border interconnections, such as the Synchronous Grid of Continental Europe or the North American Grid (CASA-1000 2024). However, the CASA-1000 is being developed in an area that faces significant social, economic and political challenges. Given that the CASA-1000 is an important step towards integrating the energy systems of South Asia and Central Asia, accessing and addressing the associated governance challenges is important not only towards the success of the project, but also for generating political and financial support for broader continent-wide energy and connectivity initiatives envisioned under the CAREC program. In the section below the challenges of the CASA-1000 project is accessed through Van de Graaf and Colgan's (2016) five-pronged approach to global energy governance.

1. Security of energy supply and demand:

Downstream countries in Central Asia have often express concerns about the economic and environmental impacts of hydroelectric dams in upstream countries. The supply of uninterrupted electricity through the CASA-1000 is thus dependent on the outcome of political relationships over shared river basins. In this context, some of the policy documents developed by CAREC can provide insights into how hydroelectric cooperation can be used as a catalyst to enhance river basin management. For instance, one suggested pathway to greater cooperation on rivers in Central Asia is to ensure that the water rights of all countries are respected and benefits shared equally (CAREC 2008). This can be undertaken through the signing of water sharing agreements and regular consultation between water authorities of CAREC member countries. One potential example for a case study on successful hydroelectric cooperation can be the Columbia River Treaty, which facilitates river basin management between the United States and Canada (DOS 2024).

Water issues can also be de-politicized through collaboration on environmental protection of rivers and join research and training. International collaboration with officials from other river basins can enhance capacity on water cooperation.

2. Economic Development: One of the objectives of the CASA-1000 project is to generate revenue for Tajikistan and Kyrgyzstan which can then be used to invest in infrastructure and alleviate poverty. Revenue from the project can also assist towards the economic stabilization of Afghanistan. While the economic rationale for CASA-1000 is compelling, a number of studies have demonstrated that revenues from resource utilization fail to create vibrant economies unless policy measures are undertaken to enhance capacities, diversify industries and invest in socio-economic programs Van De Graaf (2019).

Channelling the revenues from the CASA-1000 towards economic development will require a highly skilled bureaucracy, transparency in financial transactions and strong oversight mechanisms. Exchange of best practises between policymakers of CAREC countries and officials that are involved in energy and financial regulation in Europe and North America can bear positive outcomes for the development of the CASA-1000. Taking steps to improve the financial health of utilities in the region and developing independent monitoring bodies can also enhance the positive economic impact of CASA-1000. In addition, channelling revenues from the project to the development of communication infrastructure,

healthcare and education can have a wider positive impact on societies in the CAREC region.

3. International security: Energy transition entails greater electrification of the global economy and a reduction of the use of fossil fuels. While electrification through renewable energy will reduce GHG emissions, it may also leave economies vulnerable to attacks. Non-state actors and criminal elements may be incentivized to target electricity infrastructures of the CASA-1000 to cause blackouts that can disrupt critical services such as health care, defence and transport. In addition to physical attacks, there is growing concern that cross-border electricity infrastructures may come under cyber-attacks. While cyber-attacks on energy infrastructures are rare, they still pose a challenge to the viability of complex, interconnected systems envisioned under the CAREC initiative.

To meet this security challenges, CAREC member countries should undertake cross-border collaboration on secure borders. This can be undertaken through joint border patrols and exchange of intelligence and information sharing. As it is difficult to physically monitor all segments of cross-border grids, CAREC member countries can utilize sensors, cameras and drones to enhance security of energy systems.

CAREC member countries can also collaborate on enhancing the cyber security of electricity systems. This can be done through joint training programmes and international cooperation. For example, the Organization of Security and Cooperation in Europe (OSCE) has developed a 'Virtual Centre for the protection of critical energy infrastructure', which facilitates training and exchange of best practises between energy practitioners on technical expertise, norms and standards (OSCE 2020).

4. Environmental Sustainability: The development of the electricity transmission systems of the CASA-1000 is expected to impact Important Bird Areas and Ramsar sites and result in the cutting of vegetation (WB 2014). However, a larger concern lies in the long-term viability of the project given the impacts of climate change. The development of hydroelectricity in Central Asia will be influenced by the availability of water, which will be altered by global warming. Mean temperatures in Central Asia is expected to increase to 6.5° C by 2100 compared to pre-industrial times which will result in altered precipitation regimes, more frequent heat waves and increasing aridity in the region (adelphi and CAREC 2017). Rising temperatures will result in the melting of the glaciers that sustain

the waters of the Amu Darya and Syr Darya rivers. In the short-term, climate change will result in increased river runoff and stronger flood risks. In the medium to long-term, climate change will reduce water availability in the region, which can impact the availability of water needed to produce hydroelectricity (adelphi and CAREC 2017).

Climate change will also impact the security of the electricity transmission systems of the CASA-1000 and other regional connectivity projects in Central Asia. Studies of the impact of climate change on energy infrastructures show that increase in the frequency and severity of cold waves, wild fires, flooding and storms can cause physical damage to infrastructures and line disruptions. Very high and low temperatures can also cause efficiency losses in electricity transmission (Selesgi. et al. 2020).

CAREC countries should therefore undertake adaptation measures to ensure the long-term viability of cross-border energy infrastructures. This should include developing models that can predict the impact of climate change on shared river basins, strengthening dam infrastructures and moving electricity cables underground to reduce exposure to floods and winds. To learn best practises in climate mitigation of energy infrastructures, energy officials from CAREC can engage with policymakers in countries such as Finland, that has made substantial progress in enhancing resilience of transmission systems (De Rose et al. 2018).

5. Domestic Good Governance:

The development of the CASA-1000 project is linked to broader governance challenges related to water at the domestic level. Many countries of the CAREC region lack access to safe water and sanitation, which has negative impacts on economic development and quality of life. Inefficient agricultural practises, inadequate infrastructure and increasing population and urbanisation put enormous pressure on water resources (CABAR 2021). Climate change and lack of regional cooperation on water makes it more difficult for national governments to provide adequate water and sanitation services.

The CASA-1000 provides an opportunity for CAREC member countries to undertake cooperation on domestic water governance as well as hydroelectricity. For example, countries can extend cooperation on electricity trade to include the development of reservoirs, harmonize water use policies across borders and undertake cooperation on the development and utilization

of efficient irrigation systems. International cooperation on exchanging best practises in water management and climate change mitigation can improve water services in the region. Such measures can also resolve disputes related to the sharing of water resources among communities and countries (Huda 2024).

5. Conclusion

Regional energy interconnections in CAREC can provide access to clean energy and generate considerable revenues. These projects are therefore of great importance to social and economic development. However, large energy infrastructures create considerable governance challenges such as political conflicts, environmental degradation and human rights violations. CAREC countries should collaborate on addressing these challenges through consultation and emulation of best practises of cross-border energy projects in other parts of the world. Collaborative governance of the externalities of energy projects can be used to deepen regional integration, particularly in the areas of environmental cooperation and regional security.

The TAPI Pipeline can play an important role in the utilisation of gas as a transition fuel in Central and South Asian countries, while providing considerable revenue for Turkmenistan. The pipeline also provides an opportunity for policymakers in the region to collaborate more closely on developing the capacities of energy workforces in the region and undertake policy measures that can facilitate positive socio-economic impacts of this project on the region's populations as well as the environment.

The CASA-1000 will not only accelerate energy transition in Asia through the utilisation of hydroelectricity, but will also provide an opportunity for Central Asian countries to collaborate on river basin management, which can have significant environmental and economic benefits. Cross-border trade of hydroelectricity can enhance regional integration, which can pave the way towards resolving historical challenges related to energy and water.

CAREC countries have made significant progress towards the realization of an integrated energy system, as evidenced by the development of cross-border infrastructures and regional institutions and frameworks. Continued cooperation at the regional level and sustained international engagement can ensure that existing challenges towards the implementation of cross-border projects are addressed in a timely manner.

6. Policy Recommendations

The countries and the organizations involved in TAPI and CASA-1000 have undertaken a number of steps to address governance challenges:

First, high-level coordination bodies have been formed, such as the Intergovernmental Council, supported by the United States Agency for International Development (USAID) that oversees the activities related to the CASA-1000. The TAPI Pipeline Company supported by the ADB oversees the development of the pipeline among four countries and numerous organizations.

Second, a number of important studies have been undertaken by international and national actors on the social and environmental impacts of these projects (MEW 2014; TPC 2020). One of the ways that CAREC can build on existing policy mechanisms, is to facilitate regional consensus on collaborative governance. This can be undertaken through a regional body similar to the CATCA initiative currently being envisioned by CAREC. Below some areas for collaborative governance by the member countries of the CAREC are outlined:

1. A legal regime and dispute resolution mechanism: To address the risks of disruptions to energy infrastructure, the CAREC member countries may consider developing a legal regime on cross-border energy infrastructures and dedicated dispute resolution mechanisms.

One international example is the Energy Charter, which is an agreement for energy cooperation that promotes energy security through the development of competitive energy markets. The Charter has fifty-three Signatories and Contracting Parties. The Energy Charter Secretariat has attempted to develop a Transit Protocol, which will function as a framework to facilitate energy trade across borders. CAREC member countries can develop similar legal frameworks to facilitate rules-based energy trade (Huda 2021b).

In addition to a legal regime, energy cooperation can also benefit from the development of a dispute resolution mechanism. One example that has some relevance to CAREC's projects such as the CASA-1000 and TUTAP is the institutional mechanisms of the Indus Water Treaty (IWT). The IWT was signed in 1960, and facilitated by the World Bank to foster peaceful negotiation on sharing the waters of the Indus River by India and Pakistan. The IWT has survived three wars between India and Pakistan and while it has some limitations, it

provides an important platform for negotiations, which resulted in the peaceful resolution of several water-related disputes (Huda and Ali 2017).

The member countries of the TAPI and CAREC can reflect upon international best practices and develop dispute resolution mechanisms that are suitable for the region's particular socio-economic and political realities. The multilateral development banks involved in CAREC energy projects can potentially act as third-party negotiators that facilitate the resolution of disputes before they cause disruptions of energy supplies.

2. Capacity building of policymakers: A highly skilled bureaucracy is important to ensure that energy projects facilitate economic growth and sustainable development. Capacity building initiatives that bring together policymakers from Central Asia and those from countries with similar levels of developmental challenges can enhance skills and knowledge of regional bureaucracy.

To fully benefit from cross-border energy projects, CAREC countries should also invest in diversification policies. This will ensure that the economies of the region do not become dependent solely on the export of energy. Some guidance can be taken from the United Arab Emirates (UAE) which has undertaken important policy measures to reduce dependences on resource rents, including the growth of manufacturing, biotechnology and tourism (GAD 2008).

3. Joint training of security forces and community involvement: To reduce risks to the physical security of cross-border energy infrastructures, CAREC countries may engage in joint training of security forces that will guard these assets. This will create a common set of security protocols that will foster collaboration between national security stakeholders in different countries and jurisdictions. CAREC member countries can also collaborate on the use of surveillance and remote sensing technologies to ensure the physical security of cross-border pipelines and electricity grids. In addition, joint training with development partners in North America or Asia on cyber security issues can also enhance the security of energy infrastructures.

To reduce the incentives of damaging pipelines or grids, CAREC countries can consider involving community members in securing these infrastructures. For example, community members were involved in the guarding of the BTC pipeline and reporting of suspicious activities. Such measures that encourage community participation can reduce resentment towards energy projects by disgruntled community members (Huda and Ali 2017). Countries involved in the

TAPI and CASA-1000, such as Afghanistan and Pakistan may consider involving community members in securing these energy infrastructures.

4. Cross-border environmental cooperation: Multiple routes have been considered to minimise the environmental impact of the TAPI and CASA-1000. The member countries of CAREC can complement these efforts by improving the capabilities of domestic environmental institutions and collaborating more closely with international environmental organizations. In addition, regional energy interconnections can be used by CAREC members countries to engage in transboundary environmental cooperation. For example, Afghanistan and Pakistan can use the development of the TAPI pipeline to collaborate on the environmental conservation of vulnerable and endemic species in the Registan desert. Energy integration can be used to facilitate discussion on establishing 'Peace Parks' along Central Asia's ecologically sensitive and conflict-prone borderlands (Huda 2021a).

The CASA-1000 provides an opportunity for Central Asian countries to undertake cooperation on addressing floods, water pollution and droughts. Tajikistan and Kyrgyz Republic can utilize cooperation on the CASA-1000 as a platform to collectively contribute to the sustainable development of the Isfara Basin. Utilizing an energy projects to initiate wider environmental cooperation has seen relative success between India and Bhutan. However, in some Central and South Asian countries, political conflicts result in environmental issues being relegated to "low politics" within regional policymaking. The CASA-1000 project can be used to exploit the "high politics" of energy to generate greater engagement on environment issues (Huda 2021a).

5. Human rights Agreements: CAREC has stressed on the need to address the socio-economic well-being of populations that will be directly or indirectly affected by energy projects (CAREC 2021). One of the ways by which socio-economic benefits of energy projects can be advanced is through the formalization of human rights agreements in project documents. For example, BP generated consensus on human rights issues by including certain standards within key operational documents of the BTC pipeline. This includes the Voluntary Principles on Security and Human Rights, which was referenced in the Joint Statement and the Security Protocol for the East-West Energy Corridor of the BTC Pipeline. In addition to referring to international standards, countries involved in the TAPI and CASA-1000 project can also undertake a review of

existing frameworks on human rights, and meet any gaps as they relate to the development of energy infrastructure projects.

The BTC project also included other human rights measures such as the legally binding Human Rights Understanding. BP provided human rights training to the security forces hired to guard the pipeline and developed an independent monitoring body that evaluated the impacts of the pipeline on communities (Huda and Ali 2017). These examples can inform the planning of CAREC's energy projects, which can reduce harm on societies and enhance local and international support for these projects.

References

Abdul Kerimkhanov (2019) Tajikistan launches CASA-1000 project. https://www.azernews.az/region/145192.html

ADB (2017). TAPI Gas Pipeline. Asian Development Bank: Manila. http://www.adb.org/news/infographics/tapi-gas-pipeline.

ADB (2019), 'CAREC Energy Strategy 2030: Common Borders. Common Solutions. Common Energy Futures'. Asian Development Bank: Manila. https://www.adb.org/documents/carec-energy-strategy-2030

ADB (2020) Tajikistan: Reconnection to the Central Asian Power System Project. Asian Development Bank: Manila. https://www.adb.org/projects/52122-001/main#project-pds

ADB (2020) Transaction Technical Assistance Turkmenistan-Afghanistan-Pakistan-India (TAPI) Gas Pipeline Project (Phase 1). Technical Assistant Report. Project Number: 52167-002. Asian Development Bank: Manila https://www.adb.org/projects/documents/reg-52167-002-tar

adelphi and CAREC (2017), 'Rethinking Water in Central Asia: The costs of inaction and benefits of water cooperation'. https://carececo.org/Rethinking%20Water%20in%20Central%20Asia.pdf

Aleh Cherp et al. (2016) 'Global Energy Security under Different Climate Policies, Gdp Growth Rates and Fossil Resource Availabilities', An Interdisciplinary, International Journal Devoted to the Description, Causes and Implications of Climatic Change 136, no.1, 83-94.

Agata Łoskot-Strachota, Adam Michalski, and Marcin Popławski (2024) The start of a process? Turkey and Turkmenistan are planning gas cooperation. Center for Eastern Studies.

Andreas Goldthau (2014) 'Rethinking the Governance of Energy Infrastructure: Scale, Decentralization and Polycentrism', Energy Research & Social Science, 1 Supplement C, 134-40.

Ann Florini and Benjamin K. Sovacool (2009) 'Who Governs Energy? The Challenges Facing Global Energy Governance', Energy Policy 37, no.12, 5239-48.

Bulganmurun Tsevegjav (2020), 'Regional Cooperation in Promoting Low-Carbon Energy Development in CAREC: Challenges and Opportunities' CAREC Institute. https://www.carecinstitute.org/wp-content/uploads/2020/09/VFP-2020-low-carbon-energy-development-ED.pdf

Business Standard (2015) TAPI project finally to get off the ground in Asghabat next week. https://www.business-standard.com/article/news-ians/tapi-project-finally-to-get-off-the-ground-in-asghabat-next-week-115120800563_1.html

CABAR (2021) Water deficiency in Central Asia: Countries need to rethink policies of water use. https://cabar.asia/en/water-deficiency-in-central-asia-countries-need-to-rethink-policies-of-water-use

CAREC (2008) Strategy for Regional Cooperation in the Energy Sector of CAREC Countries. Central Asia Regional Economic Cooperation Program: Mandaluyong. https://www.carecprogram.org/uploads/CAREC-Regional-Cooperation-Strategy-in-Energy.pdf

CAREC (2021), 'Energy Sector Progress Report & Work Plan (November 2020 - June 2021)'. Central Asia Regional Economic Cooperation Program: Mandaluyong https://www.carecprogram.org/uploads/3-2021_Progress-Report_Energy.pdf.

CASA-1000 (2024) Afghanistan. https://www.casa-1000.org/afghanistan/

CASA-1000 (2022), 'Afghanistan Country updates'. http://www.casa-1000.org/newsandevents-2/

Cristina Alcaraz and Sherali Zeadally (2015) 'Critical Infrastructure Protection: Requirements and Challenges for the 21st Century', International Journal of Critical Infrastructure Protection 8, 53-66.

Daryo (2024) World Bank backs $1.2 bn CASA-1000 project following requests from Kyrgyzstan, Pakistan, and Tajikistan. https://daryo.uz/en/2024/03/11/world-bank-backs-12-bn-casa-1000-project-following-requests-from-kyrgyzstan-pakistan-and-tajikistan

De Rose et al. (2018) Climate change adaptation of major infrastructure projects: A stock-taking of available resources to assist the development of climate resilient infrastructure. European Commission.

Government of Abu Dhabi (2008), 'The Abu Dhabi Economic Vision 2030'. https://www.actvet.gov.ae/en/Media/Lists/ELibraryLD/economic-vision-2030-full-versionEn.pdf

Habib Rahman Qooyash (2023) Uzbekistan Electricity Contract Extended for 2024: DABS. Tolo News. https://tolonews.com/afghanistan-186502

Elena Shadrina (2019). Renewable Energy in Central Asian Economies: Role in Reducing Regional Energy Insecurity. ADBI Working Paper 993. Tokyo: Asian Development Bank Institute. https://www.adb.org/publications/renewable-energy-central-asian-economies

Fan Zhang (2018) 'In the Dark: How Much Do Power Sector Distortions Cost South Asia?', (Washington: The World Bank. https://openknowledge.worldbank.org/entities/publication/ad4d1d9f-f61c-5dbf-8ca4-cf31c10382f2

Ghualm Samad and Qaisar Abbas (2020), 'Infrastructure in Central Asia and Caucasia'. ADBI Working Paper 1202. Tokyo: Asian Development Bank Institute. https://www.adb.org/publications/infrastructure-central-asia-caucasia

IEA (2022) 'Greenhouse Gas Emissions from Energy Data Explorer' Paris: International Energy Agency. https://www.iea.org/articles/greenhouse-gas-emissions-from-energy-data-explorer

Indra Overland and Gunilla Reischl (2018) 'A Place in the Sun? IRENA's Position in the Global Energy Governance Landscape', International Environmental Agreements: Politics, Law and Economics 18 no.3, 335-50.

IRENA (2020) World Energy Transitions Outlook 2022. International Renewable Energy Agency. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Apr/IRENA_GRO_Summary_2020.pdf?la=en&hash=1F18E445B56228AF8C4893CAEF147ED0163A0E47

Johan Eriksson and Gunilla Reischl (2019) 'Worlds Apart, Worlds Together: Converging and Diverging Frames in Climate and Energy Governance', Globalizations 16, no.1, 67-82.

Kathleen J. Hancock and Juliann Allison (2018) The Oxford Handbook of Energy Politics (New York: Oxford University Press).

Kathleen J. Hancock and Vlado Vivoda (2014) 'International Political Economy: A Field Born of the Opec Crisis Returns to Its Energy Roots', Energy Research & Social Science 1, 206-16.

Kedar Mehta, Mathias Ehrenwirth, Christoph Trinkl, Wilfried Zörner and Rick Greenough (2021) 'The Energy Situation in Central Asia: A Comprehensive Energy Review Focusing on Rural Areas', Energies 14, no.10, 2805.

Mateen Haider (2024), Zardari calls for early finalisation of Pak-Turkmen trade deal. The Nation. https://www.nation.com.pk/02-Apr-2024/zardari-calls-for-early-finalisation-of-pak-turkmen-trade-deal

Ministry of Energy and Water Islamic Republic of Afghanistan (2014), 'Resettlement and Compensation in connection with South Asia Regional Electricity Trade Project (CASA-1000)'. https://www.casa-1000.org/Docs/0104/CASA%20RPF%20Afghanistan%20-%20English.pdf

Mirza Sadaqat and Saleem Ali (2017) 'Energy diplomacy in South Asia: Beyond the security paradigm in accessing the TAPI pipeline project', Energy Research & Social Science 34, 202-13.

Mirza Sadaqat Huda and Matt McDonald (2016) 'Regional Cooperation on Energy in South Asia: Unraveling the Political Challenges in Implementing Transnational Pipelines and Electricity Grids', Energy Policy 98, 73-83.

Mirza Sadaqat Huda and Saleem Ali (2018) 'Environmental Peacebuilding in South Asia: Establishing Consensus on Hydroelectric Projects in the Ganges-Brahmaputra-Meghna (Gbm) Basin', Geoforum 96, 160-71.

Mirza Sadaqat Huda and Saleem Ali (2018) 'The Energy Politics of the Asia-Pacific Region', in Kathleen J. Hancock and Juliann Allison (eds.), The Oxford Handbook of Energy Politics (New York: Oxford University Press, 2018).

Mirza Sadaqat Huda (2023) ‘Governance Challenges of South Asia's Energy Megaprojects,’ Geopolitics 28, no. 5, 2142–68.

Mirza Sadaqat Huda (2024) ‘Renewable Energy Diplomacy and Transitions: An Environmental Peacebuilding Approach’, Environmental Innovation and Societal Transitions 50, 100815.

Mirza Sadaqat Huda, (2019) 'Addressing Challenges to Regional Energy Cooperation in South Asia', in S Narayan, Len, Christopher and Roshni, Kapur (ed.), Sustainable Energy Transition in South Asia (Singapore: World Scientific).

Mirza Sadaqat Huda, 2021a 'An Ecological Response to Ethno-Nationalistic Populism: Grassroots Environmental Peacebuilding in South Asia', International Affairs 97, no.1, 119-38.

Mirza Sadaqat Huda (2021b). ‘The Governance of the TAPI Pipeline: Political, Social, and Environmental Challenges,’ The National Bureau of Asian Research, Washington.

Mirza Sadaqat Huda, (2022) 'Autocratic Power? Energy Megaprojects in the Age of Democratic Backsliding', Energy Research & Social Science 90, 102605.

Mirza Sadaqat Huda, (2013) 'Can Robust Bilateral Cooperation on Common Rivers between Bangladesh and India Enhance Multilateral Cooperation on Water Security in South Asia?', Strategic Analysis 37, no.3, 305-09.

Mirza Sadaqat Huda (2020) Energy Cooperation in South Asia: Utilizing Natural Resources for Peace and Sustainable Development (London: Routledge).

Mirza Sadaqat Huda, (2017) 'Envisioning the Future of Cooperation on Common Rivers in South Asia: A Cooperative Security Approach by Bangladesh and India to the Tipaimukh Dam', Water International 42, no.1, 54-72.

Mirzobobo Yormirzoev (2022) 'Economic Growth and Productivity Performance in Central Asia', Comparative Economic Studies 64, 520–539.

Naghmeh Nasiritousi and Hugo Faber (2021) 'Legitimacy under Institutional Complexity: Mapping Stakeholder Perceptions of Legitimate Institutions and Their Sources of Legitimacy in Global Renewable Energy Governance', Rev. Int. Stud 47, no.3, 377-98.

Nandakumar Janardhanan and Vaibhav Chaturvedi (2021) Renewable Energy Transition in Asia : Policies, Markets and Emerging Issues (Singapore: Palgrave Macmillan).

Nebit-Gaz (2024), The Turkmengaz State Concern announces an international tender: 20.03.2024. https://oilgas.gov.tm/en/posts/news/10225/the-turkmengaz-state-concern-announces-an-international-tender-20032024

OSCE (2020) OSCE Virtual Centre for the protection of critical energy infrastructure. https://www.osce.org/secretariat/443674

Pavel K. Baev and Indra Øverland (2010) 'The South Stream Versus Nabucco Pipeline Race: Geopolitical and Economic (Ir)Rationales and Political Stakes in Mega-Projects', International Affairs 86, no. 5, 1075-90.

RECCA (2024) Central Asia–South Asia Regional Energy Market (CASA-1000). https://recca.mfa.gov.af/central-asia-south-asia-casa-1000/

WB (2015), 'Q&A: Central Asia-South Asia Electricity Transmission and Trade Project (CASA-1000). https://www.worldbank.org/en/news/speech/2016/05/10/central-asia-south-asia-electricity-transmission-and-trade-project-casa-1000

Sadhana Nirandjan, Elco E Koks, Philip J Ward, and Jeroen C J H Aerts (2022) 'A Spatially-Explicit Harmonized Global Dataset of Critical Infrastructure.' Scientific Data 9, no. 1 (2022), 150–150.

Saleem H. Ali and Mirza Sadaqat Huda (2016) 'Constructive Consumption: Bridging Livelihoods and Conservation in Democratic Societies', in Gabriel Eweje and Ralph Bathurst (eds.), Csr, Sustainability and Leadership (New York: Routledge).

Sanket Sudhir Kulkarni (2016) 'India's Decision Making on Cross-Border Natural Gas Pipelines (1989-2012)', Strategic Analysis 40, no.5, 405-24.

Shuqin Gao (2017) 'China and Global Energy Governance: Integration or Confrontation?', Global Governance 23, no. 2, 307-25.

Svein S. Andersen, Andreas Goldthau, and Nick Sitter (eds.) (2017) Energy Union: Europe's New Liberal Mercantilism? (London: Palgrave Macmillan).

TAPI Pipeline Company (2020), 'Environmental and Social Impact Assessment. Regional: TAPI Gas Pipeline Project (Phase 1)'.

The Times of Central Asia (2024). Kyrgyzstan Resumes Construction Work on Pakistan Electricity Export Project. https://timesca.com/kyrgyzstan-resumes-construction-work-on-pakistan-electricity-export-project/

The US Department of State (2024) The Columbia River Treaty. https://www.state.gov/columbia-river-treaty/

Thijs Van De Graaf and Jeff D. Colgan (2016) 'Global Energy Governance: A Review and Research Agenda', Palgrave Communications 2, 15047.

Thijs Van De Graaf, Benjamin K. Sovacool, Arunabha Ghosh, Florian Kern, Michael T. Klare (2016) 'The Palgrave Handbook of the International Political Economy of Energy' (London: Palgrave Macmillan).

Thijs Van De Graaf, Kingsmill Bond, and Indra Overland, 'A New World: The Geopolitics of the Energy Transformation', (Abu Dhabi: International Renewable Energy Agency). https://www.irena.org/publications/2019/Jan/A-New-World-The-Geopolitics-of-the-Energy-Transformation

Thijs Van De Graaf (2013) ;The Politics and Institutions of Global Energy Governance ;(London: Palgrave Macmillan).

TPC (2020), 'Environmental and Social Impact Assessment Study—Pakistan,' TAPI Pipeline Company. https://www.adb.org/sites/default/files/project-documents/52167/52167-001-esia-en_54.pdf

WB (2013) Central Asia Energy Water Development Program: Working for Energy and Water Security. The World Bank: Washington https://documents1.worldbank.org/curated/en/141991567780869624/pdf/Central-Asia-Water-and-Energy-Program-Working-for-Energy-and-Water-Security.pdf

WB (2014), 'CASA-1000: Central Asia South Asia Electricity Transmission and Trade Project Regional Environmental Assessment'. The World Bank: Washington https://www.eib.org/attachments/registers/53251246.pdf

WB (2024) Central Asia South Asia Electricity Transmission and Trade Project (CASA-1000). The World Bank: Washington https://projects.worldbank.org/en/projects-operations/project-detail/P145054

WB (2016), 'Enhancing Regional Power Trade in Central Asia', The World Bank: Washington https://documents1.worldbank.org/curated/en/672501486549955103/pdf/ACS21198-WP-P147021-PUBLIC-EnhancingRegionalPowerTradeinCentralAsiaReport.pdf

WB (2020), 'Central Asia Electricity Trade Brings Economic Growth and Fosters Regional Cooperation'. The World Bank: Washington https://www.worldbank.org/en/news/feature/2020/10/20/central-asia-electricity-trade-brings-economic-growth-and-fosters-regional-cooperation

Wolfgang Hein and Lars Holstenkamp (2018) 'Global Governance and the Interplay of Coordination and Contestation the Case of Renewable Energies in the South', Global Governance 24 no.3, 431-49.

Yalew, Selesgi. et al. (2020) Impacts of climate change on energy systems in global and regional scenarios. Nature Energy 5, no. 10, 794-802.

[1] ADB (2019), 'CAREC Energy Strategy 2030: Common Borders. Common Solutions. Common Energy Futures', Asian Development Bank, Manila. https://www.adb.org/documents/carec-energy-strategy-2030

[2] The analysis on this section draws on earlier work published by the author, see Mirza Sadaqat Huda, 'Governance Challenges of South Asia's Energy Megaprojects,' Geopolitics 28, no. 5 (2023): 2142–68.

[3] Elena Shadrina (2019). Renewable Energy in Central Asian Economies: Role in Reducing Regional Energy Insecurity. ADBI Working Paper 993. Tokyo: Asian Development Bank Institute. https://www.adb.org/publications/renewable-energy-central-asian-economies

[4] IEA world energy statistics 2021

[5] Mehta, Kedar, Mathias Ehrenwirth, Christoph Trinkl, Wilfried Zörner, and Rick Greenough. 2021. "The Energy Situation in Central Asia: A Comprehensive Energy Review Focusing on Rural Areas" Energies 14, no. 10: 2805; IEA, IRENA, UNSD, World Bank, WHO. 2023. Tracking SDG 7: The Energy Progress Report. World Bank, Washington; The Global Competitiveness Report 2019;

[6]IEA, IRENA, UNSD, World Bank, WHO. 2023. Tracking SDG 7: The Energy Progress Report. World Bank, Washington;

[7] Fan Zhang, 'In the Dark: How Much Do Power Sector Distortions Cost South Asia?', (Washington: The World Bank, 2018). https://openknowledge.worldbank.org/entities/publication/ad4d1d9f-f61c-5dbf-8ca4-cf31c10382f2

[8] The analysis on this section draws on earlier work published by the author on the TAPI pipeline, see Mirza Sadaqat Huda and Ali, Saleem H. (2017), 'Energy diplomacy in South Asia: Beyond the security paradigm in accessing the TAPI pipeline project', Energy Research & Social Science, 34, 202-13; Mirza Sadaqat Huda (2021a). 'The Governance of the TAPI Pipeline: Political, Social, and Environmental Challenges,' The National Bureau of Asian Research, Washington.

[9] Map produced through Geographic Information Systems (GIS) 10.8. by Karen Andrea Ruiz Santos. The maps provide a visual representation of the trajectory of energy projects using data in CAREC (2019) Energy Sector Progress Report and Work Plan (June 2018–May 2019).

[10] ibid

+86.991.8891151

km@carecinstitute.org | www.carecinstitute.org

21th Floor, Commercial Building Block 8, Vanke Metropolitan,
No. 66 Longteng Road, Shuimogou District,
Xinjiang Uygur Autonomous Region, the People's Republic of China , 830028