



RENEWABLE ENERGY INVESTMENT ECOSYSTEM IN CENTRAL ASIA



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RENEWABLE ENERGY INVESTMENT
ECOSYSTEM IN CENTRAL ASIA

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Abbreviations

● ADB	Asian Development Bank
● AIIB	Asian Infrastructure Investment Bank
● CAREC	Central Asia Regional Economic Cooperation
● CAPEX	Capital Expenditure
● COP	Conference of the Parties
● EBRD	European Bank for Reconstruction and Development
● EUR	Currency of the European Union
● FDI	Foreign Direct Investment
● GDP	Gross Domestic Product
● ICDT	Islamic Centre for Development of Trade
● IEA	International Energy Agency
● ILO	International Labour Organization
● IPA	Investment Promotion Agency
● IRENA	International Renewable Energy Agency
● IsDB	The Islamic Development Bank
● MDB	Multilateral Development Bank (e.g. ADB, AIIB, EBRD, IsDB)
● MOE	Ministry of Energy
● MOF	Ministry of Finance
● OECD	Organization for Economic Co-operation and Development
● OPEX	Operating Expenditure
● PESTEL	Political, Economic, Social, Technical, Environmental and Legal
● PPA	Power Purchase Agreement
● PPP	Public-Private Partnership
● RE	Renewable Energy
● SOE	State-Owned Enterprise
● SWOT	Strengths, Weaknesses, Opportunities and Threats
● TA	Technical Assistance
● UE	Unitary Enterprise
● UNECE	United Nations Economic Commission for Europe
● UNCTAD	United Nations Conference on Trade and Development
● USD	American Dollars
● WEF	World Economic Forum

Table of Contents

FOREWORD.....	13
EXECUTIVE SUMMARY.....	17
DETAILED SUMMARY.....	20
1. Introduction.....	27
1.1 Background and Rationale.....	28
1.2 Study Objectives.....	29
1.3 Scope and Limitations.....	29
1.4 Methodology.....	30
2. Global Energy Investment.....	32
3. Global Renewable Energy Metrics.....	35
4. Renewable Energy Characteristics in Central Asia.....	43
4.1 The Region.....	44
4.2 The Countries.....	56
4.3 Role of International Institutions.....	70
4.4 General Investment Considerations in Central Asian Countries.....	77
5. Framework to Assess the Renewable Energy Foreign Direct Investment Ecosystem.....	86
5.1 Ecosystem—Key Determinants of Attracting Foreign Direct Investment.....	87
5.2 Ecosystem—Country Scorecard.....	101
6. Positives and Challenges of the Investment Ecosystem for Each Country.....	118
7. Pseudo-Ecosystem for Renewable Energy Investments in Central Asia.....	142
7.1 Leveling Ecosystem Components Between Countries.....	146
7.2 Need to Adapt Each Country’s Ecosystem Elements for Compliance and Parity.....	149
8. Priority Renewable Energy Subsectors for Each Country.....	170
9. Pilot Country Recommendation.....	176
9.1 Pros and Cons	178
9.2 Assessment.....	200
9.3 Stylized Facts of Pilot Country.....	206
10. Investment Promotion Program.....	209
11. Next Steps.....	220
12. Technical and Market Aspects.....	224
Appendix 1 Questionnaire.....	228
Appendix 2 Countries’ Adherence to Ecosystem’s Key Determinants.....	233
Appendix 3 Categories and Elements in Joint Pseudo-Ecosystem.....	303
Appendix 4 References.....	323

List of Figures



Figure 3-1	Global Electricity Generation.....	36
Figure 3-2	Global Renewable Electricity Generation.....	37
Figure 3-3	Global Installed Electricity Capacity.....	38
Figure 3-4	Global Installed Electricity Capacity - Annual Additions.....	39
Figure 3-5	Global Jobs in Renewables.....	39
Figure 3-6	Gaps from the UAE Consensus.....	41
Figure 3-7	Cumulative Investments Needed for COP28 Compliance.....	42
Figure 4-1	Renewable Energy Share of Electricity Capacity and Generation in Central Asia.....	49
Figure 4-2	Renewable Energy Finance Flows in Central Asia.....	51
Figure 4-3	Top 10 Sectors of FDI Inflows in Central Asia.....	52
Figure 6-1	Scorecard – Snapshot of Renewable Energy Investment Ecosystem Quality in All Countries.....	121
Figure 6-2	Country Score - Adherence to Investment Ecosystem Criteria by Each Country.....	122
Figure 7-1	Comparison of Each Country's Score by Ecosystem Category.....	147
Figure 7-2	Ecosystem Elements Missing or not Compliant by Country.....	149
Figure 9-1	Intervention Required for Compliance with Ecosystem by Country.....	178
Figure 10-1	Execution of Investment Promotion Program.....	219
Figure 11-1	Next Steps.....	223

List of Tables



Table 4-1	Accumulated Renewable Energy Capacity in Central Asia.....	48
Table 4-2	Accumulated Renewable Energy Generation in Central Asia	49
Table 4-3	Renewable Energy Share of Electricity Capacity in Central Asia.....	50
Table 4-4	Renewable Energy Share of Electricity Generation in Central Asia.....	51
Table 4-5	Renewable Energy Finance Flows in Central Asia.....	53
Table 4-6	Investment Environments in Central Asia.....	78
Table 7-1	Ecosystem - The Main Categories and Their Weighting.....	144
Table 7-2	Kazakhstan - Ecosystem Elements Missing or not Compliant.....	150
Table 7-3	Kyrgyzstan - Ecosystem Elements Missing or not Compliant.....	152
Table 7-4	Tajikistan - Ecosystem Elements Missing or not Compliant.....	157
Table 7-5	Turkmenistan - Ecosystem Elements Missing or not Compliant.....	161
Table 7-6	Uzbekistan - Ecosystem Elements Missing or not Compliant.....	166
Table 9-1	Pros and Cons for Kazakhstan to Become a Pilot Country.....	178
Table 9-2	Pros and Cons for Kyrgyzstan to Become the Pilot Country.....	182
Table 9-3	Pros and Cons for Tajikistan to Become a Pilot Country.....	186
Table 9-4	Pros and Cons for Turkmenistan to Become the Pilot Country.....	191
Table 9-5	Pros and Cons for Uzbekistan to Become the Pilot Country.....	195

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Foreword

As the Central Asia region confronts the pressing challenges of climate change, transitioning to renewable energy sources is essential for sustainable development. All five Central Asian countries—Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan—have committed to ambitious energy transition goals. Achieving these goals requires the creation of a conducive investment ecosystem capable of attracting and realizing foreign investments in renewable energy, supported by green finance mechanisms.

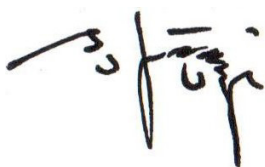
This report is timely. The global landscape is rapidly changing, with geopolitical dynamics and tensions demanding stronger regional integration. In this context, the Islamic Development Bank (IsDB), the CAREC Institute, and the Islamic Centre for Development of Trade (ICDT) are pleased to present this study as a step toward strengthening thought leadership and advocacy for sustainable development at the regional level, particularly by promoting renewable energy investments in Central Asia.

This study provides a comprehensive analysis of the renewable energy investment ecosystem in Central Asia, offering valuable insights into the key factors foreign investors consider when evaluating opportunities in the region. By examining 15

critical pillars of the investment ecosystem—ranging from regulatory frameworks to infrastructure readiness and financial conditions—the report highlights the strengths, weaknesses, and gaps in each country's renewable energy landscape.

A key outcome of this study is the proposed Investment Promotion Program, which includes organizing a regional investment forum to showcase bankable projects and capacity-building opportunities in the renewable energy sector. The program is designed to facilitate renewable energy investments across the entire project lifecycle, from initial investment attraction to project execution and operation. It offers practical recommendations to improve the investment climate, attract more foreign investments, and ensure sustainable operations, making it an essential tool for policymakers, investors, and development partners.

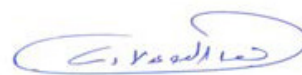
We express our sincere gratitude to all contributors who made this study possible, particularly representatives from the Ministry of Energy, Ministry of Investment, and Investment Promotion Agencies of the aforementioned countries, whose invaluable feedback and suggestions during the consultation process were critical. Their collaboration has played an essential role in shaping an effective and sustainable approach to renewable energy investment in the region, ensuring ownership of the proposed Investment Promotion Program. This serves as a clear example of how the IsDB, the CAREC Institute, and the ICDT can leverage partnerships to support member countries and regional bodies in developing homegrown solutions to address the development challenges they face.



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Executive Summary

Central Asian economies face significant climate-related challenges due to their geographical vulnerabilities and historical reliance on fossil fuels. This study explores the factors influencing renewable energy investments in Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan), offering an investment promotion program as a pilot to develop a comprehensive strategy for select renewable energy sectors. The research identifies constraints, challenges, and opportunities through extensive data collection, assessing the region's capacity and potential for renewable energy investments.

A comprehensive framework was developed to evaluate the foreign direct investment (FDI) ecosystem for renewable energy in Central Asia. This framework includes 15 key determinants organized into three core categories: **(i) Fundamentals**, such as government commitment, regulatory frameworks, market conditions, and investment promotion; **(ii) Robustness**, including resource availability, grid infrastructure, market access, investment protection, and the financial environment; and **(iii) Execution and Operations**, covering workforce quality, project developers, public-private partnerships, environmental and social factors, technology and innovation, and regional cooperation. The study assessed the ecosystem based on 202 individual elements across these determinants, using a scorecard to evaluate each country's strengths, weaknesses, opportunities, and threats in renewable energy investment, providing a holistic view of the region's landscape.

Kazakhstan demonstrates strong government commitment and a solid regulatory framework but faces challenges in grid integration and regulatory complexity. Of the 202 elements in the joint pseudo-ecosystem, Kazakhstan has 36 non-compliant elements. KAZAKH INVEST functions as a one-stop shop for foreign investors, supporting the investment process, including project identification, partner search, site selection, and aftercare. Despite its regional and international offices

and collaboration with government bodies to streamline procedures and promote investor-friendly policies, its historical focus on extractive industries may limit its expertise in renewable energy investments.

Kyrgyzstan has a robust hydropower foundation but requires significant improvements in its regulatory framework and investment climate. It has the highest number of non-compliant or missing elements in the renewable energy investment ecosystem in Central Asia, with 132 items. The National Investment Agency is the primary body for promoting investment, offering legal and regulatory assistance and facilitating meetings with officials. However, the country's decentralized investment structure, involving multiple government bodies, can lead to overlapping roles and unclear guidance for investors. Kyrgyzstan also has limited experience with large-scale FDI.

Tajikistan possesses substantial hydropower potential but faces economic instability and significant regulatory gaps. It has 92 non-compliant investment ecosystem indicators, ranking third in the region in terms of deficiencies. Tajikistan's State Committee on Investments, through its State Unitary Enterprise "TAJINVEST" serves as the primary investment promotion agency, providing information on opportunities, registration assistance, and facilitating communication with government bodies. However, the country lacks a specialized agency for renewable energy investment and does not offer comprehensive support throughout the investment process.

Turkmenistan has a high potential for solar and wind energy but requires considerable development in its renewable sector. With 117 non-compliant elements, it ranks second lowest in terms of deficiencies. The country lacks a dedicated investment promotion agency, and investment activities are managed by the Ministry of Finance and Economy's Department for Foreign Economic Relations and Development. Its highly centralized approach primarily focuses on strategic partnerships in the oil and gas sector, and investment procedures and opportunities are not always easily accessible to foreign investors.

Uzbekistan, with ambitious renewable energy targets and increasing investments, still faces challenges with grid integration and regulatory inconsistencies. It reports 70 non-compliant items, making it the second-best performer in the region after

Kazakhstan in terms of a conducive renewable energy investment ecosystem. However, there are still several areas needing improvement. Uzbekistan Investment Promotion Agency (UzIPA) operates as a one-stop shop, offering services such as information provision, project development assistance, and aftercare. Despite organizing investment forums, participating in international events, and engaging potential investors, challenges persist in their capacity, mandate, bureaucratic procedures and coordination with other government entities.

In summary, the region's renewable energy potential is evident, but challenges such as regulatory barriers, economic instability, and limited experience in attracting foreign investment must be addressed. The role of investment promotion agencies varies across countries, with some offering more structured and centralized support than others, which impacts the overall investment ecosystem for renewable energy in Central Asia.

According to the United Nations Economic Commission for Europe's Roadmap to Carbon Neutrality for Europe, North America, and Central Asia (2022), a substantial shift from fossil fuels to renewable sources is necessary for countries to meet their obligations under the Paris Agreement and transition to a low-carbon, sustainable energy system.

Uzbekistan is recommended as the pilot country for an Investment Promotion Program, which provides a template for targeted, phased investments in prioritized renewable energy subsectors. This program outlines the role of the Investment Promotion Agency across all phases, strategies to optimize the investment ecosystem, and steps for project pipeline development, screening, and investor-developer matchmaking. It also emphasizes market assessments, data collection, key performance indicators, and risk management to ensure effectiveness.

Detailed Summary

This study aims to recommend measures for improving the ecosystem for foreign investment in renewable energy in Central Asia, with a focus on wind, solar, biomass, and small-scale hydroelectric power. The geographic scope includes Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan.

The objectives of the research are to:

1. Describe the renewable energy landscape of the selected Central Asian economies.
2. Develop a framework for assessing the foreign direct investment (FDI) ecosystem for renewable energy in Central Asia.
3. Propose policies, measures, and regulations to attract more investment.
4. Conduct policy dialogues with key stakeholders.
5. Propose a pilot country for designing a comprehensive investment promotion program.
6. Offer specific policy guidelines tailored to the pilot country.

The research methodology includes:

- Reviewing previous research by relevant organizations.
- Administering a questionnaire to evaluate FDI drivers in renewable energy.
- Collecting, analyzing, and evaluating data.
- Conducting policy dialogues with key stakeholders.
- Integrating feedback into the proposed FDI framework.

Chapters 2 through 4 of the Research Report provide an overview of global and regional energy investments, as well as renewable energy metrics for 2024, based on reports from international energy agencies. These chapters highlight trends in energy investment and the adoption of renewable energy.

The Central Asian countries are at varying stages of renewable energy deployment. The region has experienced substantial growth in renewable power capacity, primarily driven by solar photovoltaic and wind power. All Central Asian countries possess significant renewable energy resources, particularly wind and solar. The report presents an overview of renewable energy generation capacity and electricity production from 2014 to 2023. The Research Report outlines a framework to assess the renewable energy FDI ecosystem in the region. It identifies 15 key determinants that collectively form the investment ecosystem for renewable energy in Central Asia:

1. Government Commitment and Institutional Support
2. Regulatory Framework and Policy Environment
3. Market Conditions and Potential
4. Investment Promotion Agencies
5. Resource Availability and Transparency
6. Grid Infrastructure
7. Market Access
8. Investment Protection
9. Financial Environment
10. In-country Skilled Workforce
11. Project Developers and Engineering, Procurement, and Construction Companies
12. Public-Private Partnerships
13. Environmental and Social Factors, Stakeholder Engagement
14. Technology and Innovation
15. Regional Cooperation

For each determinant, the Research Report provides detailed elements—202 in total—along with explanations of factors investors consider when evaluating potential investments in the region.

The framework also includes a “Scorecard” to assess each country's strengths, weaknesses, opportunities, and threats related to these factors. Chapter 5 summarizes how each country adheres to the ecosystem's key determinants. The full assessment is provided in Appendix 2. This framework serves as a comprehensive tool for evaluating the renewable energy investment ecosystem in Central Asia,

highlighting areas of progress and identifying challenges that must be addressed to attract foreign investment in the sector.

Chapter 6 outlines the strengths, opportunities, and challenges faced by each country, along with potential countermeasures. The analysis highlights varying levels of preparedness for foreign investment in renewable energy across the region, with Kazakhstan being the most advanced and Turkmenistan requiring the most development in its renewable energy sector and investment ecosystem.

Chapter 7 provides an in-depth analysis of critical topics for evaluating each country's readiness and attractiveness for foreign investments in renewable energy. The 15 categories and their 202 elements form a robust framework for this assessment, which can be considered a joint "pseudo-ecosystem" for inbound foreign investment in renewable energy in Central Asia.

Each main category is assigned a weighting to reflect its importance in the overall investment ecosystem. The individual elements within these categories also have relative weights, contributing to a comprehensive assessment of each country's strengths and weaknesses. Chapter 7 offers detailed breakdowns and scores for each country, showing the percentage of compliance with the established criteria and identifying areas where additional efforts are needed to achieve full conformity with the pseudo-ecosystem.

Chapter 7 includes radar plots and tables that illustrate how well each country adheres to the criteria. These representations facilitate comparisons between countries based on their scores across various categories, emphasizing the need for a nuanced understanding of specific barriers to investment. The chapter underscores the importance of coordinated efforts among the countries to enhance their attractiveness to foreign investors.

Kazakhstan has the highest level of compliance, with only 36 deviations (from the 202 elements described above). Although Kyrgyzstan (officially the Kyrgyz Republic) has the highest number of elements that do not comply with the criteria set for each element, 132 in total, Turkmenistan, with 117 non-compliant elements, has an overall lower score due to the relative weighting of the elements missing

or not compliant. Uzbekistan shows 70 deviations from the optimal ecosystem elements, positioning it as the second most compliant country after Kazakhstan.

By considering resource availability, technical feasibility, economic viability, and policy alignment, each country aims to leverage its unique resources to enhance energy security, attract foreign investment, guide investment focus, and promote sustainable economic growth. The prioritization of investments across renewable energy subsectors varies between countries, as discussed in Chapter 8:

Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
Wind	SHP	SHP	Solar	Solar
Solar	Solar	Solar	Wind	Wind
SHP	Wind	Wind	Biomass	SHP
Biomass	Biomass	Biomass	SHP	Biomass

Note: SHP = Small Hydropower

This study also identifies a potential country to serve as a pilot for renewable energy investment promotion programs. Chapter 9 examines the pros and cons based on specific selection criteria. This evaluation assesses a country's eligibility to become a Pilot Country based on: i) its need for external assistance to establish the joint ecosystem, ii) the scope, pace, and duration of ecosystem implementation, along with the required resources, and iii) the domestic and regional impact of the ecosystem's establishment.

Each country stands to benefit to varying degrees from becoming the Pilot Country. Kazakhstan has the shortest path to full compliance with the pseudo-ecosystem and would benefit from additional external assistance. However, the development of its renewable energy sector is expected to continue at a rapid pace even without expanded support from international development partners.

The Research Project ranks the countries based on where targeted support from

these entities would have the greatest overall impact on the Central Asian region as follows:

1. Uzbekistan
2. Tajikistan
3. Kyrgyzstan
4. Kazakhstan
5. Turkmenistan

Therefore, Uzbekistan is recommended as the Pilot Country for this study. Chapter 10 presents a template for an “Investment Promotion Program,” a structured framework designed to create a conducive environment for renewable energy investment in the selected pilot country or any other studied country.

The program outlines strategies for phased investment promotion within prioritized renewable energy subsectors, the pivotal role of an Investment Promotion Agency in all phases, measures to optimize the investment ecosystem, project pipeline development, project screening, and matchmaking between developers and investors. It also discusses the importance of market assessments, data collection and analysis, key performance indicators, and risk management strategies to ensure the program's effectiveness.

Chapter 11 details the steps deemed appropriate for transitioning from research to action in establishing a robust renewable energy investment ecosystem in the Pilot Country. Key steps include:

1. Debriefing and obtaining endorsement from participating countries and sponsors
2. Agreeing on premises and next steps with the Pilot Country, including signing a Memorandum of Understanding
3. Detailing the Investment Promotion Program
4. Securing resources for program execution
5. Implementing the program in the Pilot Country over 1–3 years
6. Maintaining support for non-pilot countries through workshops, technical assistance, and an annual Energy Transition Investment Forum

This plan emphasizes collaboration, capacity building, and ongoing support for all participating countries, with a focus on developing a successful model in the Pilot Country.

Chapter 12 provides brief considerations on various renewable energy technologies

and their potential in Central Asia. It references the “Technical and Market Report,” which complements the Research Report. The technical and market (T&M) report covers wind, solar, biomass, and small-scale hydropower, detailing core components, technological advancements, manufacturers, capacity markets, and market support mechanisms. Although the T&M and Research reports should be read together, the T&M report will be published separately due to brevity considerations.

The analytical materials developed and applied by the Research Project are included in the Appendices: i) Questionnaire, ii) Country Scorecard, iii) Pseudo-Ecosystem, and iv) references relevant to the characterization of the key determinants of the ecosystem defined in Chapter 5.1.

Investment Promotion Entities

Kazakhstan:

KAZAKH INVEST serves as a “one-stop shop” for foreign investors, supporting them throughout the investment lifecycle, including project identification, partner search, site selection, and aftercare. The agency operates through regional offices in Kazakhstan and representative offices abroad. KAZAKH INVEST collaborates closely with government bodies to streamline processes and advocate for investor-friendly policies. Although experienced in assisting investors, its historical focus on extractive industries may limit its expertise in renewable energy.

Kyrgyzstan:

The National Investment Agency is the primary body responsible for investment promotion, offering services such as information dissemination, legal and regulatory assistance, and facilitation of meetings with government officials. However, Kyrgyzstan's investment promotion structure is decentralized, with several other government bodies involved in attracting and facilitating foreign investment. This fragmented approach can sometimes lead to overlapping functions and a lack of clear guidance for investors. The country has limited experience with large-scale FDI.

Tajikistan:

The State Committee on Investments and State Property Management, through its State Unitary Enterprise “Tajinvest,” serves as the main investment promotion agency. Tajinvest works to attract FDI by providing information about investment opportunities, assisting with registration processes, and facilitating communication between investors and government bodies. However, Tajikistan lacks a specialized agency for renewable energy investment promotion, resulting in gaps in support throughout the investment lifecycle.

Turkmenistan:

Turkmenistan does not have a dedicated, independent investment promotion agency. Investment promotion is primarily handled by the Ministry of Finance and Economy’s Department for Foreign Economic Relations and Development. The country's approach to attracting foreign investment is highly centralized, focusing mainly on strategic partnerships in the oil and gas sector. Information about investment procedures and opportunities is often not readily available or transparent.

Uzbekistan:

The UzIPA, under the Ministry of Investment, Industry, and Trade (MIIT), is the main body responsible for investment promotion. UzIPA functions as a one-stop shop for investment promotion, information provision, project development assistance, and coordination. Despite efforts to attract investors through forums, international outreach, and targeted engagement, UzIPA faces challenges related to capacity, bureaucratic processes, and coordination with other government entities. To address these challenges, UzIPA is currently developing a Single Window system, which will cover investor registration, business setup, project showcasing, and appeals management. However, further efforts and capacity building are necessary to effectively mobilize and facilitate foreign investors in the renewable energy sector.

01

CHAPTER ONE

1. Introduction

1.1 Background and Rationale

Central Asian economies face significant climate-related challenges due to their geographical vulnerabilities and historical reliance on fossil fuels for energy generation, as well as water and resource scarcity, both within and between countries in the region.

Climate change is driven primarily by increasing global and national greenhouse gas (GHG) emissions. Historically, the Central Asian economies have been energy-intensive, with relatively high emissions due to factors such as outdated infrastructure, inefficient energy use, and an economic structure heavily reliant on energy-intensive industries. Additionally, pricing signals to encourage energy conservation are not widely implemented. Energy intensity is a critical indicator of energy efficiency and requires improvement across the region. There is currently a lack of coherent energy policies and governance frameworks to promote energy efficiency and renewable energy adoption.

Despite these challenges, the region has committed to reducing emissions by 10% to 25% by 2030, contingent upon international assistance, as part of the COP process. Transitioning from fossil fuels to renewable sources will necessitate substantial investments. To reduce GHG emissions and promote sustainable regional development, it is essential to focus on cleaner energy sources, improving energy efficiency, and implementing climate mitigation strategies. This requires the creation of a conducive investment environment for renewable energy production, infrastructure, and energy efficiency initiatives.

This study examines the factors influencing renewable energy investments in Central Asia and proposes strategies to propose an inclusive renewable energy investment ecosystem. The geographic scope includes Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. The research aims to produce a report detailing the renewable energy landscape in these countries, covering the current status, recent developments, potential, and outlook for wind, solar, small-scale hydropower, and biomass.

The study will also analyze policy deficiencies and propose recommendations for attracting investment into the renewable energy sectors of these countries. A tailored investment framework will be developed for a pilot country to design a comprehensive investment promotion program for specific renewable energy subsectors in that country's investment environment.

1.2 Study Objectives

The objectives of this Research Project are:

- To establish renewable energy profiles for the selected Central Asian economies;
- To develop a framework for assessing the foreign direct investment (FDI) ecosystem for renewable energy in Central Asia;
- To propose key policies, measures, and regulations that Central Asian governments can adopt to attract more investment into renewable energy (the FDI Ecosystem(s));
- To facilitate policy dialogue with key stakeholders from the selected countries and disseminate the consensus reached as part of the proposed FDI framework;
- To identify a pilot country for designing a comprehensive investment promotion program for selected renewable energy subsectors, based on objective prioritization criteria;
- To provide specific policy guidelines customized to the pilot country.

1.3 Scope and Limitations

The deliverables of the Research Project are as follows:

1. The **Report**, including a description of the renewable energy landscape in the selected Central Asian countries, an assessment of the FDI ecosystem, and associated SWOT analysis (strengths, weaknesses, opportunities, and threats);
2. **Policy Briefs**, published along with the Research Report, detailing the most important policies, measures, and regulations that governments can adopt to attract more investment into renewable energy;

3. A proposal for selecting a **pilot country**, for which an investment promotion program for selected renewable energy subsectors will be developed;
4. Specific policy recommendations tailored to the pilot country (**Pilot Country Guidelines**), addressing investment details that may not be covered by the general policy briefs.

Limitations:

1. **Renewable Energy Sector Maturity:** The countries studied are at varying stages of developing their renewable energy sectors, making it challenging to identify common factors for a unified FDI ecosystem.
2. **Dialogue:** Due to the vast geographical scope and limited time, conducting in-depth dialogues with all relevant stakeholders has proven difficult.

1.4 Methodology

The Project involved reviewing prior research by relevant organizations and administering a questionnaire to assess FDI drivers in renewable energy across the Central Asian countries included in the study.

The methodology includes the following steps:

- Review of prior research conducted by organizations such as the Central Asia Regional Economic Cooperation (CAREC) Institute, Islamic Centre for the Development of Trade, Islamic Development Bank (IsDB), International Renewable Energy Agency (IRENA), International Energy Agency (IEA), and other regional and international bodies, including Multilateral Development Banks (MDBs) and UN Agencies/Regional Commissions;
- Review of relevant publications in reputable international journals and periodicals;

- Administration of a questionnaire to evaluate the core drivers of FDI into renewable energy in the Central Asian context;
- Data collection, analysis, and evaluation;
- Conducting policy dialogue with key stakeholders from the selected countries, followed by dissemination and discussion of the proposed outputs;
- Incorporating feedback from the policy dialogue into the proposed FDI framework.



02

CHAPTER TWO

2. Global Energy Investment

The IEA published its latest "World Energy Investment" report in June 2024, which provides a global benchmark for tracking capital flows in the energy sector. In 2024, global investment in clean energy technologies is expected to be nearly double that in fossil fuels, pushing overall energy investment above \$3 trillion for the first time.

Since 2020, the clean energy sector has experienced accelerating growth. In 2024, an estimated \$2 trillion will be spent on clean energy technologies and infrastructure. This investment will be distributed as follows: renewable power (\$771 billion), grids and storage (\$452 billion), efficiency improvements and end-use (\$669 billion), nuclear and other clean power (\$80 billion), and low-emissions fuels (\$31 billion).

Spending on renewable power, grids, and storage now exceeds total spending on oil, gas, and coal. The cost of solar panels has decreased by 30% over the last two years, stimulating their deployment. For electricity generation, investment in solar photovoltaic (PV) technology now surpasses all other generation technologies combined. In 2024, \$503 billion will be invested in solar PV, compared to \$426 billion for all other generation technologies.

The integration of renewables and upgrades to existing infrastructure have spurred a recovery in spending on grids and storage. In 2024, expenditures are expected to reach \$400 billion for grids and \$50 billion for storage. However, significant investment imbalances persist; emerging markets and developing economies outside of advanced economies and China account for only 15–20% of global clean energy spending.

This year's report also offers a first-of-its-kind analysis of investment sources and financing in the energy sector. The capital structure of global energy sector investments has remained stable since 2015. Currently, debt constitutes approximately 46% of total spending, while equity accounts for 54%. However, certain parts of the sector, such as clean electricity, are more reliant on debt than others.

Although global interest rates are decreasing, the era of cheap borrowing appears to be ending. Certain investments are being constrained by higher financing costs. However, the impact on project economics has been partially offset by easing supply chain pressures and falling prices post-COVID-19.

Another key observation from the report is the increasing role of households in energy investment. While corporations still account for the largest share, the proportion of energy investment from households has doubled since 2015, driven by accelerated clean energy transitions. This includes investments in rooftop solar, energy efficiency improvements, heat pumps, and electric vehicles, with some support from governments.

The background is a vibrant green with a gradient from a lighter shade at the top to a darker shade at the bottom. It features several large, overlapping, wavy shapes in different shades of green. Thin, white, curved lines sweep across the background, adding a sense of motion and depth. In the center, the number '03' is displayed in a large, bold, white font with a slight 3D effect and a gradient.

03

CHAPTER THREE

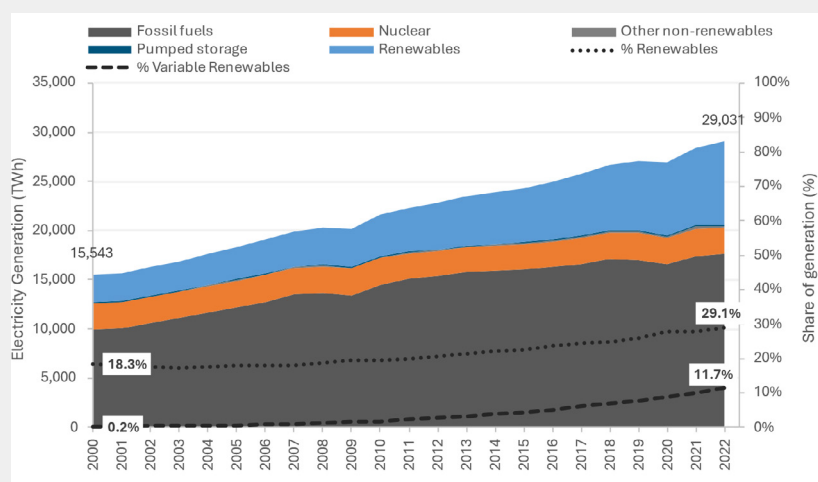
3. Global Renewable Energy Metrics

The IRENA released its latest “Renewable Energy Highlights” report in July 2024, presenting key findings related to electricity generation by source and region for 2022 and electricity capacity for 2023, along with historical trends.

Electricity generation

In 2022, global electricity generation from all sources totaled 29,031 TWh. Renewable energy sources contributed 29.1%, amounting to 8,440 TWh, while fossil fuels, nuclear energy, pumped storage, and other non-renewables accounted for the remaining 70.9% (20,591 TWh). Figure 3-1 illustrates this breakdown.

Figure 3-1: Global Electricity Generation

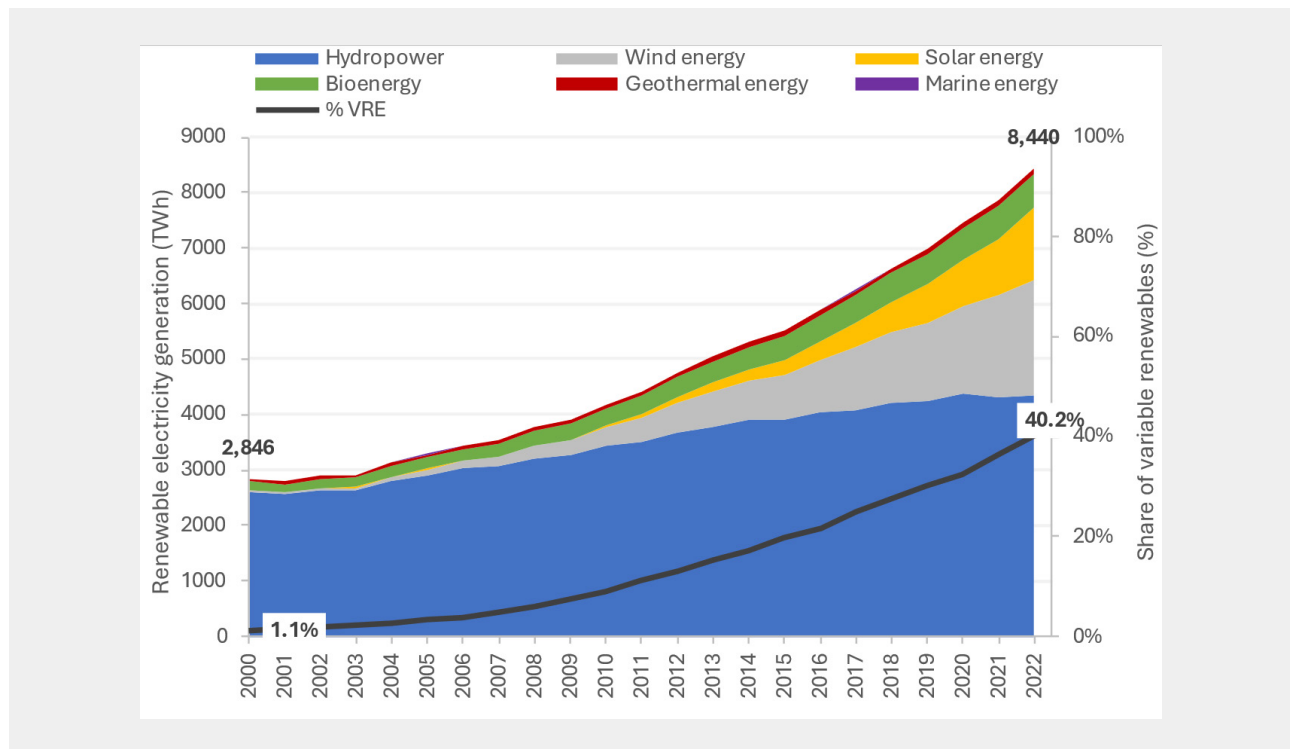


IRENA: “Renewable energy highlights”, 11 July 2024

Total electricity generation has increased by 2.4% annually since 2011, with renewables growing at a rate of 6.1%, while non-renewables increased by 1.3%. In 2022 alone, renewable electricity generation grew by 7.2% compared to 2021. Since 2010, the most significant growth in renewable electricity has been driven by solar and wind energy (variable renewables), which represented 11.7% of the global electricity mix in 2022, a growth of 18.2% from 2021.

Hydropower continues to provide the majority of renewable electricity, generating 4,330 TWh in 2022, as shown in Figure 3-2. However, variable renewables have steadily increased their share of the global electricity mix, growing from 1.1% of renewable generation in 2000 to 40.2% in 2022, with 3,392 TWh combined. From 2021 alone, wind generation increased by 14.0%, while solar generation rose by 25.6%. Bioenergy, geothermal, and marine energy contributed the remaining 717 TWh in 2022.

Figure 3-2: Global Renewable Electricity Generation



IRENA: “Renewable energy highlights”, 11 July 2024

Capacity

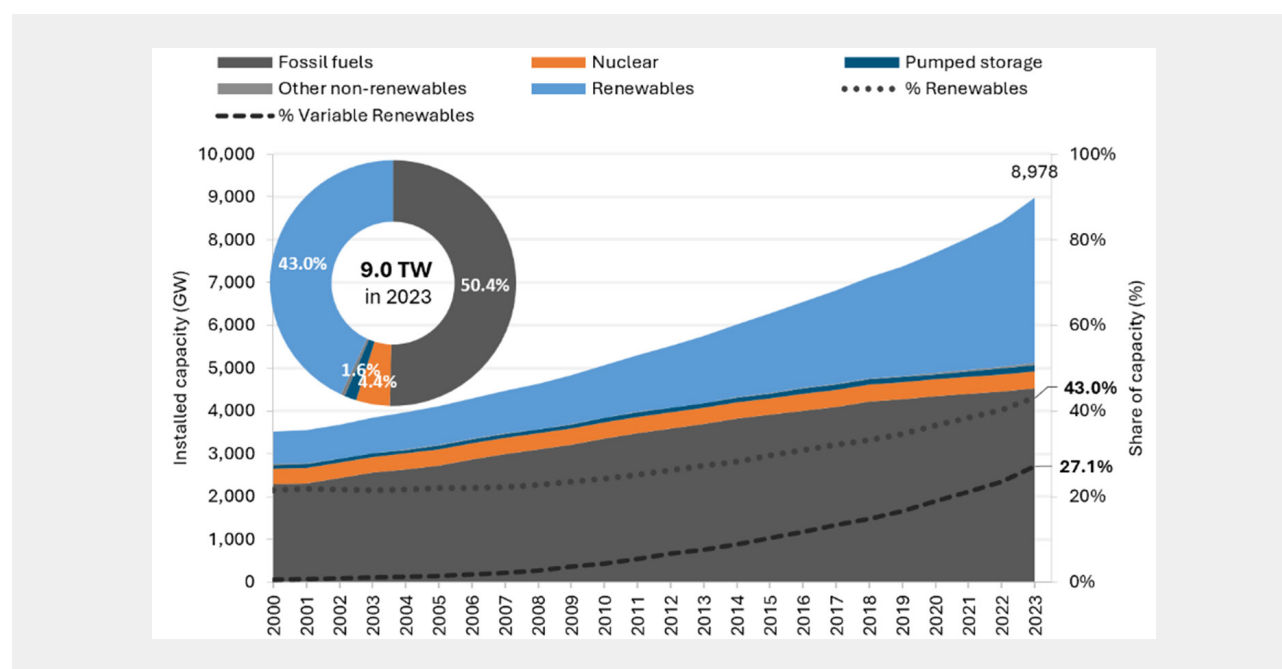
IRENA’s latest statistics (Summer 2024 edition), as shown in Figure 3-3, indicate that global renewable generating capacity reached 3,865 GW in 2023, representing 43.0% of the total global capacity of 9.0 TW, including non-renewables. This marks a 14.0% increase from 2022, continuing a trend of 10.0% compound annual growth

from 2017 to 2023. Within renewables, variable renewable energy (solar and wind) capacity grew by 23.4% in 2022, accounting for 27.1% of total capacity.

The remaining installed capacity consists of 4.5 TW (50.4%) from fossil fuels, 398 GW (4.4%) from nuclear energy, 142 GW (1.6%) from pumped storage, and 45 GW (0.5%) from other non-renewables. This trend highlights renewables as the fastest-growing capacity source, contrasted with a slowdown in non-renewables and the decommissioning of fossil fuel plants in several countries.

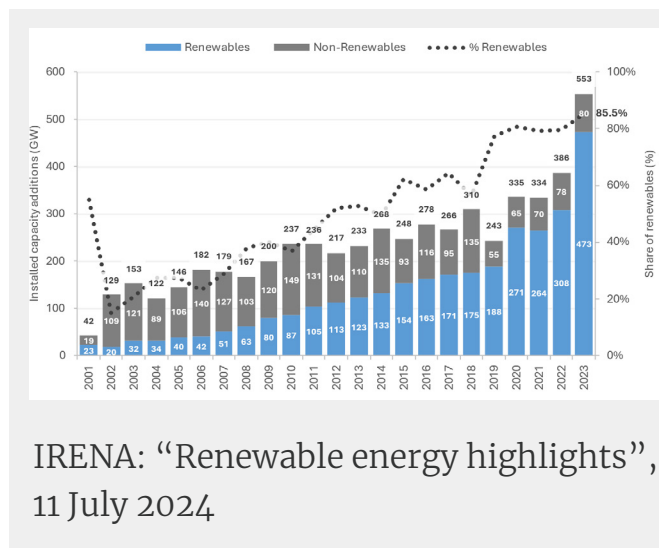
In 2023, solar energy represented the largest share of renewable capacity at 36.7% (1,418 GW), followed by hydropower (32.7%), wind energy (26.3%), bioenergy (3.9%), and smaller contributions from geothermal and marine energy. The combined share of wind and solar now represents 63.0% of renewable capacity, signifying a shift toward these more intermittent sources. Solar energy is likely to maintain its dominance in the coming years, as reflected in its contribution of 347 GW of the 473 GW of renewable power additions in 2023.

Figure 3-3: Global Installed Electricity Capacity



IRENA: "Renewable energy highlights", 11 July 2024

Figure 3-4: Global Installed Electricity Capacity – Annual Additions

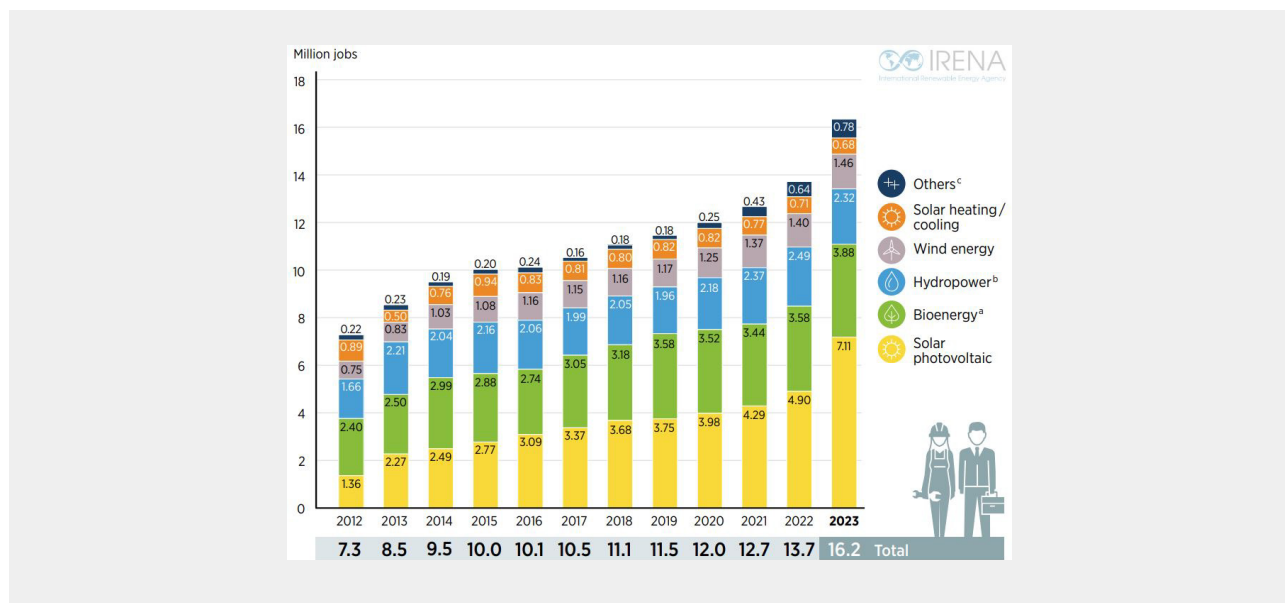


Renewable capacity additions reached a record 473 GW in 2023, marking a significant increase over the past 23 years. The share of renewables in total annual capacity additions has steadily risen, reaching 85.5% in 2023. In contrast, non-renewable capacity additions have remained relatively stable or declined, staying below 80 GW annually since 2019, as shown in Figure 3-4.

Jobs

In October 2024, IRENA and the ILO released the "Renewable Energy and Jobs – Annual Review 2024" (Figure 3-5). The renewable energy sector saw its largest annual increase in employment, rising from 13.7 million jobs in 2022 to 16.2 million in 2023. This compares to an estimated 7.3 million jobs in 2012.

Figure 3-5: Global Jobs in Renewables



China

China's energy landscape is critical to global trends. As of June 2024, for the first time, wind and solar energy in China collectively surpassed coal in capacity, according to data from the National Energy Administration, with energy consultant Rystad Energy forecasting that solar alone will exceed coal capacity by 2026, with a cumulative capacity of 1.38 TW—150 GW more than coal.

Historically, coal installations dominated at around 50 GW annually before 2016. However, since 2020, wind and solar installations have consistently surpassed 100 GW annually, tripling or even quadrupling coal additions. In 2023, China installed a record 293 GW of wind and solar power. Conversely, China's coal power sector is shrinking. In 2023, about 40 GW of coal power was added, but this dropped to just 8 GW in the first half of 2024. Efforts are now focused on phasing out smaller coal plants, upgrading existing ones to reduce emissions, and imposing stricter standards on new projects. By early 2024, the gap between coal and renewable energy capacity additions had widened significantly, with renewables leading by a 16-fold margin.

Europe and US (and the World)

In the first half of 2024, wind and solar energy accounted for 30% of the European Union's electricity generation, surpassing fossil fuels in more than half of the EU member states. Despite growing demand and electricity prices returning to pre-pandemic levels, fossil fuels produced 17% less electricity than the previous year, contributing to a historic low of 27% of the EU's total electricity generation. Analysts¹ suggest that this marks a "permanent structural change," driven by the large-scale deployment of renewable capacity. However, integrating these new resources into the grid remains a challenge.

In the United States, wind and solar generation exceeded coal generation for the first time in the first seven months of 2024, according to federal data. Renewables' combined production of 393 TWh in 2024 outpaced coal generation, which totaled 388 TWh. This growth has been fueled by a surge in solar production, with utility-scale solar facilities generating 118 TWh through July 2024—an increase of 36% over the same period the previous year. Wind energy production also grew by 8%, reaching 275 TWh.

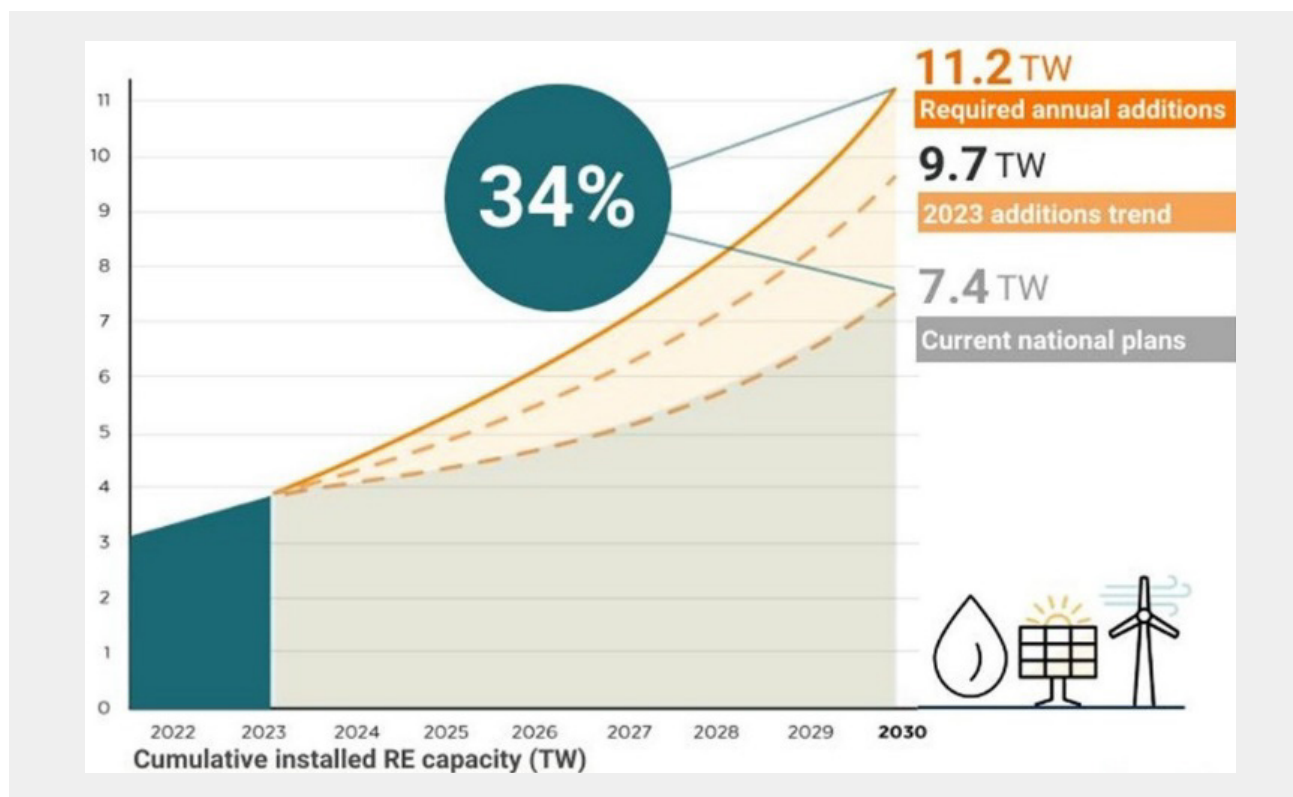
In the United Kingdom, the last coal-fired power plant was decommissioned in September 2024, ending 140 years of coal use in electricity generation.

According to the IEA's "Energy Snapshot" (September 2024), global solar PV capacity tripled between 2018 and 2023, altering global electricity generation patterns. Solar PV, alongside hydropower and wind power, is expected to generate more electricity than coal in 2025, marking a historic first.

COP

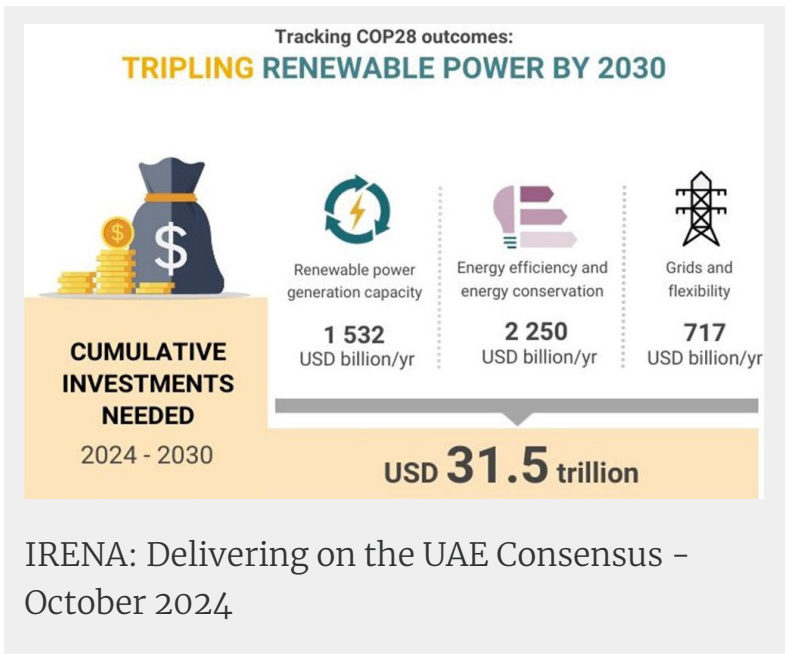
Despite a 14.0% increase in renewable capacity additions in 2023, the largest annual growth since 2000, this rate is insufficient to meet the COP28 target of tripling renewable capacity to at least 11 TW by 2030. If the growth rate from 2023 continues, the world will only reach 9.7 TW by 2030, falling 1.5 TW (13.5%) short of the target.

Figure 3-6: Gaps from the UAE Consensus



IRENA: Delivering on the UAE Consensus October 2024

Figure 3-7: Cumulative Investments Needed for COP28 Compliance



If the historical growth rate of 10.0% since 2017 persists, the world would achieve only 7.5 TW, missing the target by 3.7 TW (32.6%). To meet the COP28 target, an annual growth rate of at least 16.1% from 2022 to 2030 is required. This necessitates an even faster growth rate of 16.4% per year for the remaining seven years of the target period (2024-2030).

However, as renewable power capacity grows globally, electricity generated from technologies like solar panels and wind turbines is increasing rapidly. The IEA predicts that, by 2025, renewables will surpass coal in global electricity production for the first time. Additionally, IEA's "2024 Electricity Mid-Year Update" indicates that global electricity generation from solar PV and wind is expected to surpass that from hydropower in 2024 for the first time.

Commercial Heat

Commercial heat lags behind electricity in renewable energy adoption. The share of renewable energy in global heat generation rose from 2.5% in 2000 to 6.3% in 2022, with bioenergy contributing 91.6% of this share. The remaining 93.7% of heat generation is primarily derived from fossil fuels. Geothermal and solar thermal energy also make modest contributions to renewable global heat generation.

Europe leads in renewable heat generation, accounting for 92.1% of global renewable heat and 10.7% of the total heat generated in the region. In Asia, 6,351 PJ of heat was generated in 2022, but less than 1% of this came from renewable sources. Renewable heat generation in Central Asia is negligible.

04

CHAPTER FOUR

4. Renewable Energy Characteristics in Central Asia

4.1 The Region

The countries of Central Asia are at various stages of deploying and preparing for the large-scale implementation of renewable energy. The region has seen significant growth in renewable energy capacity in recent years, primarily driven by solar photovoltaic (PV) and wind power. However, a disparity exists between hydrocarbon-rich countries (Kazakhstan, Turkmenistan, and Uzbekistan) and hydrocarbon-poor but hydro-rich countries (Kyrgyzstan and Tajikistan) in terms of non-hydro renewable energy development.

Central Asia generally exhibits higher energy intensity compared to many other regions, due to factors such as outdated infrastructure, inefficient energy use, and an economic structure historically reliant on energy-intensive industries. Furthermore, pricing signals to encourage energy conservation are not widely implemented.

Energy intensity is a critical indicator of energy efficiency and requires improvement across the Central Asian economies. A lack of coherent energy policies and governance frameworks hampers progress in both energy efficiency and renewable energy adoption. While the Kyrgyz Republic and Tajikistan exhibit relatively low GHG emissions due to their significant use of hydropower, Kazakhstan, Turkmenistan, and Uzbekistan have high emissions, primarily due to their dependence on fossil fuels.

Despite high energy intensities and GHG emissions in some countries, the potential for improvement is considerable through the adoption of renewable energy and energy efficiency measures. These countries have recognized this potential and made pledges at COP meetings to reduce emissions by 10% to 25% by 2030, contingent on international assistance.

Transitioning to renewable energy, enhancing energy efficiency, and implementing

climate mitigation strategies are essential for reducing GHG emissions and promoting sustainable development in the region.

All Central Asian countries possess substantial renewable energy resources, particularly in wind and solar, where developments are accelerating but remain largely untapped. Kyrgyzstan and Tajikistan have vast, underdeveloped hydro resources that could be harnessed for both domestic use and regional electricity trade.

In addition to abundant renewable energy resources, common factors across these economies include a commitment to reducing CO₂ emissions and a desire to diversify their energy mix away from fossil fuels.

Key Facts:

- **Combined population:** Approximately 79.1 million (2023–2024)
- **Combined GDP:** Approximately \$385 billion (2022–2023)
- **Diverse renewable energy potential across the region**
- **Varying levels of renewable energy development** and targets among countries
- **Regional initiatives:** CASA-1000, Central Asian Power System

Strengths:

1. Abundant and diverse renewable energy resources
2. Growing government commitments to renewable energy development, carbon neutrality strategies, and transitioning to a “green” economy
3. Significant progress in developing local sustainable finance markets
4. Increasing interest from international investors and development partners
5. Existing regional energy cooperation frameworks
6. Potential for cross-border electricity trade
7. Climate funding for mitigation greatly exceeds adaptation finance, accounting for approximately 70% of total climate finance in the region

Weaknesses:

1. Underinvestment in energy infrastructure by governments
2. Lack of international investment due to perceived country risks and inadequate regulatory frameworks
3. Varying levels of regulatory development and consistency across countries
4. Heavy dependence on fossil fuels in some countries
5. Aging, inefficient, and insufficient grid infrastructure for regional integration
6. Limited regional electricity trade market
7. Skills gaps in renewable energy technologies
8. Ongoing concerns about water-sharing agreements between riparian countries
9. Lack of transparency and insufficient data sharing
10. Inadequate development of environmental and social safeguards

Opportunities:

1. Development of a regional renewable energy market
2. Harmonization of renewable energy policies and regulations
3. Joint development of large-scale renewable energy projects
4. Knowledge sharing and technology transfer within the region, including between authorized bodies and relevant information-sharing platforms
5. Attraction of international investment through coordinated efforts
6. Development of regional supply chains for renewable energy technologies
7. Reduced GHG emissions based on the goals set in the Paris Agreement, ratified by each country
8. Accelerated transition from fossil-fuel generation to renewable energy in each country

Threats:

1. Climate change impacts on water resources and energy infrastructure, affecting regional water sharing and land management
2. Geopolitical tensions hindering regional cooperation
3. Competition from external powers in the energy sector
4. Economic volatility affecting investment stability

4. Economic volatility affecting investment stability
5. Uneven development of renewable energy sectors, creating regional imbalances
6. Insufficient government budgets and development funds for greenfield and brownfield renewable energy projects

Policy Implications for the Region:

1. Develop a coordinated regional strategy for renewable energy development
2. Harmonize renewable energy policies and regulations across the region
3. Invest in regional grid infrastructure to support increased renewable energy integration and cross-border trade
4. Establish a regional platform for knowledge sharing and capacity building in renewable energy technologies
5. Create a regional investment fund or mechanism to support renewable energy projects
6. Implement coordinated climate change adaptation strategies for the energy sector
7. Develop regional standards for environmental and social impact assessments in renewable energy projects
8. Foster regional cooperation in the research and development (R&D) of renewable energy technologies
9. Establish a regional renewable energy association to promote industry interests and coordination
10. Develop a regional strategy for securing critical raw materials required for renewable energy technologies

International Renewable Energy Agency

IRENA published its "Renewable Energy Statistics 2024" in July 2024, providing detailed statistics on electricity generation capacity by energy source and country for 2023, as well as electricity production for 2022. These statistics cover the countries included in the Research Project commissioned by the CAREC Institute and address renewable energy subsectors including hydropower, wind, solar, bioenergy, solid

biofuels, and biogas. The accumulated renewable energy generation capacity for the studied countries and the region as a whole over the last decade, as of the end of 2023, is shown in Table 4-1:

Table 4-1: Accumulated Renewable Energy Capacity in Central Asia

Capacity (MW)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Kazakhstan	2734	2807	2851	2898	3088	3606	4190	4536	5069	5663
Kyrgyzstan	3671	3677	3677	3689	3673	3673	3674	2780	2780	3210
Tajikistan	4983	4983	4 983	4983	4984	5 744	5744	5745	5763	5763
Turkmenistan	1	1	1	1	1	1	1	2	2	2
Uzbekistan	1872	1882	1883	1861	1919	1912	2025	2156	2478	2668
Total	13261	13350	13395	13432	13665	14936	15634	15219	16092	17306

MW= Megawatt

Source: IRENA

Table 4-2 presents IRENA's statistics on renewable electricity production from 2013 to 2022.

Table 4-2: Accumulated Renewable Energy Generation in Central Asia

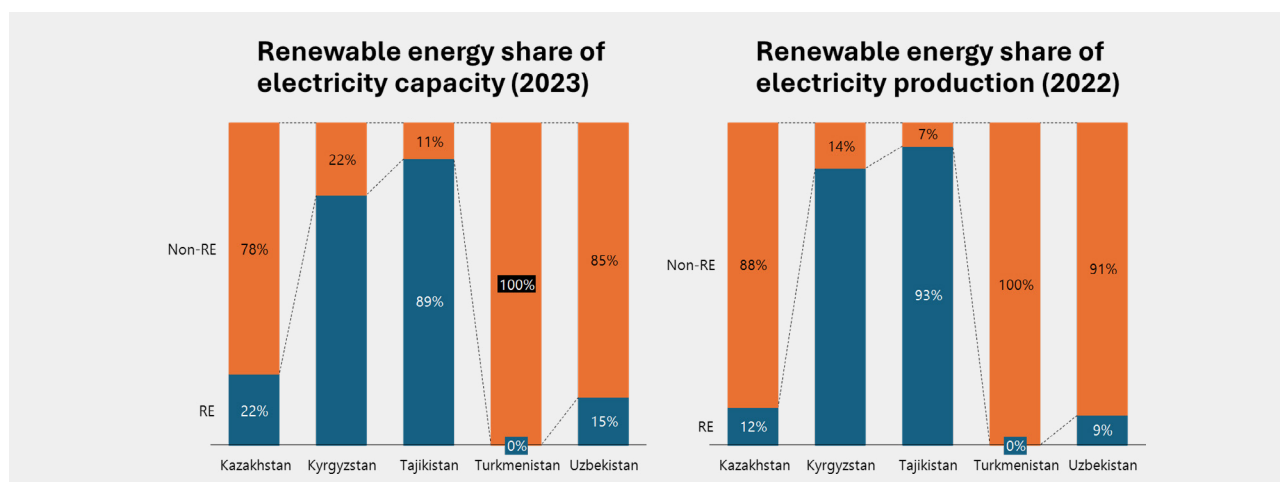
Production (GWh)	2014	2015	2016	2017	2018	2019	2020	2021	2022
Kazakhstan	8321	9 488	12030	11694	11024	11304	12122	12 656	13259
Kyrgyzstan	13298	11093	11498	14204	14318	13859	13979	12957	11929
Tajikistan	16312	16900	16803	17312	18573	19348	19 348	19348	19879
Turkmenistan	3	3	3	3	3	3	3	3	3
Uzbekistan	8102	8102	8105	8106	5904	6468	5016	5050	6936
Total	46036	45586	48439	51319	49822	50982	50468	50014	52006

GWh= Gigawatt hours

Source: IRENA

While the renewable energy share of total electricity capacity has increased in Kazakhstan and Uzbekistan over the last decade, it has slightly decreased in Kyrgyzstan and Tajikistan. As shown in Figure 4-1, notable differences exist among the studied countries.

Figure 4-1: Renewable Energy Share of Electricity Capacity and Generation in Central Asia



Fluctuating climatic conditions have caused the actual renewable energy share of total electricity generation to vary, particularly in Kazakhstan and Uzbekistan, highlighting the intermittent nature of renewable energy and the need for additional baseload support to maintain a stable electricity supply.

Tables 4-3 and 4-4 demonstrate how the renewable energy share of both electricity capacity and generation has varied in each country over the last decade.

Renewable energy share of electricity capacity in the studied countries:

Table 4-3: Renewable Energy Share of Electricity Capacity in Central Asia

CAP (%MW)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Kazakhstan	13.1	13.2	12.9	13.1	13.7	15.6	17.7	18.9	20.7	21.9
Kyrgyzstan	82.3	85.3	85.3	85.4	85.3	85.3	85.3	75.1	75.1	77.6
Tajikistan	92.3	92.3	87.4	87.4	87.4	88.9	88.9	88.9	88.9	88.9
Turkmenistan	-	-	-	-	-	-	-	-	-	-
Uzbekistan	14.4	14.2	13.3	12.9	13.5	12.0	12.2	13.0	14.0	14.9

MW: Megawatt

Source: IRENA

Renewable energy share of electricity production:

Table 4-4: Renewable Energy Share of Electricity Generation in Central Asia

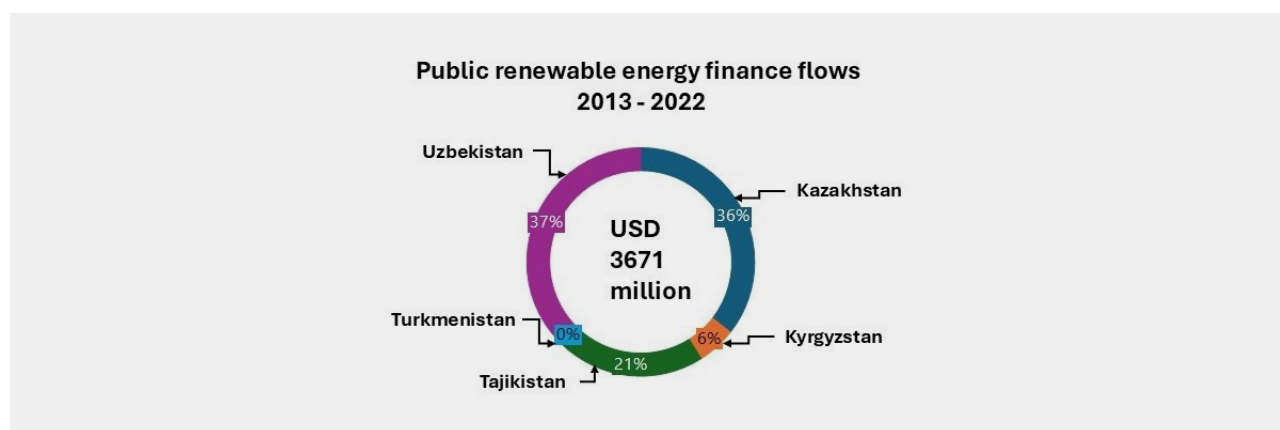
PROD (%GWh)	2014	2015	2016	2017	2018	2019	2020	2021	2022
Kazakhstan	8.7	10.3	12.7	11.3	10.3	10.6	12.5	11.0	11.7
Kyrgyzstan	91.4	85.2	87.6	91.9	91.0	91.7	90.7	85.6	85.9
Tajikistan	98.1	98.0	96.3	94.4	93.2	92.8	92.8	92.8	92.8
Turkmenistan	-	-	-	-	-	-	-	-	-
Uzbekistan	16.0	16.0	13.9	13.5	10.1	11.2	9.5	7.7	9.3

PROD= Production , GWh= Gigawatt hours

Source: IRENA

According to IRENA, total public renewable energy finance flows to Central Asia from 2013 to 2022 amounted to nearly USD3.7 billion. The share allocated to each country is displayed in Figure 4-2.

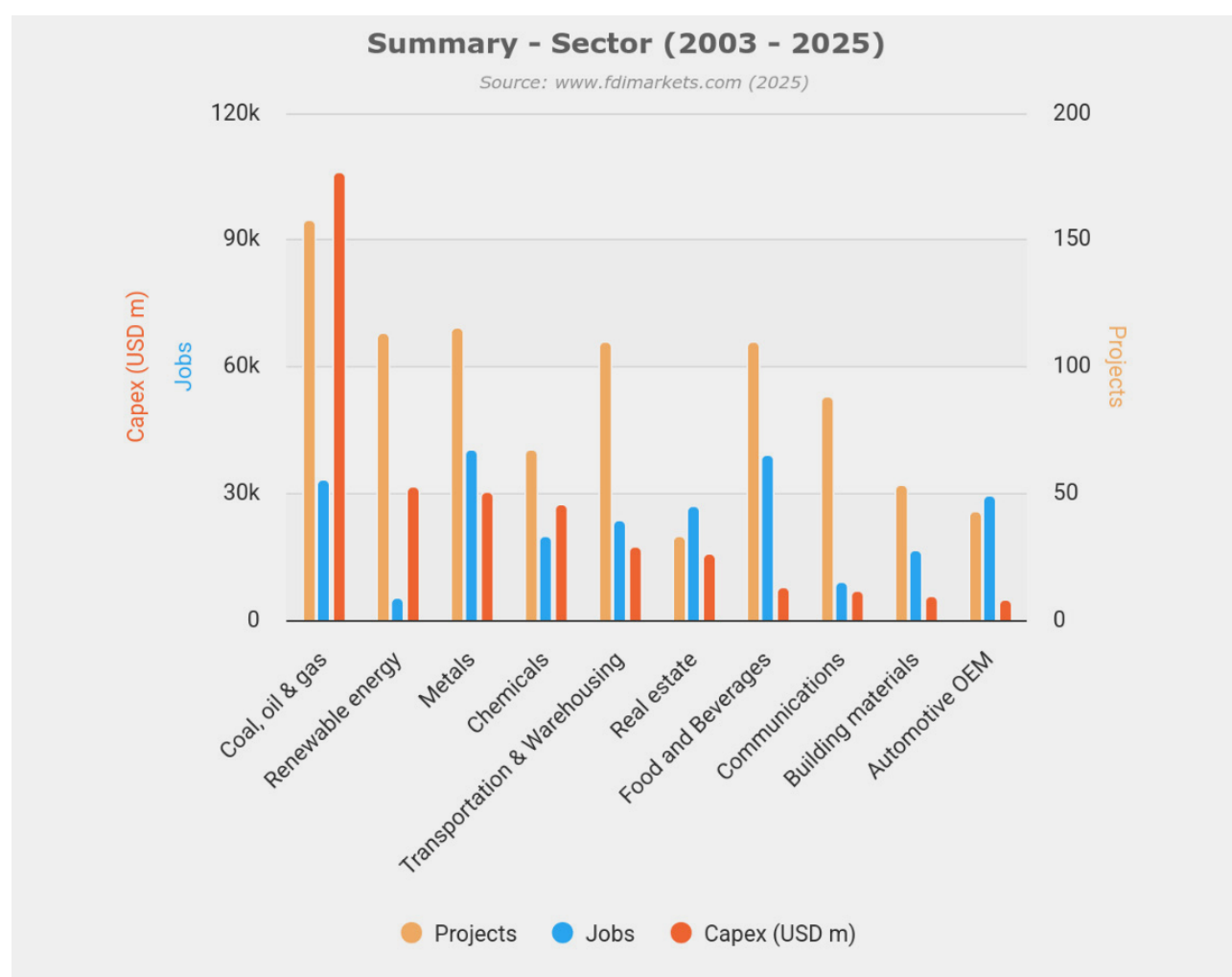
Figure 4-2: Renewable Energy Finance Flows in Central Asia



Source: IRENA

Renewable energy is the second highest sector in which Central Asian countries received FDI from January 2003 to March 2025. Figure 4-3 reports that the renewable energy sector witnessed 113 projects valued at USD 31.642 billion, creating 5,346 jobs, and involving 62 companies. Uzbekistan is the largest recipient, attracting USD 17.794 billion, representing approximately 56% of the total renewable FDI. Kazakhstan follows with USD 8.668 billion (27%), while Tajikistan received USD 3.026 billion (10%). Kyrgyzstan and Turkmenistan attracted relatively minor shares, with USD 1.825 billion (6%) and USD 330 million (1%) respectively. This distribution highlights Uzbekistan and Kazakhstan as the dominant hubs for renewable energy investment in the region.

Figure 4-3: Top 10 Sectors of FDI Inflows in Central Asia



Source: Financial Times data

Table 4-5 presents the distribution across countries and years.

Table 4-5: Renewable Energy Finance Flows in Central Asia

\$ million (2021)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Kazakhstan	0.02	40.88	53.08	50.22	164.22	274.25	647.16	29.82	45.07	0.41	1305,13
Kyrgyzstan	14.70	-	0.03	41.85	1.36	0.08	94.38	0.07	-	50.62	203,09
Tajikistan	146.85	0.46	0.20	0.10	365.93	-	116.46	49.99	53.72	47.88	781,59
Turkmenistan	6.48	0.05	0.13	0.09	0.07	-	0.04	-	0.03	2.46	9,35
Uzbekistan	214.91	-	0.30	0.76	67.68	1.04	2.15	227.46	102.00	756.22	1372,52
Total	382,96	41,39	53,74	93,02	599,26	275,37	860,19	307,34	200,82	857,59	3671,68

Source: IRENA

United Nations Economic Commission for Europe

The 2023 United Nations Economic Commission for Europe (UNECE) Carbon Neutrality Toolkit highlights that the region requires approximately \$1.4 trillion in investment between 2020 and 2050 to transition to a net-zero emissions scenario by 2050. This transition will necessitate increased investment in the development of new generation capacity for hydro, solar, and wind power plants, as well as upgrades to water treatment facilities.

Although the total expenditure is substantial, the analysis suggests that the transition to net-zero emissions by 2050 would only require a marginal increase in overall energy spending compared to a business-as-usual (BAU) scenario. Specifically, the shift to net-zero would require a 2.15% increase in total energy

investment relative to the BAU scenario, which amounts to an additional 0.07% annually.

This indicates that the renewable energy transition in Central Asia is economically feasible, provided there is appropriate redirection of investments and policy support.

The primary investment areas identified are:

- Renewable energy production and storage
- Electricity transmission and distribution, with adjustments for renewable energy integration
- Energy efficiency measures

UNECE estimates that over \$255 billion will be required between 2020 and 2050 to upgrade electricity grid capacity to support a 75% share of intermittent renewable energy sources in the electricity mix by 2050. This investment would enable a 175% improvement in electricity transmission, distribution, and storage capabilities.

Total Cost of Electricity / Full Cost of Electricity

The traditional definition of Levelized Cost of Energy (LCOE) typically focuses on the cost of the electricity-generating facility itself, including the capital expenditures (Capex) and operating expenditures (Opex) associated with these facilities. Investment decisions in electricity generation have often been based solely on the LCOE.

However, to provide a more comprehensive and accurate metric, LCOE should include additional costs such as grid upgrades, environmental impacts, and social costs. This expanded definition is referred to as the Total Cost of Electricity (TCOE) or Full Cost of Electricity and includes:

- **Grid Upgrade Costs:** These encompass expenses related to enhancing transmission and distribution infrastructure to accommodate new renewable energy sources. This includes constructing new transmission lines, substations,

and other infrastructure necessary for the reliable integration of renewable energy into the grid.

- **Environmental Costs:** These account for the environmental impacts of energy projects, including land-use changes, water usage, and emissions. They also cover costs associated with mitigating pollution, managing waste, and addressing the lifecycle environmental impacts of renewable energy technologies, such as the production and disposal of solar panels and wind turbines.
- **Social Costs:** These costs relate to the socio-economic impacts on local communities, including displacement, land-use changes, effects on local economies and employment, and potential health consequences associated with energy production and consumption.
- **System Integration Costs:** These include the additional expenses involved in integrating renewable energy into the existing energy system, such as balancing supply and demand, maintaining grid stability, and ensuring a reliable energy supply.

Incorporating these factors into the LCOE requires a more comprehensive approach that accounts for externalities, offering a fuller picture of the true cost of energy generation.

Overall, while Central Asian countries are making progress in renewable energy investment, fully accounting for all associated costs remains a complex challenge. This task requires coordinated policy efforts, investments in infrastructure, and careful consideration of environmental and social impacts. These considerations are especially important for renewable energy, even more so than for traditional energy sources, yet they have only been partially addressed by the Central Asian economies.

International Support

International institutions, such as the Asian Infrastructure Investment Bank (AIIB), the Asian Development Bank (ADB), the European Bank for Reconstruction and Development (EBRD), and the IsDB, along with other development partners like the European Union, the United States, and China, can offer technical and financial assistance. Their support can help improve energy statistics and planning, as well as facilitate investments in renewable energy facilities, which are crucial for

enhancing energy management and efficiency in the region.

Leveraging climate finance instruments from MDBs could further accelerate the region's transition to a low-carbon economy.

4.2 The Countries

Kazakhstan

Kazakhstan has made substantial progress in developing its renewable energy sector, in line with government targets. Key developments include:

- As of 2024, 148 renewable energy facilities are operational, with a total installed capacity of 2,903.5 MW.
- In the first half of 2024, renewable energy accounted for 6.47% of total electricity generation, surpassing the 6% target set for 2025.
- The government has approved an auction schedule to add 6.7 GW of renewable capacity by 2027.
- International companies such as Total Energies, Masdar, and ACWA Power have signed agreements to develop large-scale wind projects.
- Key challenges include grid integration and limited public awareness of small-scale renewable energy technologies.
- The investment environment is supported by agencies such as the Investment Committee and Kazakh-Invest.
- Financing for renewable energy projects typically involves 70% debt and 30% equity, with blended finance common for large-scale projects.
- Small-scale renewable energy projects are eligible for net metering (up to 200 kW).
- Large-scale renewable projects may benefit from 20-year Power Purchase Agreements (PPAs) via auction, along with tax exemptions and investor facilitation.

Key Facts

- Population: 20.2 million (2024)

- GDP: \$220.6 billion (2022)
- Renewable energy targets: 6% by 2025, 15% by 2030, 50% by 2050
- Carbon neutrality target: 2060
- Total installed renewable capacity: 2,903.5 MW (2024)
- Renewable energy share: 6.47% of total electricity generation (first half of 2024)

Strengths

1. Strong government commitment to renewable energy development.
2. Clear and ambitious renewable energy targets.
3. Abundant wind and solar resources.
4. Well-established regulatory framework for renewable energy.
5. Experienced Investment Promotion Agency (IPA) (Kazakh-Invest).
6. Comprehensive Investor Guide Book with step-by-step instructions for project implementation.
7. Well-established auction system with tariff indexation for winning propositions.
8. Relatively well-developed financial sector.
9. Strong legal framework for investment protection.

Weaknesses

1. High dependence on fossil fuels, with coal constituting 60% of power generation.
2. Complex bureaucracy for foreign investors.
3. Aging grid infrastructure in some regions.
4. Local content requirements that may hinder foreign investment.
5. Skills gap in specialized renewable energy technologies.

Opportunities

1. Potential for rapid growth in wind and solar energy sectors.
2. Expansion of the auction system to include other forms of renewable energy.
3. Development of local renewable energy supply chains.
4. Expansion of grid infrastructure to support renewable energy integration.

5. Implementation of energy storage solutions (BESS).
6. Increased regional energy cooperation and trade.
7. Development of the green bond market.
8. Creation of funding mechanisms for small-scale renewable energy projects, including crowdfunding, subsidies, grants, and programs by international organizations.
9. Development of hydrogen projects aligned with national goals.
10. Legislation to provide consumer credits based on net-metering standards.
11. Introduction of International Renewable Energy Certificates (I-RECs).²

Threats

1. Economic volatility due to dependence on global energy prices.
2. Competition from traditional fossil fuel industries.
3. Climate change impacts on renewable energy infrastructure.
4. Potential regulatory changes that may affect investor confidence.
5. Regional geopolitical tensions.

Policy Implications

1. Accelerate the transition from fossil fuels to renewables by implementing stronger incentives and phasing out subsidies for conventional energy sources.
2. Simplify bureaucratic processes for foreign investors in the renewable energy sector.
3. Invest in grid modernization and expansion to accommodate increased renewable energy capacity.
4. Revise local content requirements to align with international norms and attract more foreign investment.
5. Develop targeted education and training programs to address skills gaps in the renewable energy sector.
6. Enhance regional cooperation in energy trade and infrastructure development.
7. Implement policies to support the development of energy storage solutions.
8. Develop a comprehensive strategy for climate change adaptation in the energy sector.

² International Renewable Energy Certificate. <https://www.trackingstandard.org/product-code/electricity/>

Kyrgyzstan

Kyrgyzstan possesses significant untapped renewable energy potential but faces challenges in sector development. Key points include:

- Estimated renewable energy potential includes 5–8 TWh from small hydropower, 44.6 GWh from wind, 490 million GWh from solar, and 1.3 TWh from biomass.
- Currently, renewable energy accounts for less than 2% of the energy mix, with large hydropower providing 85.9% of electricity.
- The country relies heavily on local and imported coal, and imports natural gas and electricity during low water periods, raising concerns about energy security, particularly due to outdated infrastructure and seasonal hydropower fluctuations.
- To address these issues, the government aims to increase the share of renewable energy to 10% by 2035, equivalent to 1,750 MW.
- Recent investments and agreements with international partners signal increasing interest in renewable energy projects. Several solar, wind, and small hydropower projects are in various stages of development.
- Key challenges include outdated grid infrastructure, regulatory frameworks that are not adapted to renewable energy, uncompetitive electricity tariffs, a lack of guarantees, issues with land allocation and tendering, limited experience with large-scale FDI, inadequate funding, and environmental concerns.
- The Green Energy Fund and Climate Finance Center have been established to improve investment opportunities.
- Recent policy changes include tax benefits, extended grace periods for renewable energy projects (except hydropower), improvements to PPAs, guaranteed renewable electricity purchases, and annual tariff indexation due to currency fluctuations.
- Regional cooperation projects such as CASA-1000 and the Kambarata-1 hydropower project with Kazakhstan and Uzbekistan are expected to enhance the energy sector.

Key Facts

- Population: 7.2 million (2024)
- GDP: \$13.7 billion (2023)
- Renewable energy target: 10% by 2030 (excluding large hydropower)
- Carbon neutrality target: 2050

- Hydropower dominance: Up to 90% of electricity generated from hydropower
- Renewable energy potential: 5–8 TWh for small hydropower, 44.6 GWh for wind, 490 million GWh for solar, and 1.3 TWh for biomass

Strengths

1. Strong foundation in hydropower generation.
2. Growing government interest in renewable energy development.
3. Legislative initiatives to improve the renewable energy investment environment, including amendments to the Tax Code.
4. Established Green Energy Fund seeking to attract investors and working on aligning the regulatory framework with international standards.
5. Abundant untapped renewable energy resources, particularly in small hydropower and solar energy.
6. Non-discriminatory legal environment for foreign investors.
7. Participation in regional energy projects (e.g., CASA-1000).

Weaknesses

1. Political and institutional instability.
2. Gaps in the regulatory framework for renewable energy.
3. Limited experience with large-scale FDI.
4. Underdeveloped financial sector.
5. Seasonal electricity supply fluctuations.
6. Limited skilled workforce in renewable energy technologies.
7. Limited experience of domestic Engineering, Procurement, and Construction (EPC) companies in large-scale renewable energy projects.

Opportunities

1. Potential for significant expansion in small hydropower.
2. Growing interest in solar and wind energy development.
3. Decentralized renewable energy technologies for rural areas.

4. International support for renewable energy projects and capacity building.
5. Regional electricity trade through projects like CASA-1000.
6. Development of green taxonomy and investment zones.
7. Further strengthening of the legal framework, particularly focusing on green loans and certificates.
8. Clearer institutional responsibility for renewable energy development and the promotion of a "single-window" approach for investors.

Threats

1. Climate change impacts on hydropower generation.
2. Economic constraints limiting investment in renewable energy infrastructure.
3. Potential conflicts in regional water resource management.
4. Brain drain of skilled workers.
5. Geopolitical tensions affecting regional energy cooperation.

Policy Implications

1. Develop a comprehensive and consistent regulatory framework for all renewable energy sources.
2. Implement measures to enhance institutional stability and reduce bureaucratic inefficiencies.
3. Create targeted incentives and guarantees for foreign investors in the renewable energy sector.
4. Invest in grid modernization and expansion to accommodate increased renewable energy capacity.
5. Enhance education and training programs to align with modern requirements and international best practices, ensuring the development of a skilled workforce in renewable energy technologies.
6. Implement energy pricing reforms to ensure the financial viability of renewable energy projects.
7. Strengthen regional cooperation in energy trade and water resource management.
8. Finalize and implement the National Adaptation Plan for the energy sector, ensuring adequate financial resources for effective execution and climate change adaptation.

9. Introduce digitalization in the tendering and permitting processes for renewable energy projects.

Tajikistan

Tajikistan possesses significant renewable energy potential, particularly in hydropower, but faces challenges in diversifying its energy mix:

- It ranks 8th globally in hydropower potential, with 527 TWh of potential annual generation.
- Over 90% of electricity currently derives from hydropower, making the country vulnerable to seasonal fluctuations.
- Solar and wind energy present significant untapped potential.
- The government aims to generate 1 GW of renewable energy by 2030.
- Major projects include a 200 MW solar plant and plans for 500 MW of clean energy capacity.
- Key challenges include outdated infrastructure, seasonal energy shortages, and limited technical expertise.
- The investment climate remains challenging due to bureaucratic hurdles and unclear regulatory frameworks.

Key Facts

- Population: 9.9 million (2023)
- GDP: \$9.2 billion (2022)
- Renewable energy targets: 10% from wind and solar by 2040
- Hydropower dominance: Over 90% of electricity from hydropower
- Hydropower potential: Ranked 8th globally, with 527 TWh per year
- Solar target: 1 GW by 2030

Strengths

1. Abundant hydropower resources and potential.
2. Strong government commitment to renewable energy development.

3. Ambitious renewable energy capacity targets.
4. Growing interest in solar energy development.
5. Strategic position for cross-border electricity trading (e.g., CASA-1000).
6. Open market for foreign investment in renewable energy.

Weakness

1. Heavy reliance on hydropower, making the country vulnerable to climate change impacts, such as glacial retreat and changes in river discharge patterns.
2. Lack of consistent policies for all renewable energy sources, with gaps in regulatory frameworks.
3. Limited experience with large-scale solar and wind projects.
4. Underdeveloped regulatory framework for renewables, requiring ongoing reforms.
5. Economic constraints and limited domestic financial resources for renewable energy investments.
6. Skills gap in renewable energy technologies, with limited educational or vocational programs focused on renewables.
7. Aging grid infrastructure, particularly in remote areas, which hinders renewable energy integration.

Opportunities

1. Vast untapped hydropower potential, with ongoing feasibility assessments to identify priority areas.
2. Growing interest in solar energy projects, with favorable solar irradiation levels across the country.
3. Potential for regional electricity exports through initiatives like CASA-1000.
4. International support and funding for renewable energy projects, including potential collaborations with the World Bank (WB), ADB, and the Green Climate Fund.
5. Development of a comprehensive renewable energy strategy covering all sources.
6. Establishment of a dedicated IPA for renewables, similar to agencies in neighboring countries.

Threats

1. Climate change impacts on hydropower generation, including glacial melt and variability in river flows, posing risks to energy security.
2. Regional political tensions affecting energy cooperation and cross-border electricity trade.
3. Economic instability deterring foreign investment, particularly in the renewable energy sector.
4. Potential environmental and social challenges in large-scale projects, requiring enhanced environmental and social impact assessments.
5. Competition from other regional powers in the energy sector, affecting energy exports.

Policy Implications

1. Develop a coherent and comprehensive renewable energy strategy, with clear timelines and milestones for achieving targets.
2. Implement a transparent regulatory framework for renewable energy investments, addressing existing gaps.
3. Establish a dedicated IPA for the renewable energy sector, modeled on successful agencies in the region.
4. Invest in grid modernization and expansion to support increased renewable energy capacity, particularly in remote areas.
5. Develop targeted education and training programs to address the skills gap in renewable technologies, including partnerships with international institutions.
6. Implement energy pricing reforms to ensure the financial viability of renewable projects.
7. Enhance regional cooperation in energy trade and water resource management, leveraging Tajikistan's strategic position for cross-border electricity exports.
8. Develop a strategy for climate change adaptation in the energy sector, including measures to mitigate risks to hydropower generation.
9. Strengthen environmental and social impact assessment processes for energy projects, ensuring sustainability and community support.

Turkmenistan

Turkmenistan holds substantial renewable energy potential but is still in the early stages of development:

- Estimated renewable energy potential includes 655 GW for solar, 10 GW for wind, and 1.3 GW for small hydropower.
- Currently, renewable energy generation is negligible, with the energy mix dominated by natural gas.
- The government has adopted a National Strategy for Renewable Energy Development until 2030, but specific targets are not yet announced.
- An upcoming plan to strengthen international cooperation on renewable energy (2025–2030) and ongoing regulatory reforms may create opportunities for clearer policy and regulatory frameworks.
- A 10 MW solar–wind hybrid plant will soon be commissioned, with plans for a 100 MW solar plant.
- Key challenges include limited diversification in the energy sector and a complex investment environment.
- The country lacks a dedicated renewable energy IPA.
- International cooperation on policy development and knowledge transfer is already underway, with support from the United Nations Development Program (UNDP), OSCE, and other organizations.

Key Facts

- Population: 6.2 million (2023)
- GDP: \$59.9 billion (2023)
- Renewable energy development: In the early stages
- High reliance on natural gas for electricity generation
- Significant potential for solar and wind energy development
- National Strategy for Renewable Energy Development until 2030

Strengths

1. Abundant solar and wind energy potential.

2. Strong government control, facilitating large-scale project implementation.
3. Active pursuit of improvements to the legislative framework and governance structures for renewable energy, including public-private partnerships (PPPs).
4. Significant reserves of critical raw materials for renewable technologies.
5. Experience in bilateral and regional energy cooperation.
6. Open market for foreign investment without local partnership mandates.

Weaknesses

1. High dependence on natural gas in the energy system.
2. Underdeveloped renewable energy sector.
3. Lack of clear policies and specific renewable energy targets.
4. Limited data availability.
5. Underdeveloped regulatory framework for renewable energy.
6. Limited skilled workforce in renewable energy technologies.
7. Lack of experience in renewable energy project financing.

Opportunities

1. Potential to become a leading producer of solar panels due to abundant silicon resources.
2. Development of a green hydrogen strategy.
3. Integration of renewable energy with existing gas-fired power plants.
4. International partnerships for knowledge transfer and technology adoption.
5. Potential for regional cooperation in renewable energy projects.
6. Development of a comprehensive renewable energy regulatory framework.

Threats

1. Economic dependence on fossil fuel exports.
2. Potential resistance to change from established energy interests.
3. Climate change impacts, particularly in desert regions.
4. Limited international exposure, which affects knowledge transfer.
5. Global political tensions that could disrupt regional energy cooperation and trade.

Policy Implications

1. Develop a comprehensive renewable energy strategy with clear, quantified targets.
2. Establish a transparent, investor-friendly regulatory framework for renewable energy.
3. Create a dedicated IPA for the renewable energy sector.
4. Invest in education and training programs to build a skilled workforce in renewable technologies.
5. Implement energy pricing reforms to make renewable projects more attractive.
6. Enhance data collection and transparency in the energy sector.
7. Develop incentives for foreign investment in renewable energy projects.
8. Invest in grid modernization to support renewable energy integration.
9. Foster international partnerships for technology transfer and capacity building.
10. Strengthen regional cooperation in renewable energy development and trade.

Uzbekistan

Uzbekistan is making significant progress in renewable energy:

- The country aims to increase the share of renewables to 40% of its energy mix by 2030.
- As of 2023, 1.6 GW of solar and wind capacity has been connected to the grid.
- Plans are in place to establish 28 large solar and wind plants (8 GW) by 2027.
- By 2024, more than \$7 billion in FDI has been attracted to the renewable sector.
- Key policies include tax exemptions and guaranteed purchases of renewable electricity.
- Challenges include grid integration and the need for storage solutions.
- The IPA plays a key role in attracting foreign investment, though it could benefit from a dedicated renewable energy division.

Key Facts

Population: 35.6 million (2023)

- GDP: \$80.4 billion (2022)
- Renewable energy target: 40% by 2030
- Current renewable capacity: 1.6 GW of solar and wind connected to the grid (2023)
- Planned renewable projects: 28 large solar and wind plants (8 GW) by 2027
- FDI in renewables: \$2.1 billion (as of 2023)

Strengths

1. Strong government commitment to renewable energy development.
2. Clear and ambitious renewable energy targets.
3. Energy efficiency, with initiatives to optimize consumption, is a key element of the renewable energy strategy.
4. Significant potential for solar and wind energy development.
5. Recent reforms that improve the investment climate.
6. Growing interest from international investors.
7. A relatively well-developed technical workforce.
8. Active involvement of domestic EPC and O&M contractors in renewable projects.

Weaknesses

1. High dependence on natural gas and coal.
2. A complex regulatory environment for foreign investors.
3. Large-scale renewable energy FDI projects remain relatively novel, requiring more domestic financing options.
4. Aging grid infrastructure in some areas.
5. A skills gap in specialized renewable energy technologies, with international investors and international financial institutions (IFIs) contributing to the modification of curricula at educational institutions.
6. Limited experience in conducting environmental impact assessments for renewable energy projects.

Opportunities

1. Rapid growth potential in the solar and wind sectors, including significant expansion of rooftop installations.

2. Strengthening the role of the IPA to serve as a one-stop shop for foreign and domestic investors and improving coordination between government bodies.
3. The development of green bond markets.
4. Expansion of grid infrastructure to support renewable energy integration.
5. Implementation of energy storage solutions (Battery Energy Storage Systems, BESS).
6. Further adaptation of local content policies to promote domestic production and increase the involvement of local industries in the renewable energy sector.
7. Increased regional energy cooperation and trade.
8. The development of a national hydrogen strategy.

Threats

1. Economic volatility affecting investment stability.
2. Competition from fossil fuel industries.
3. Climate change impacts on renewable energy infrastructure.
4. Potential regulatory changes that could affect investor confidence.
5. Regional geopolitical tensions.

Policy Implications

1. Accelerate the transition from fossil fuels to renewables through stronger incentives and the phased reduction of fossil fuel subsidies.
2. Simplify and streamline regulatory processes for foreign investors in the renewable energy sector.
3. Invest in grid modernization and expansion to accommodate increased renewable energy capacity.
4. Develop targeted education and training programs to address skills gaps in the renewable energy sector.
5. Implement a comprehensive environmental and social impact assessment framework for renewable energy projects.
6. Enhance regional cooperation in energy trade and infrastructure development.
7. Develop and implement a national strategy for energy storage solutions.
8. Foster international partnerships for technology transfer and capacity building.
9. Develop a comprehensive strategy for climate change adaptation in the energy sector.

4.3 Role of International Institutions

International institutions will play a critical role in advancing the renewable energy agenda in Central Asia, including attracting FDI. By leveraging their financial resources, technical expertise, and convening power, these institutions help mitigate risks, foster private investment, build local capacity, and promote regional cooperation—elements essential for establishing a robust renewable energy ecosystem.

International institutions can facilitate regional cooperation by:

- Providing platforms for policy dialogue and knowledge exchange
- Offering technical assistance to harmonize regulatory frameworks
- Supporting the development of regional renewable energy markets
- Financing cross-border transmission infrastructure for power trade
- Facilitating joint renewable energy resource assessments and planning

The most relevant and influential institutions in Central Asia's renewable energy sector currently include:

1. ADB
2. EBRD
3. WB
4. International Finance Corporation (IFC)
5. IsDB
6. UNDP
7. UNECE
8. Regional Cooperation Initiatives
 - CAREC Program
 - Central Asia Water and Energy Program (CAWEP)
 - EU-Central Asia Platform for Environment and Water Cooperation
9. International Agencies
 - IRENA
 - IEA
10. Neighboring Initiatives
 - Azerbaijan – “Green Energy Leader”
 - China – Belt and Road Initiative
 - Russia – Existing Interconnections and Historical Ties

Below is a brief description of each institution's potential roles and contributions:

1. Asian Development Bank

Roles:

- Provides technical assistance for policy development and capacity building
- Offers concessional financing for renewable energy projects
- Supports grid modernization to integrate renewable energy

Contributions to Increasing FDI:

- Offers risk-mitigation instruments to attract private investors
- Provides co-financing opportunities with private-sector partners
- Supports project preparation to enhance investment bankability

Innovative Financing:

- Green bonds and climate bonds to mobilize capital for renewable projects
- Results-based lending programs tied to renewable energy targets

Capacity Building and Knowledge Transfer:

- Organizes workshops and training programs for government officials and local stakeholders
- Facilitates knowledge sharing on best practices between member countries

2. European Bank for Reconstruction and Development

Roles:

- Finances renewable energy projects, particularly in Kazakhstan and Uzbekistan
- Provides policy advice on regulatory frameworks and tariff structures

Contributions to Increasing FDI:

- Offers political risk insurance to protect foreign investors
- Provides local currency financing to mitigate exchange rate risks

Innovative Financing:

- Green Economy Transition approach, integrating climate finance across investments
- Energy efficiency credit lines through local banks

Capacity Building:

- Supports the development of local renewable energy service providers
- Provides training on project finance and risk assessment for local banks

3. World Bank

Roles:

- Offers analytical and advisory services on energy sector reform
- Provides concessional loans for renewable energy infrastructure

Contributions to Increasing FDI:

- Offers partial risk guarantees to mitigate political and regulatory risks
- Supports PPPs in the renewable energy sector

Innovative Financing:

- Scaling Solar program to develop utility-scale solar projects
- Climate Investment Funds to support transformational clean technology projects

Knowledge Transfer:

- Global knowledge hub on renewable energy policies and technologies
- Facilitates South-South cooperation on renewable energy development

4. International Finance Corporation

Roles:

- Provides direct financing and advisory services to private-sector renewable energy projects
- Supports the development of bankable project pipelines

Contributions to Increasing FDI:

- Mobilizes commercial financing through its B-loan program
- Offers early-stage project development support to attract investors

Innovative Financing:

- Green bonds to finance climate-smart projects
- Blended finance solutions to catalyze private sector investments

Capacity Building:

- Provides technical assistance to local financial institutions on renewable energy financing
- Supports the development of local renewable energy supply chains

5. Islamic Development Bank

Roles:

- Provides Sharia-compliant financing for renewable energy projects
- Supports energy access initiatives in urban and rural areas

Contributions to Increasing FDI:

- Offers political risk insurance through the Islamic Corporation for the Insurance of Investment and Export Credit

- Facilitates partnerships between member countries and international investors

Innovative Financing:

- Green Sukuk to finance climate-friendly projects
- Islamic finance instruments tailored for renewable energy investments

Capacity Building:

- Supports technology transfer and knowledge sharing among member countries
- Provides training on Islamic finance for renewable energy projects

6. United Nations Development Program

Roles:

- Supports policy development and institutional capacity building
- Implements small-scale renewable energy demonstration projects

Contributions to Increasing FDI:

- Helps create enabling environments for private sector investment
- Supports the development of national renewable energy action plans

Capacity Building:

- Provides training on renewable energy technologies and project management
- Supports the integration of renewable energy into national development plans

7. United Nations Economic Commission for Europe

Roles:

- Promotes regional cooperation on sustainable energy development
- Provides policy guidance on renewable energy integration

Contributions to Increasing FDI:

- Facilitates dialogue between policymakers and investors
- Supports the development of harmonized regulatory frameworks

Knowledge Transfer:

- Organizes regional forums on renewable energy investment
- Develops best practice guidelines for renewable energy policies

8. Regional Cooperation Initiatives

CAREC Program:

- Supports regional power trade and renewable energy integration
- Facilitates cross-border renewable energy projects

CAWEP Program:

- Promotes integrated water and energy resource management and supports energy and water security in Central Asia
- Supports the development of hydropower and other renewable sources

EU- Central Asia Platform for Environment and Water Cooperation:

- Facilitates dialogue on sustainable energy development, aiming to enhance energy security, efficiency, and the use of renewable energy sources
- Supports knowledge sharing on renewable energy technologies

9. International Agencies

International Renewable Energy Agency:

- IRENA has established a Central Asia Regional Initiative to support countries in accelerating renewable energy deployment.
- The agency provides technical assistance, capacity building, and resource assessments to help Central Asian countries tap into their renewable potential.
- IRENA facilitates regional dialogue and knowledge sharing through workshops and training programs focused on renewable energy statistics, policy support mechanisms, and grid integration.

International Energy Agency:

- The IEA provides data, analysis, and policy recommendations to support Central Asian countries in their energy sector development.
- It has conducted energy policy reviews for several countries in the region, offering tailored advice on energy security, market reforms, and clean energy transitions.

10. Neighboring Initiatives

Azerbaijan — “Green Energy Leader”:

- Azerbaijan, host of COP29, has set ambitious renewable energy targets and is positioning itself as a green energy leader in the region.

China – Belt and Road Initiative:

- China’s Belt and Road Initiative includes significant renewable energy investments in Central Asia.

Russia – Existing Interconnections and Historical Ties:

- Russia’s energy policies and transition plans impact Central Asian energy markets due to existing interconnections and historical ties.

11. COP Process and Central Asia

The UN Climate Change Conference (COP) process has significant implications for renewable energy development in Central Asia:

- Central Asian countries have committed to reducing GHG emissions under the Paris Agreement, which drives renewable energy adoption.
- COP26 in Glasgow focused on phasing down fossil fuels, an issue particularly relevant for hydrocarbon-rich countries in Central Asia.
- COP29 in Azerbaijan in 2024 offered an opportunity to showcase renewable energy progress in the region, with climate financing as a pivotal theme throughout the conference.

4.4 General Investment Considerations in Central Asian Countries

The investment environment in Central Asia varies across countries, but all are actively working toward improvements. Funding options differ, as do market support mechanisms for the renewable energy subsectors studied: wind, solar, biomass, and small-scale hydropower.

Investment Requirements

Across Central Asia, key investment requirements, beyond electricity generation, include:

- Grid infrastructure upgrades to accommodate variable renewable energy.
- Development of energy storage solutions, particularly battery systems.
- Capacity building and training for the local workforce in renewable technologies.
- Improvement of regulatory frameworks and investment protection mechanisms.
- Development of institutional structures for the renewables sector.
- Enhancement of regional cooperation for cross-border energy trading.

Financial and Economic Investment Environments

Table 4–6: Investment Environments in Central Asia

Country	Investment Environment	Key Features
Kazakhstan	Most advanced	· Well-established auction system · Tax incentives and subsidies · Dedicated investment promotion agency · Government commitment and robust framework
Kyrgyzstan	Early stage	· Focus on hydropower · Limited financial support for other renewables · Efforts to improve legislation · Support from international organizations
Tajikistan	Early stage	· Significant hydropower potential · Limited financial support for other renewables · Efforts to improve legislation · Reliance on international organizations
Turkmenistan	Nascent stage	· Heavy reliance on natural gas exports · Limited policy framework for renewables · Recent state initiatives · Partnerships with international organizations
Uzbekistan	Rapidly improving	· Competitive auctions for solar and wind · Feed-in tariffs and tax exemptions · Collaboration with international financial institutions · Unbundling of the electricity sector

Source: Author

Funding Options

Existing and emerging funding options for renewable energy projects in Central Asia include:

Traditional Financing

- Corporate balance sheet and project-level financing.
- Commercial bank loans.

- Central Asian countries should establish a joint framework to strengthen banks' and funding institutions' financial structuring of renewable energy projects, such as by implementing safeguards (e.g., PPA pledges by project developers) and strong ESG requirements for financial institutions.
- Export credit agencies.

Public Sector and Development Finance

1. MDB financing, primarily:
 - ADB
 - EBRD
 - WB (including subordinate specialized banking entities)
 - Islamic Development Bank
 - AIIB
2. Bilateral agencies for development cooperation (e.g., France, Germany).
3. PPPs.
4. National development banks and funds (e.g., Development Bank of Kazakhstan).
5. International climate funds.

Innovative Financing

Some evolving trends in renewable energy funding could be particularly relevant for Central Asia:

- **Green Bonds:** These debt instruments provide access to a broader pool of investors interested in environmentally friendly projects, potentially lowering the cost of capital for renewable energy initiatives in Central Asia.
- **Blended Finance:** This approach, which combines public and private capital, could help mitigate risks and attract more private investment to the region's renewable energy sector.
- **Results-Based and Sustainability-Linked Finance:** By linking payments to verified climate-related outcomes, this method could help ensure the effectiveness of renewable energy projects and attract performance-focused investors.
- **Carbon Finance:** Leveraging carbon credits and emissions trading schemes to support renewable energy projects.

- **Green Venture Capital:** Venture capital funding for clean energy start-ups could increase rapidly, partly driven by investments in emerging technologies and, in some cases, supported by targeted government subsidies.
- **Crowdfunding:** This innovative financing mechanism mobilizes small contributions from many individuals, often via digital platforms. It is particularly beneficial for smaller-scale renewable energy projects that struggle to secure traditional financing due to high upfront costs and perceived risks.

Potential Future Sources

Additional funding sources may offer valuable options for financing renewable energy projects, essential for the region's transition to cleaner energy:

- **Institutional Investors:** Pension funds, insurance companies, and endowments can provide substantial long-term capital for renewable energy projects, aligning with the extended time horizons of these investments.
- **Private Equity Firms:** Their involvement offers not only capital but also expertise in project development and management, which could be especially beneficial for countries with less experience in large-scale renewable projects.
- **Microfinance:** This could support small-scale and off-grid renewable energy projects, which are often community-based and crucial for rural and remote areas in Central Asia.
- **Impact Investors:** This group can be especially valuable for projects that may not meet traditional risk-return profiles but offer significant environmental and social benefits.
- **Sovereign Wealth Funds:** Most sovereign wealth funds have mandates requiring predictable returns, making it challenging to find suitable sustainable projects. While they invest in clean energy, the scale of investment has not yet reached its full potential.
- **Regional Green Fund:** Central Asian countries may consider establishing joint regional green funds, pooling investments from governments, national development institutions, MDBs, and international climate funds.

Regional Relevance

The diverse funding sources and trends are particularly relevant to Central Asia, given the region's specific challenges:

- The need for significant investment in grid infrastructure to support renewable energy integration.
- The varying levels of market maturity across the countries in the region.
- The potential for both large-scale projects (e.g., wind farms in Kazakhstan) and small-scale, distributed solutions (e.g., off-grid solar in remote areas of Kyrgyzstan, Tajikistan, and Turkmenistan).

To encourage necessary investments, IPAs, relevant ministries, and agencies must raise awareness about available financial mechanisms among both large- and small-scale renewable energy communities. This will enhance investment robustness and effectiveness and reduce costs.

Potential Impact

Incorporating these funding sources could lead to several positive impacts:

1. Increased capital availability for renewable energy projects.
2. Reduced reliance on government funding and international development assistance.
3. Improved project quality and performance due to diverse investor oversight.
4. Accelerated renewable energy adoption, helping the region meet its climate commitments.

However, their successful implementation will require supportive policy frameworks, improved investment climates, and capacity building in local financial sectors. Policymakers and energy stakeholders in the region should consider how to best leverage diverse funding options to expedite renewable energy transitions.

For widespread utilization, the countries should assess the need for additional

mechanisms to support small and medium-sized enterprises (SMEs) in obtaining critical funding, including measures to reduce their overall transactional costs.

Market Support Mechanisms

The more common global and regional market support mechanisms for renewable energy are as follows:

- 1. Feed-in Tariffs (FITs):** A common mechanism in which the government guarantees a fixed price for solar-generated electricity, often for a set period. This has been widely used in Europe and Asia to incentivize solar energy deployment.
- 2. Competitive Auctions:** In some regions, projects compete in auctions to secure contracts for selling electricity at the lowest price.
- 3. Tax Incentives:** These include investment tax credits (ITC), production tax credits, exemptions, and accelerated depreciation, which reduce the tax burden and upfront costs for solar project developers. For example, the United States offers a 30% federal ITC for solar installations, also available in India and several European countries.
- 4. Renewable Portfolio Standards (RPS):** These require electricity suppliers and utilities to source a certain percentage of their energy from renewable sources, including solar. RPS creates a market for renewable energy credits (RECs) and is common in US states and some European countries.
- 5. Net Metering:** Allows solar energy producers to feed excess electricity back into the grid, receiving credits that offset their electricity consumption. It is widely implemented in North America and parts of Europe.
- 6. Grants and Subsidies:** Direct financial support to reduce the upfront costs of solar projects, available in many countries, including Japan, Germany, and Australia.
- 7. Public-Private Partnerships:** Collaboration between governments and private companies to develop solar infrastructure. PPPs leverage private investment in solar energy and reduce risks.
- 8. International Development Assistance:** Organizations like the WB, ADB, and IsDB provide financial and technical assistance for solar projects in the region.
- 9. Renewable Energy Certificates:** RECs are tradable certificates that represent the environmental benefits of renewable energy generation.
- 10. Contracts for Difference (CfD):** A long-term contract between an electricity generator and a buyer, allowing the generator to stabilize its revenues at a pre-agreed level. Payments can flow from buyer to generator or vice versa.

11. Grid Parity: Clean energy is remunerated at the same regulated price as the benchmark energy price.

12. Green Bonds and Financing: Issuance of bonds specifically to fund renewable energy projects, providing access to capital at lower interest rates. Green bonds are becoming increasingly popular for financing large-scale solar projects.

Of these mechanisms, the first eight may currently be of the highest relevance for Central Asia.

Market support mechanisms are implemented differently across various renewable energy subsectors. These include:

Wind:

- Auctions/tenders (e.g., Kazakhstan, Uzbekistan)
- FiTs (limited application)
- Tax incentives and exemptions

Solar:

- Competitive auctions (e.g., Kazakhstan, Uzbekistan)
- FiTs (phasing out in some countries)
- Net metering for small-scale installations
- Tax exemptions and reductions

Biomass:

- Limited support mechanisms across the region
- Some countries are exploring FiTs and tax incentives

Small-Scale Hydropower:

- FiTs (in some countries)
- Grants and subsidies
- Tax incentives

Impact of Feed-in Tariffs

Feed-in tariffs (FiTs) have had varying effects across renewable energy subsectors in Central Asia:

- **Solar:** FiTs have effectively stimulated solar investments, particularly in Kazakhstan and Uzbekistan. However, a shift toward competitive auctions is underway to reduce costs.
- **Wind:** While FiTs have facilitated wind power development, their impact has been less pronounced compared to solar. Competitive auctions are becoming more common for large-scale wind projects.
- **Biomass:** FiTs have had a limited impact on biomass energy development, mainly due to the underdeveloped nature of this sub-sector.
- **Small-Scale Hydropower:** FiTs have had moderate success in promoting small hydropower projects, especially in countries with substantial hydro resources, such as Kyrgyzstan and Tajikistan.

Impact of Fossil Fuel Subsidies

Fossil fuel subsidies continue to be a significant obstacle to renewable energy development in Central Asia. Their key impacts include:

- Distorted energy markets that undervalue renewable energy
- Reduced incentives for energy efficiency improvements
- Fiscal burdens on government budgets, limiting available funds for clean energy investments
- Challenges in meeting national and international climate commitments

Specific country impacts include:

- **Kazakhstan:** Despite advancements in renewable energy, substantial fossil fuel subsidies, particularly for coal, hinder the competitiveness of clean energy technologies.
- **Kyrgyzstan:** Fossil fuel subsidies, particularly for heating, make it challenging for renewable alternatives to compete on a cost basis.

- **Tajikistan:** Although less reliant on fossil fuels, subsidies for imported oil and gas undermine the economic viability of renewable energy projects.
- **Turkmenistan:** Extensive subsidies for natural gas consumption significantly reduce the economic feasibility of renewable energy investments.
- **Uzbekistan:** Despite recent reforms, subsidies for natural gas and electricity from fossil sources continue to impede renewable energy adoption.

To address these challenges, policymakers should consider the following actions:

- Implementing carbon pricing mechanisms
- Gradually phasing out fossil fuel subsidies
- Redirecting subsidy savings toward renewable energy and energy efficiency programs
- Providing targeted support for vulnerable populations affected by subsidy removal
- Enhancing public awareness of the true costs of fossil fuels and the benefits of renewable energy

05

CHAPTER FIVE

5. Framework to Assess the Renewable Energy Foreign Direct Investment Ecosystem

The research project recommends measures to establish an investment ecosystem in the Central Asian region, focusing on the following renewable energy subsectors:

- Wind
- Solar
- Biomass
- Small-scale hydroelectric

The primary investment areas identified are:

- Renewable energy production and storage
- Electricity transmission and distribution, adapted to renewable energy
- Energy efficiency measures

5.1 Ecosystem—Key Determinants of Attracting Foreign Direct Investment

Foreign investors seeking opportunities in renewable energy in emerging markets look for specific favorable conditions while aiming to minimize particular risks. The key factors considered by an investor before making an FDI decision will collectively define the investment ecosystem.

Based on an extensive literature review, expert feedback, and its own expertise, the research project has identified 15 categories, including but not limited to PESTEL analysis, that together form the investment ecosystem for renewable energy in Central Asia:

1. Government Commitment and Institutional Support

2. Regulatory Framework and Policy Environment
3. Market Conditions and Potential
4. IPA
5. Resource Availability and Transparency
6. Grid Infrastructure
7. Market Access
8. Investment Protection
9. Financial Environment
10. In-country Skilled Workforce
11. Project Developers and EPC Companies
12. PPPs
13. Environmental and Social Factors, Stakeholder Engagement
14. Technology and Innovation
15. Regional Cooperation

These categories represent the essential elements of a supportive ecosystem. They reflect the primary concerns and considerations of investors. To attract foreign investors interested in contributing to sustainable energy solutions, each component must be optimized to create a conducive environment.

The application of these categories provides a holistic view of the investment landscape in Central Asia and the region at large. This framework covers political, regulatory, economic, social, technical, environmental, legal, and regional aspects of renewable energy investment. It offers a comprehensive tool for assessment, enabling targeted improvements, as further described in Chapter 7.2, and facilitating informed decision-making by investors.

International Precedents

The categories identified in this research align with frameworks used by international organizations and researchers. Several studies and classification systems from reputable sources underscore similar pillars as critical for renewable energy investment decisions. Some of these references are provided in Appendix 5.

International Energy Agency Framework

The IEA emphasizes the importance of policy frameworks, market design, and system integration for renewable energy investments. Key elements include (IEA, 2024; IEA/IFC, 2023):

- Supportive policies and targets
- Power market reforms
- Grid infrastructure and flexibility
- Investment in new capacity and manufacturing

World Bank Evaluation Framework

The WB's evaluation of renewable energy support identifies several critical factors (WB, 2020, 2022):

- Government commitment and political will
- Regulatory infrastructure
- Institutional capacity
- Macroeconomic stability
- Private sector dynamism
- Removal of fossil fuel subsidies

International Renewable Energy Agency Investment Analysis

The IRENA highlights several factors that influence renewable energy finance (IRENA, 2023):

- Policy support and national targets
- Technology-specific measures
- Market conditions and potential
- Financial environment and investment flows
- Technology and innovation

Multilateral Development Bank Approach

MDBs focus on creating enabling environments for renewable energy investments (Council on Foreign Relations, 2024). Key pillars include:

- Long-term, low-cost financing
- Risk mitigation
- Policy and regulatory support
- Capacity building
- Project development assistance

United Nations Economic Commission for Europe

The UNECE has published several relevant reports (UNECE, 2022, 2023), including:

1. The UNECE Renewable Energy Status Report (2015, 2017, 2022), which provides comprehensive overviews of renewable energy and energy efficiency markets, policies, and investments in 17 countries across South Eastern and Eastern Europe, the Caucasus, Central Asia, and the Russian Federation.
2. The 2022 UNECE Renewable Energy Status Report, prepared jointly with REN21, focuses on renewable energy development in 17 countries, including Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan.
3. A Policy Brief on Advancing SDG7 in the UNECE Region, which discusses renewable energy investments in the region. In 2018, renewable energy investments in these countries were \$7.2 billion, accounting for just 2.2% of global totals.

United Nations Environment Program

The United Nations Environment Program (UNEP) has also contributed to renewable energy investment research (UNEP, 2016, 2020). UNEP, in collaboration with the Frankfurt School-UNEP Collaborating Centre, publishes the "Global Trends in Renewable Energy Investment" report.

World Economic Forum

The World Economic Forum (WEF) has released several publications related to renewable energy investment and the global energy transition (WEF, 2024; WEF/KPMG, 2018). These include:

1. Fostering Effective Energy Transition (2024):

This annual report benchmarks 120 countries on their energy system performance, focusing on the global energy transition's progress. Key findings include:

- The gap in energy transition scores has narrowed between advanced and developing economies.
- The "center of gravity" of the energy transition is shifting toward developing countries.
- Developed countries and China have attracted nearly 90% of the growth in clean energy investment since 2021.
- Sub-Saharan Africa has shown strong growth in Energy Transition Index scores but still struggles with a lack of investment.

2. Accelerating an Equitable Transition—A Data-driven Approach:

This report presents metrics for leaders to identify key opportunities and challenges in the energy transition, emphasizing the need for evidence-based strategies to ensure climate action benefits both people and the planet.

3. Building Trust through an Equitable and Inclusive Energy Transition:

This white paper discusses the complexity of the energy transition and its wide-reaching implications for society, the economy, and the environment. It stresses the importance of ensuring all nations can participate equally in the transition to clean energy.

4. Accelerating Sustainable Energy Innovation:

- This report, in collaboration with KPMG, identifies key enablers of sustainable energy innovation and proposes strategies to accelerate the pace of innovation. It emphasizes the need for increased investment in clean energy R&D from both governments and the private sector.
- These WEF publications highlight the importance of accelerating renewable energy investment, especially in developing economies, to ensure an equitable and effective global energy transition.

The above reports and findings collectively underscore the need for increased renewable energy investment in Central Asia and neighboring regions, emphasizing both the progress made and the challenges remaining in developing robust renewable energy sectors in these countries. They highlight the importance of government commitment, regulatory frameworks, market conditions, financial environments, and technical capacity—factors reflected in the research report's categories.

Category Interplay

The interactions among the 15 categories are complex and multifaceted. A complete ecosystem encompasses numerous societal policy areas, with many potential interactions between the identified categories, such as:

- Strong Government Commitment often leads to a more favorable Regulatory Framework and Investment Promotion efforts, creating a positive feedback loop.
- Favorable Market Conditions affect the Financial Environment, attracting more financial institutions, which in turn further enhances market conditions, and vice versa.
- High Resource Availability may drive Technology Innovation to harness these resources more efficiently.
- Grid Infrastructure impacts Market Access.
- Enhanced Regional Cooperation can improve Market Access across countries.

Endogeneity may exist between categories such as Government Commitment and Market Conditions, as strong government support can improve market conditions, which in turn reinforces government commitment.

Several categories are correlated with a country's broader economic indicators:

- Market Conditions and Potential, Financial Environment, and Skilled Workforce often correlate positively with GDP, driving long-term growth and energy demand projections.
- Categories such as Investment Protection and Regulatory Framework are strongly associated with FDI inflows.
- The Financial Environment may relate to indicators such as inflation rates and foreign exchange stability.
- Grid Infrastructure and Resource Availability may correlate with a country's energy intensity (energy consumption per unit of GDP).
- The Technology and Innovation category may correlate with national innovation indices or R&D expenditure as a percentage of GDP.
- Categories, including Regulatory Framework and Market Access, often correlate with a country's ranking in ease of doing business indices.
- In-country Skilled Workforce may relate to education and employment statistics.

Some categories are specific to renewable energy investments, such as Resource Availability, Grid Infrastructure, and Technology and Innovation. The proposed framework may, therefore, be perceived as more comprehensive than those used in other regions or sectors. For instance:

- The WB's Ease of Doing Business index focuses on general business regulations rather than sector-specific factors.
- IRENA's Renewable Energy Country Attractiveness Index emphasizes policy and regulatory frameworks but gives less weight to factors such as regional cooperation or environmental and social aspects.

A full analysis of the interactions and dependencies among all key determining factors is beyond the scope of this Research Project and should, if necessary, be conducted by each country when establishing domestic policies and national budgets, as conditions vary from country to country.

The key content and context of each determining factor, fully detailed in Appendix 3, are outlined below:

1. Government Commitment and Institutional Support

Government commitment is crucial for shaping the renewable energy landscape. Strong government backing provides investor confidence and ensures long-term policy stability. Key considerations include:

- Political stability and risk management (e.g., protection against expropriation)
- Long-term energy strategy with specific renewable energy targets
- Commitment to the renewable energy transition
- Organization and coordination of renewable energy efforts
- Track record of honoring agreements with investors
- Adaptive management of policies based on market developments

Investors might seek answers to:

- How does the government prioritize attracting foreign investment?
- What specific policies or programs support renewable energy?

2. Regulatory Framework and Policy Environment

A clear and stable regulatory framework reduces investment risks and ensures predictable returns. Investors look for:

- A consistent, robust, comprehensive, and transparent regulatory framework
- An easy-to-navigate regulatory environment
- A bureaucracy that facilitates renewable energy investments
- Streamlined tendering and permitting processes, with a high degree of digitalization

Before investing, an investor would inquire:

- Are there upcoming policy changes that could affect FDI attractiveness?
- How predictable are regulatory frameworks for foreign investors?

3. Market Conditions and Potential

This category assesses the economic viability of renewable energy projects, essential for attracting investment. Investors seek assurance that they are entering a thriving business segment:

- Adequate market size and growing demand for renewable energy
- A competitive electricity market with tailored incentives for FDI and local value creation
- Government mandates and targets for renewable energy use
- A supportive policy environment for clean energy adoption
- Sufficient safeguards and legal protection for investors

Investors may raise the following questions:

- What is the current and projected demand for renewable energy?
- How do PPAs facilitate investment?

4. Investment Promotion Agencies

IPAs are vital for facilitating foreign investment and providing essential information and support throughout the investment process. Critical factors include:

- IPA expertise in renewable energy, with adequate resources
- IPA support for foreign investors in business registration, pre-investment, investment, and operational matters, reducing 'red tape'
- An IPA with sufficient authority and enforcement mechanisms
- Clear delineation of responsibilities between renewable energy IPAs and other public bodies

Investors will want to know:

- How do IPAs assist foreign investors throughout the investment lifecycle?
- What is the modus operandi of IPAs in the renewable energy sector?

5. Resource Availability and Transparency

The availability of renewable resources and transparent data are crucial for project planning and feasibility studies. Key considerations include:

- Availability of commercializable renewable energy resources
- Reliable data on resources, potential, and market trends
- Easy access to data for foreign investors, preferably online
- Potential synergies with adjacent sectors

Investors will seek answers to:

- How complete and transparent is the data on renewable energy resources?
- What resources are available for project development?

6. Grid Infrastructure

Adequate grid infrastructure is essential for integrating renewable energy into the power system. Investments in intermittent renewable energies require an understanding of:

- Grid capacity and the state of energy infrastructure
- Grid coverage and interconnection
- Access to grid information for foreign investors
- Grid status, policies, and plans, including storage to support renewable energy
- Network operation and ease of connecting new energy sources
- Integration of the domestic grid with the regional transmission system

Investors will inquire:

- What is the current capacity of the grid to accommodate renewable energy?
- Are there plans for expanding and modernizing grid infrastructure?

7. Market Access

Investors need to understand the potential complexity of entering a new renewable energy market:

- Ease of establishing a legally protected presence
- Assurance that foreign investors are not discriminated against
- Access to a full suite of renewable energy business opportunities
- Absence of undue restrictions on business operations

Practical considerations often include:

- How digitized is the tendering process for foreign companies?
- What are the tangible and intangible barriers to market entry for foreign investors?

8. Investment Protection

Legal safeguards are essential for attracting foreign capital. Investments will only proceed if they can be protected by:

- Strong legal frameworks for protecting foreign investors
- Fair and equitable dispute resolution and arbitration mechanisms
- Protection of revenue streams and intellectual property (IP) rights
- An independent and impartial legal system

Investors will seek clarity on:

- How does the legal system uphold contracts and protect property rights?
- What guarantees exist for capital movement?

9. Financial Environment

This category evaluates the availability of financing options and the overall financial stability of a country. Access to secure and competitive funding facilitates investments, depending on several factors:

- Availability of stable, robust funding options for foreign investors
- Presence of local and IFIs, including MDBs, operating on market-based principles

- Financial institutions knowledgeable about renewable energy projects and sufficiently capitalized
- Risk-mitigation instruments for investors

To assess investment profitability, a company's CFO will seek answers to the following questions:

- What government programs exist to attract foreign investment?
- How accessible is financing for renewable energy projects, and under what terms?

10. In-country Skilled Workforce

A skilled workforce is essential for constructing energy infrastructure, whether domestic or imported. Local expertise is crucial for both project implementation and long-term operation:

- Level of technical expertise in renewable technologies available domestically
- Availability of skilled workers proficient in renewable energy technologies
- Domestic education and training programs addressing skills gaps
- Level of structured cooperation with international development partners

In emerging economies, additional concerns may arise:

- What initiatives are in place to develop a skilled workforce?
- How sufficient is the local talent pool for renewable energy projects?

11. Project Developers and Engineering, Procurement, and Construction Companies

The presence of experienced developers and contractors facilitates project execution. Unless the investor has in-house expertise, companies will be needed to build the facilities. Key considerations include:

- Maturity of the market for domestic project developers and EPC companies experienced in renewable energy projects and their technology components
- Presence and active business engagement of foreign operators and EPC companies in the country's renewable energy sector

- Opportunities for collaboration between domestic and foreign companies to navigate the market and regulatory landscape, without undue restrictions
- Logistics infrastructure and climatic conditions conducive to renewable energy business

To fully assess opportunities and risks, investors will want to understand:

- What is the level of experience and capability of domestic project developers?
- How active are foreign EPC companies in the local market?
- What opportunities exist for partnerships between local and foreign companies?

12. Public-Private Partnerships

PPPs can be effective in mobilizing private capital for renewable energy projects. Cooperation between public and private entities can impact investments on multiple levels, and understanding their modalities is essential:

- Legal framework for PPPs and its applicability to the renewable energy sector
- Competent, authorized entities with renewable energy expertise overseeing processes
- Competitive, yet negotiable, frameworks for PPPs in renewable energy projects
- Clearly defined roles, risk-sharing mechanisms, and incentives
- Track record and successful case studies of PPPs

Investors will also seek answers to the following questions:

- What incentives are offered to private investors in PPPs?
- What challenges exist in forming and operating effective PPPs?

13. Environmental and Social Factors, Stakeholder Engagement

Community support and a "license to operate" are necessary for renewable energy projects. Ensuring projects are socially acceptable and sustainable is critical, which can be achieved through:

- Well-developed statutes and guidelines with flawless implementation
- Public awareness and support for renewable energy
- Environmental impact assessments and performance reviews
- Close collaboration between government, private sector, and communities

To evaluate these factors, investors need to understand:

- How are local community interests considered and integrated into projects?
- What standards are in place to mitigate negative impacts?

14. Technology and Innovation

Renewable energy projects involve various technical aspects. Access to mature or cutting-edge technologies can enhance project efficiency and profitability. This is supported by:

- Domestic capabilities of R&D institutions and networks
- Support for technology transfer, innovation, and international cooperation
- Collaboration between universities and other educational institutions to foster strong programs in renewable technologies
- Promotion of a culture of innovation and entrepreneurship in the renewable energy sector

Investors must understand:

- How does the government support R&D in renewable technologies?
- What is the culture of innovation within the renewable energy sector?

15. Regional Cooperation

Regional cooperation can facilitate knowledge sharing and create economies of scale in renewable energy sectors across Central Asia. For large-scale renewable infrastructure projects, regional cooperation is crucial in promoting:

- Opportunities for cross-border renewable energy trade
- Participation in regional renewable energy initiatives
- Harmonization of renewable energy policies
- Interconnection of domestic and regional transmission systems

Although projects spanning multiple countries may be complex and time-consuming, both investors and affected countries may benefit from understanding:

- How does regional cooperation enhance investment opportunities?
- What initiatives exist for regional collaboration in renewable energy?

To assess these investment ecosystem factors, a questionnaire was developed. This document, based on the initial list of questions, facilitated dialogue with national stakeholders. The original questionnaire is attached as Appendix 1, and its categories have since been expanded and refined to include all 15 factors that collectively form the investment ecosystem for renewable energy in Central Asia, as presented in Appendix 3.

5.2 Ecosystem—Country Scorecard

This research project evaluates each country's strengths, weaknesses, opportunities, and threats related to the factors influencing renewable energy investment, as outlined in Chapter 5.1. A "Scorecard" has been developed to assess each country's alignment with the key determinants of the renewable energy ecosystem. The full content of the scorecard is included in Appendix 2.

The following sections summarize how each country performs with respect to the key factors in the renewable energy investment ecosystem.

1. Government Commitment and Institutional Support

Kazakhstan: Kazakhstan The benefits from a stable political environment and strong government commitment to renewable energy goals (6% by 2025, 15% by 2030, and 50% by 2050). The country has dedicated agencies, abundant renewable resources, and a positive track record with foreign investors, making it an attractive destination. However, it remains highly dependent on fossil fuels, and challenges

such as infrastructure gaps and market barriers need to be addressed.

Kyrgyzstan: Kyrgyzstan has substantial hydropower resources and potential for wind and solar energy. The government is committed to carbon neutrality by 2050 and has set an NDC Action Plan through 2030. While the establishment of the Green Energy Fund demonstrates the country's growing interest in renewable energy, political instability, frequent leadership changes, overlapping institutional responsibilities, and economic constraints pose significant challenges to attracting foreign investment. Nonetheless, Kyrgyzstan actively participates in international environmental agreements and initiatives.

Tajikistan: Tajikistan has ambitious renewable energy targets, particularly for hydropower, and has begun developing a solar energy sector. The country aims to expand renewable energy generation by 10,000 MW by 2037 and triple electricity exports by 2030. Despite a politically stable central government and abundant hydropower resources, Tajikistan faces economic instability, institutional gaps, environmental concerns, and a lack of comprehensive renewable energy policies, all of which necessitate further work to attract foreign investors.

Turkmenistan: While Turkmenistan shows government interest in renewable energy and possesses high solar and wind potential, its heavy reliance on natural gas, underdeveloped regulatory framework, and limited diversification into renewable energy present significant barriers. However, opportunities exist for integrating renewable energy with gas-fired power plants, and the government is aiming to expand electricity trading and exports.

Uzbekistan: Uzbekistan has strong government commitment, ambitious renewable energy targets (40% by 2030), and reforms aimed at improving the investment climate. This has made the country increasingly attractive to foreign investors. Nevertheless, high dependence on natural gas and coal, regulatory hurdles, market barriers, bureaucratic challenges, and frequently changing legislation remain issues.

2. Regulatory Framework and Policy Environment

Kazakhstan: Kazakhstan has established clear, predictable policies supporting renewable energy development, with specific targets for 2025, 2030, and 2050. The country offers incentives for foreign investors and has a structured auction

mechanism. However, the regulatory environment remains inconsistent and challenging to navigate for foreign investors, even though bureaucratic processes have been streamlined and largely digitalized. More work is required to enhance investor confidence in the regulatory framework.

Kyrgyzstan: Kyrgyzstan offers opportunities for hydropower expansion and other renewable energy projects, along with international funding. While permitting processes have been streamlined, significant gaps in the regulatory framework, political and institutional instability, and the lack of comprehensive policies pose risks for foreign investors. Considerable efforts are needed to improve the regulatory environment for attracting investments in the renewable energy sector.

Tajikistan: Tajikistan's regulatory framework for renewable energy is still evolving. Although the country has signed several international agreements and is developing policies to support solar and wind energy, economic instability, regional political tensions, and a complex regulatory environment present challenges. These factors suggest that more work is needed to attract foreign investment and fully develop Tajikistan's renewable energy sector.

Turkmenistan: Turkmenistan is making progress in developing a clean energy policy framework, with high potential for solar and wind energy. However, the underdeveloped renewable energy regulatory framework, lack of clear policies and targets, and continued dependence on fossil fuels highlight the need for substantial efforts to improve the regulatory environment to attract foreign investors.

Uzbekistan: Uzbekistan has a well-defined long-term energy strategy with specific renewable energy targets. The country has clear policies and incentives in place and is working on reforms to establish an efficient energy market. While the regulatory environment appears relatively complete, it remains complex for foreign investors due to policy inconsistencies arising from frequently changing legislation.

3. Market Conditions and Potential

Kazakhstan: Low energy tariffs and a heavy reliance on coal remain obstacles, but Kazakhstan's renewable energy targets (6% by 2025, 15% by 2030, and 50% by 2050), growing electricity demand, abundant renewable resources, and supportive

policies make it attractive to foreign investors. However, the lack of incentives for small-scale projects could hinder development across various regions. Significant opportunities exist in BESS.

Kyrgyzstan: Kyrgyzstan has renewable energy targets and opportunities in decentralized renewable technologies, particularly small-scale hydropower, as well as growing electricity demand, especially during the summer months. Upcoming commitments, such as supplying electricity to South-Asian countries under the CASA-1000 project, present additional prospects. However, challenges like a lack of guarantees for electricity purchase, opaque tariff indexing mechanisms, and an absence of auctions and tenders for renewable energy infrastructure development suggest that more work is needed to attract foreign investment. Geographical limitations for wind energy exist, but solar and biogas development potential remains significant.

Tajikistan: Tajikistan has vast untapped hydropower potential (estimated at 527 TWh annually, with only 4% currently utilized). The country is developing a Green Economy Development Strategy to promote renewable energy sources like solar and wind. Tajikistan aims to expand renewable energy capacity by 10,000 MW by 2037 and reduce dependence on imported energy sources through new solar projects. Despite these positive developments, challenges such as inconsistent strategy implementation, fiscal constraints, and vulnerability to natural hazards need to be addressed. Realizing the full potential of Tajikistan's renewable energy sector requires significant investments and climate-friendly policies.

Turkmenistan: Turkmenistan's clean energy policies and abundant solar and wind potential are promising, but challenges such as an underdeveloped renewable energy sector, market entry barriers, and lack of transparency hinder foreign investment. While the country possesses considerable experience in its natural gas-based electricity sector, significant efforts are required to make the renewable energy market attractive to foreign investors.

Uzbekistan: Uzbekistan has clear renewable energy targets and increasing electricity demand, with substantial potential for renewable energy development. Although challenges such as grid integration for intermittent energy and competition from fossil fuels remain, ongoing reforms to adapt to renewable

energy make the market increasingly attractive to foreign investors. Nevertheless, issues such as high dependence on fossil fuels, energy tariffs that do not reflect real costs, and the absence of an efficient and competitive energy market need to be addressed. The government is promoting the development of BESS.

4. Investment Promotion Agencies

Kazakhstan: Kazakhstan has a well-established IPA with a clear mandate to promote FDI across various sectors, including renewable energy. The agency benefits from strong government frameworks that safeguard investors. However, its historical focus on extractive industries may limit its expertise in RE. The presence of multiple IPAs can lead to investor uncertainty and coordination challenges.

Kyrgyzstan: While Kyrgyzstan has state-owned investment agencies dedicated to renewable energy, the country has limited experience in attracting large-scale FDI and may lack resources for comprehensive investor support. Multiple government agencies with overlapping functions create confusion due to the absence of clear guidance. Although Kyrgyzstan has potential in niche renewable energy sectors, its regulatory framework lags behind policy initiatives and commitments.

Tajikistan: Tajikistan lacks a specialized IPA for renewable energy. The country is working to enhance its capacity to attract FDI with support from international organizations such as the WB and the ADB. A solar panel manufacturing project, funded by South Korean investors, marks a milestone in attracting foreign investment in the renewable energy sector. While the government recognizes FDI attraction as vital for national development, no dedicated IPA for renewable energy currently exists, and gaps remain in providing comprehensive support throughout the investment lifecycle. Tajikistan has opportunities to learn from international best practices but faces challenges in coordinating investment promotion efforts effectively.

Turkmenistan: The government of Turkmenistan exercises strong control, which could facilitate IPA operations. The country has abundant natural resources for renewable energy projects but lacks a dedicated IPA and has an underdeveloped regulatory framework for renewables. Significant energy subsidies may deter

investments in renewables, and a lack of data may further hinder potential investment.

Uzbekistan: Uzbekistan's IPA, under the Ministry of Investment, Industry, and Trade, facilitates foreign investments, particularly in renewable energy, and has experience assisting foreign investors. Despite improvements in areas like IP rights, investment-related legislation remains unclear for investors. Bureaucratic hurdles and diffuse responsibilities between government entities and state-owned enterprises (SOEs) may also present challenges.

5. Resource Availability and Transparency

Kazakhstan: The renewable energy sector in Kazakhstan has abundant resources, especially in wind and solar energy, and benefits from government support for ambitious targets. Challenges such as aging infrastructure, data gaps, and some regulatory issues are being addressed by the government. Despite these challenges, Kazakhstan remains attractive to foreign investors due to its significant potential and policy support.

Kyrgyzstan: Kyrgyzstan is strong in hydropower, with up to 90% of its electricity generated from hydro, and the government supports renewable energy. However, the country faces limitations in diversifying its energy sources, inconsistent regulatory environments, and data accessibility issues. Despite these challenges, Kyrgyzstan has considerable renewable resources, including solar and wind, and data can be obtained from authorized state bodies, making it an attractive prospect for foreign investors.

Tajikistan: Tajikistan ranks eighth globally in hydropower potential, yet the country significantly underutilizes its renewable resources. While solar and wind energy remain largely untapped, the government's 1 GW solar target by 2030 represents a significant effort to diversify its energy mix. However, data gaps, infrastructure limitations, and a heavy reliance on imported fossil fuels present challenges. Despite these obstacles, Tajikistan's immense hydropower potential and government commitment to renewable energy suggest considerable promise, although further improvements are necessary to attract investment.

Turkmenistan: Turkmenistan has substantial potential for renewable energy, including solar and wind, as well as reserves of critical raw materials like lithium, iron, and copper. However, the country faces challenges in data transparency, regulatory frameworks, and infrastructure development for the renewables sector. Further efforts are needed to increase the country's attractiveness to foreign investors, although opportunities exist for international cooperation and resource development.

Uzbekistan: Uzbekistan offers significant potential for renewable energy, particularly solar, and has favorable wind conditions. The government strongly supports renewable energy development, and there is rapid growth potential through extensive reforms. However, challenges such as aging infrastructure, high dependency on fossil fuels, regulatory risks, and data accessibility must be addressed to fully attract foreign investment.

6. Grid Infrastructure

Kazakhstan: Kazakhstan has a relatively well-developed electricity grid with ongoing upgrades to increase transmission capacity, enhance grid resilience, and integrate renewable energy (including an ADB-funded project worth US\$123 million). However, parts of the grid are aging, and transmission losses remain an issue. While the grid is robust, further modernization is needed, including the integration of BESS to store surplus renewable energy and manage peak load demands.

Kyrgyzstan: Kyrgyzstan has a strong grid based on hydropower, with recent investments to improve reliability and reduce losses. There is surplus network capacity in specific locations, but challenges such as chronic underinvestment, high levels of wear and tear, transmission losses, and network congestion persist in certain areas. While the grid is generally ready for further integration with renewable energy, new renewable power plants should be sited in areas with available capacity.

Tajikistan: Tajikistan's grid is largely underpinned by hydropower, and modernization projects are ongoing. However, there are data gaps and limited information on grid performance, and parts of the aging infrastructure require modernization. Despite these challenges, the electricity network is considered

ready for larger-scale renewable energy integration, with plans for further expansion.

Turkmenistan: The electricity network in Turkmenistan is currently optimized for stable gas-fired power generation. It is not yet capable of integrating large-scale renewable energy. A lack of accessible data on grid infrastructure and renewable energy further complicates the situation. Significant improvements are necessary for the grid to meet the demands of renewable energy integration.

Uzbekistan: Uzbekistan has a relatively well-developed electricity network and energy infrastructure, with recent projects aimed at strengthening the national grid and integrating renewable energy. Although the country faces challenges similar to other Central Asian nations, such as aging infrastructure and transmission losses, Uzbekistan's grid is being modernized and is considered ready for the large-scale integration of intermittent renewable energy, including BESS.

7. Market Access

Kazakhstan: Kazakhstan offers a favorable environment for foreign companies, characterized by successful renewable energy auctions and significant strides in digitalization. The country presents a relatively easy process for establishing foreign businesses and provides an investment tax residency program, creating a competitive market for international investors. However, local content policies and a complex bureaucracy may present challenges.

Kyrgyzstan: Kyrgyzstan is generally inviting to foreign companies, with an easy entry process and a strong, non-discriminatory legal framework for foreign business activity. There is no requirement for local partnerships or stakeholder equity, and market entry is simplified. The CASA-1000 project facilitates access to South-Asian markets, while there is substantial potential for diversifying into other renewable energy sources. However, the small market size and seasonal fluctuations pose challenges, and the lack of a fully digitized tendering process can delay project approvals.

Tajikistan: Tajikistan's renewable energy market is gradually opening up, with increasing foreign investment, especially in solar projects led by Chinese and South Korean firms. This market opening is supported by the government's commitment

to renewable energy. The government is also implementing bureaucratic reforms and streamlining regulations to facilitate market access for foreign investors. Tajikistan has significant hydropower potential and is exploring other renewable energy sources. While foreign investment is not restricted, challenges such as bureaucratic inefficiencies, data gaps, and reliance on international financial aid may hinder project development. Nonetheless, the government's positive attitude toward foreign investment presents a promising environment for future opportunities.

Turkmenistan: Turkmenistan possesses considerable renewable energy resource potential and an open market for foreign investment, with no mandates for local partnerships. Investment laws are in place, and there is no discrimination between foreign and domestic investors. However, the underdeveloped renewable energy market, lack of data transparency, limited international exposure, and potential regulatory barriers suggest that further efforts are necessary to improve market access for foreign investors.

Uzbekistan: Uzbekistan has made significant progress in improving its investment climate, with a straightforward establishment process and a range of tax incentives for renewable energy developers. The country offers a strong, non-discriminatory legal environment for foreign investors, who can participate in competitive tenders and auctions, as well as direct negotiations for large-scale solar and wind projects. However, local content requirements and regulatory risks could complicate market entry.

8. Investment Protection

Kazakhstan: Kazakhstan has a strong legal framework for protecting foreign investments, including robust laws governing investor rights and international arbitration mechanisms. The country permits the free movement of capital and has an established system for protecting IP rights. However, regulatory complexity and inconsistent enforcement pose challenges.

Kyrgyzstan: Kyrgyzstan offers an open market without mandatory local partnerships and recognizes international arbitration as well as international standards for IP protection, albeit with some caveats. There are investment zones with state guarantees. While the judiciary's robustness and impartiality may be questioned, overall protection for investors and investments is relatively strong.

Tajikistan: Tajikistan has laws in place for international arbitration and investment protection, although the government is working to improve transparency and governance to bolster investor confidence. These improvements are crucial, especially given the planned \$1.5 billion in renewable energy investments. The government is committed to enhancing the investment climate and recognizes international arbitration and IP rights, though certain areas require further attention. Like its Central Asian neighbors, Tajikistan offers substantial investor protection, but its legal framework is less robust and transparent than that of other countries. There are opportunities for international support to strengthen legal protections and improve the investment environment.

Turkmenistan: Turkmenistan is developing a relatively robust legal framework for investment protection, adhering to international arbitration conventions such as the International Centre for Settlement of Investment Disputes (ICSID) and the New York Convention. However, discrepancies may exist between domestic and foreign arbitration laws. Despite these issues, the legal protections for foreign investors are generally strong, although challenges related to limited legal information remain.

Uzbekistan: Uzbekistan has established a strong legal framework for investment protection, including guarantees for the free use of funds, transferability, currency convertibility, the right to cease investment activities, and protection against expropriation. It recognizes international arbitration and has systems in place for IP protection. However, regulatory complexities and inconsistent enforcement may undermine investor confidence. Upcoming legal reforms, including the establishment of an International Commercial Court, are positive developments.

9. Financial Environment

Kazakhstan: Kazakhstan boasts a relatively well-developed financial sector, including financial incentive mechanisms such as green bonds with Astana International Financial Centre (AIFC), though it has limited experience in large-scale renewable energy financing. The country also benefits from strong government support and access to international funds such as the EBRD, UNDP, and USAID. However, the economy's heavy reliance on fossil fuel exports and potential conflicts of interest between financial institutions present challenges, though the overall environment remains favorable.

Kyrgyzstan: Kyrgyzstan has a growing interest in renewable energy and receives international support for reforms from financial institutions such as the WB, ADB, and EBRD. The country faces challenges, including limited domestic financial resources, an underdeveloped financial sector, and frequent changes in government personnel. Significant efforts are required to create a more attractive environment for foreign investors.

Tajikistan: Tajikistan demonstrates a strong government commitment to renewable energy, with ambitious targets for solar and wind energy development, supported by international funding from organizations like the WB, USAID, and ADB. Despite this, the country faces challenges such as limited financial resources, an underdeveloped financial sector, and economic volatility, along with reliance on external funding.

Turkmenistan: Turkmenistan has significant natural gas resources and a strong state-led economy, which could support large-scale renewable energy projects. The country enjoys a positive outlook from Fitch Ratings and has the potential for sovereign wealth fund investments. However, its highly centralized economy, limited private sector participation, and lack of experience in renewable energy financing present substantial challenges that would require significant efforts to attract foreign investors.

Uzbekistan: Uzbekistan is transitioning toward a more market-based economy and has made strides in issuing green bonds on international and domestic markets. It is attracting growing interest from international investors and collaborating with international organizations on joint projects. However, the country still has limited experience in financing large-scale renewable energy projects and faces regulatory risks, indicating that more work is needed to attract foreign investors.

10. In-country Skilled Workforce

Kazakhstan: Kazakhstan has a well-developed technical workforce with expertise across various energy sectors, including renewables. The country is home to several universities and technical institutes that offer programs in renewable energy technologies, supported by government investment in local skill development and industry capacity. However, there are skills gaps, particularly in specialized renewable energy technologies, and concerns about potential brain drain.

Kyrgyzstan: Kyrgyzstan retains a scientific heritage from the Soviet period, contributing to personnel training for renewable energy. However, it faces a limited skilled workforce in this sector due to the underdeveloped demand for such employees and ongoing brain drain. There is growing interest in renewable energy, alongside international support, but the limited skilled workforce and underdeveloped training programs indicate that more capacity-building efforts are required.

Tajikistan: Tajikistan demonstrates strong government commitment to renewable energy development, with significant international support for projects. However, there is a notable skills gap, and the education system has limited incorporation of renewable energy topics. While brain drain is not currently an issue, retaining talent remains a challenge.

Turkmenistan: Turkmenistan benefits from strong government control, which could facilitate large-scale training and workforce development programs. There is significant potential for renewable energy resources and early signs of incorporating renewable energy specialties into higher education. However, the country currently has a limited skilled workforce and insufficient training programs focused on renewable energy.

Uzbekistan: Uzbekistan has a relatively well-developed technical workforce with expertise in various energy sectors, including renewables. Several vocational education and training (VET) schools and universities offer relevant programs. Although the government supports local skills development, the country still faces a significant skills gap and limited integration of renewable energy topics into the national curriculum.

11. Project Developers and Engineering, Procurement, and Construction Companies

Kazakhstan: The country has a well-developed renewable energy sector, with operational facilities and experience in implementing projects involving wind, solar, and biogas. There is growing investor interest and potential for collaboration between domestic and foreign companies. However, financial barriers due to insufficient domestic and foreign investment, along with potential skills gaps in specialized technologies, may hinder progress.

Kyrgyzstan: Although there is increasing interest in renewable energy, the country has limited experience with large-scale renewable energy projects. The lack of domestic EPC companies with renewable energy expertise presents a challenge, but there is potential for partnerships with foreign EPC companies for capacity building and knowledge transfer.

Tajikistan: There is growing interest and some international collaboration in renewable energy, particularly in solar. However, bureaucratic challenges, limited experience with large-scale projects, lack of local expertise, and potential monopoly issues suggest that considerable efforts are needed to enhance the country's attractiveness to foreign investors and EPC companies.

Turkmenistan: Turkmenistan has a centralized economy, which could facilitate large-scale renewable energy project implementation. However, the country has limited experience in renewable energy and lacks domestic EPC companies with renewable energy expertise. Opportunities exist for partnerships with foreign EPC companies and knowledge transfer, but limited international exposure and heavy reliance on fossil fuels may impede rapid progress.

Uzbekistan: Uzbekistan has seen active involvement from EPC and O&M contractors in utility-scale renewable energy projects, with local entities beginning to participate as subcontractors. However, there are still limitations in technical and financial capabilities for end-to-end project construction, along with potential skills gaps in specialized technologies. Increasing interest from international investors and EPC companies offers opportunities for more domestic partnerships.

12. Public-Private Partnerships

Kazakhstan: Kazakhstan has an established framework for renewable energy development, including auctions that have reduced tariffs for renewable energy sources. The country has a track record of meeting renewable energy targets and offers priority dispatching and guaranteed offtake for all renewable energy production. However, low energy prices and a lack of flexible generating capacity present challenges. While there is no standalone PPP framework for renewables, the general PPP framework and the Law on PPP, along with other laws and bylaws, create an environment conducive to PPPs.

Kyrgyzstan: Kyrgyzstan has clear legislation for PPP projects and an authorized agency to oversee such partnerships. However, there is limited experience with renewable energy PPPs, an unclear procurement regime, and economic constraints affecting government incentives. The country has the potential to develop specific PPP frameworks for renewable energy and foster international partnerships for knowledge transfer and capacity building.

Tajikistan: The government is committed to renewable energy development, aiming for 10% of energy production from wind and solar by 2040. While international investors are interested, concerns about market monopoly and geopolitical competition exist. There is no established PPP framework, but Tajikistan is modernizing its legal and regulatory frameworks to better accommodate foreign investments, which may eventually lead to a formal PPP framework in the renewable energy sector.

Turkmenistan: Turkmenistan's state-led economy and governance facilitate PPP implementation, increasing the non-state sector's share in GDP. However, there is limited experience with renewable energy and a low level of PPP-based companies, as well as potential issues with transparency in procurement. There is potential to further develop PPP frameworks to attract foreign investment, supported by state laws on PPPs.

Uzbekistan: Uzbekistan has recently adopted a PPP law and is promoting PPP projects to attract foreign investors. However, there is limited experience with PPPs in the renewable energy sector, and challenges such as tariff reform and the need for flexible generating capacity persist. The country has opportunities for large- and small-scale renewable energy PPP projects in wind and solar and can attract international support to establish a PPP unit dedicated to renewable energies.

13. Environmental and Social Factors, Stakeholder Engagement

Kazakhstan: Kazakhstan has a relatively well-developed renewable energy sector with experience in implementing various projects. Potential conflicts of interest with traditional fossil fuel industries and a lack of strong standards for environmental impact assessments and mitigating measures remain. The country can leverage existing experience to improve stakeholder engagement and develop more comprehensive environmental impact assessment processes.

Kyrgyzstan: Kyrgyzstan has environmental impact assessment (EIA) procedures and a growing interest in renewable energy. Given the country's smaller size and population, there is potential for strong community engagement. However, limited experience with large-scale renewable energy projects and public awareness of the benefits of renewable energy may impede progress. The country has opportunities to develop comprehensive stakeholder engagement processes and integrate environmental and social considerations early in the sector's development.

Tajikistan: Tajikistan is committed to renewable energy and has integrated climate action into its energy policies. However, the country faces significant environmental challenges due to its mountainous topography and potential social and cultural barriers. Tajikistan is on the right path but must continue its modernization efforts to attract more foreign investment.

Turkmenistan: Turkmenistan's strong state-led governance could facilitate the implementation of environmental and social standards. However, the country has limited experience with renewable energy projects and associated environmental assessments. Its desert climate, seismic zones, and potential resistance to change pose specific challenges. Nonetheless, Turkmenistan has the opportunity to develop comprehensive environmental and social standards as it progresses in renewable energy.

Uzbekistan: Uzbekistan has adopted national policies and commitments to address climate change and is collaborating with various stakeholders to implement climate-friendly projects. Despite the government's commitment to renewable energy, there is limited experience in stakeholder engagement and environmental impact assessments, and the country lacks waste management and recycling requirements. Its diverse geography may also present challenges. However, the country now has the potential to leverage international best practices and develop comprehensive stakeholder engagement processes.

14. Technology and Innovation

Kazakhstan: Kazakhstan has a strong foundation in renewable energy technology and innovation, supported by several universities and research institutions. The government provides significant support for R&D, and there is a growing culture

of innovation and entrepreneurship. However, the country faces limited domestic expertise in cutting-edge technologies, bureaucratic hurdles, and a lack of local manufacturers in renewable energy technologies. Kazakhstan has the potential for international collaboration and new government initiatives to support R&D.

Kyrgyzstan: Kyrgyzstan is receiving growing domestic and international support for its renewable energy sector, which is driving demand for innovation and technology. However, the country faces limited R&D infrastructure, educational gaps, and economic constraints, indicating a need for capacity-building initiatives and access to international funding.

Tajikistan: The government's commitment to renewable energy, along with international support, is promising. However, limited domestic expertise and educational gaps highlight the potential benefits of developing local R&D capabilities through international collaboration. Future plans include research partnerships to advance solar and wind technologies.

Turkmenistan: Turkmenistan has the potential to facilitate large-scale renewable energy projects, but faces significant challenges, including limited R&D infrastructure, domestic technology development, and a shortage of educational institutions with strong renewable energy programs. While there are opportunities for international collaboration, significant efforts are required to build local capabilities.

Uzbekistan: Uzbekistan is scaling up its R&D and innovation programs, particularly in renewable energy and hydrogen. The government has shown strong commitment through various initiatives and international partnerships. However, the country faces educational gaps, regulatory barriers, and limited domestic expertise in advanced renewable technologies. Economic volatility and regulatory risks remain concerns.

15. Regional Cooperation

Kazakhstan: Kazakhstan has substantial experience in renewable energy projects and planned investments totaling \$38 billion across 60 projects. It also has the potential to export expertise and technology in the energy sector, making it a

valuable partner for regional cooperation. Opportunities exist for cross-border energy trade and joint projects. However, Kazakhstan faces competition from other regional powers and potential political tensions.

Kyrgyzstan: Kyrgyzstan possesses significant potential for renewable energy development, particularly in solar, wind, and small-scale hydro resources. The country has shown growing interest in regional cooperation for energy security and revenue generation, with several successful joint projects. Nevertheless, Kyrgyzstan lacks experience with large-scale projects and faces challenges stemming from potential policy differences with neighboring countries, as well as geopolitical competition. It could become a major beneficiary of enhanced regional cooperation.

Tajikistan: Tajikistan relies heavily on hydropower for electricity and aims to transition into a green country by 2037. The country participates in regional initiatives, such as the CASA-1000 project, but has limited experience with solar and wind power. Regulatory inconsistencies and dependence on regional countries for fossil fuel resources present challenges. Tajikistan stands to gain significantly from further regional cooperation.

Turkmenistan: Despite its abundant hydrocarbon resources and energy subsidies, Turkmenistan plays a less active role in renewable energy cooperation compared to its regional peers. However, it has experience in bilateral and regional energy cooperation, along with opportunities for climate technology transfer. New institutional and policy frameworks are needed to enhance its involvement.

Uzbekistan: Uzbekistan has considerable potential for renewable energy development, particularly in solar and wind power. As a net energy importer, the country is increasingly interested in regional cooperation and has several successful joint projects to its credit. However, Uzbekistan faces competition from regional powers and requires additional electricity to meet growing demand.



06

CHAPTER SIX

6. Positives and Challenges of the Investment Ecosystem for Each Country

Chapter 5.1 outlines the key factors that foreign investors evaluate before making an investment decision. Although all 15 components will eventually be assessed, three stand out as initial hurdles that need to be addressed before advancing a potential investment in renewable energy:

Fundamental

- 1. Government Commitment and Institutional Support:** Political stability, commitment to renewable energy, capable institutions to manage renewable energy investments, and a track record of honoring agreements are essential for attracting investors.
- 2. Regulatory Framework and Policy Environment:** A predictable, transparent, and investor-friendly regulatory environment is crucial, including clear policies and streamlined processes for investment.
- 3. Market Conditions and Potential:** The presence of clear renewable energy targets, growing electricity demand, a competitive market, and supportive policies with incentives will increase the sector's attractiveness.

To navigate the regulatory landscape and prepare for investment, a country with a well-functioning PA may have a competitive edge, particularly for investors exploring new opportunities. This adds a fourth critical component to the ecosystem:

- 4. Investment Promotion Agency:** Effective IPAs with clear mandates to facilitate FDI serve as the primary point of contact for investors, acting as intermediaries between investors and government bodies. They assist with company establishment, data collection, investment promotion, site selection, incentives, bureaucratic certification, and aftercare services for existing investors.

Once the first stage of investment scrutiny is passed, a prospective investor in renewable energy will turn to the next set of ecosystem categories, which primarily address the robustness of the investment:

Robustness

5. Resource Availability and Transparency
6. Grid Infrastructure
7. Market Access
8. Investment protection
9. Financial Environment

The final seven components will define the project execution and operational environment. These must also meet the investor's pre-established criteria before the final investment decision is made:

Execution & Operations

10. In-country Skilled Workforce
11. Project Developers and EPC Companies
12. PPPs
13. Environmental and Social Factors, Stakeholder Engagement
14. Technology and Innovation
15. Regional Cooperation

At the macro level, Central Asian countries have varied levels of preparedness for attracting foreign investments into their renewable energy sectors. All countries will need to implement targeted measures and legislation to create a more favorable environment for renewable energy investments.

- **Kazakhstan:** Strong government commitment, abundant resources, and established regulatory frameworks make it attractive, although aging infrastructure and regulatory complexity present challenges.
- **Kyrgyzstan:** A solid hydropower foundation and growing government commitment exist, but institutional instability, regulatory gaps, and data accessibility issues hinder investor attraction across all renewable energy subsectors.
- **Tajikistan:** Significant hydropower potential and government commitment,

with increasing solar activity, but economic instability, regulatory gaps, and data accessibility issues require substantial improvements.

- **Turkmenistan:** Promising potential for solar and wind energy, but the underdeveloped renewable sector, regulatory and institutional complexity, and lack of transparency suggest significant efforts are necessary to attract foreign investment.
- **Uzbekistan:** Ambitious targets and government support are present, and investments are accelerating. However, challenges in grid integration and regulatory and institutional complexity require further work.

The overall status of each country, considering all factors, is depicted in Figure 6–1, where the color coding indicates how the investment ecosystem in each country could support investments in wind, solar, biomass, and small-scale hydro based on the priorities applied.

Figure 6–1: Scorecard – Snapshot of Renewable Energy Investment Ecosystem Quality in All Countries

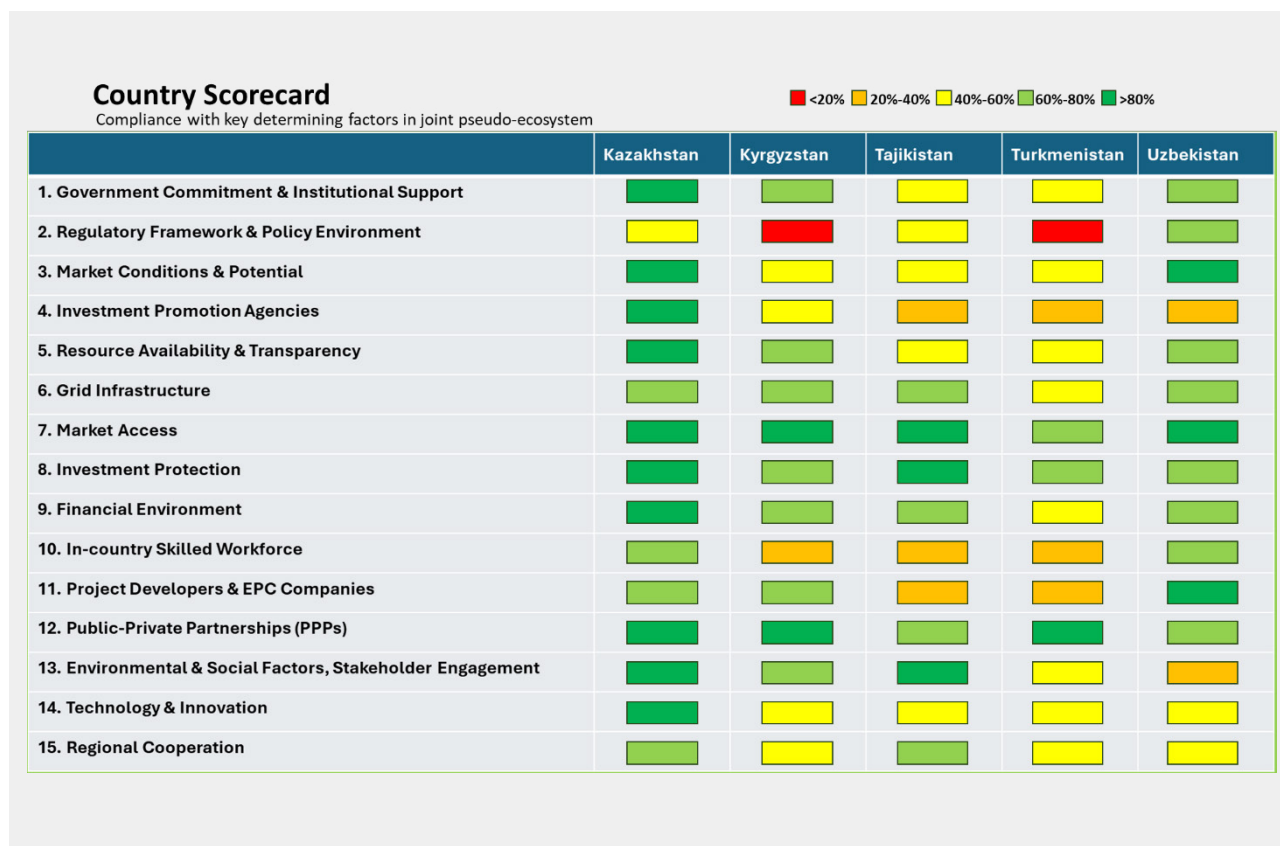
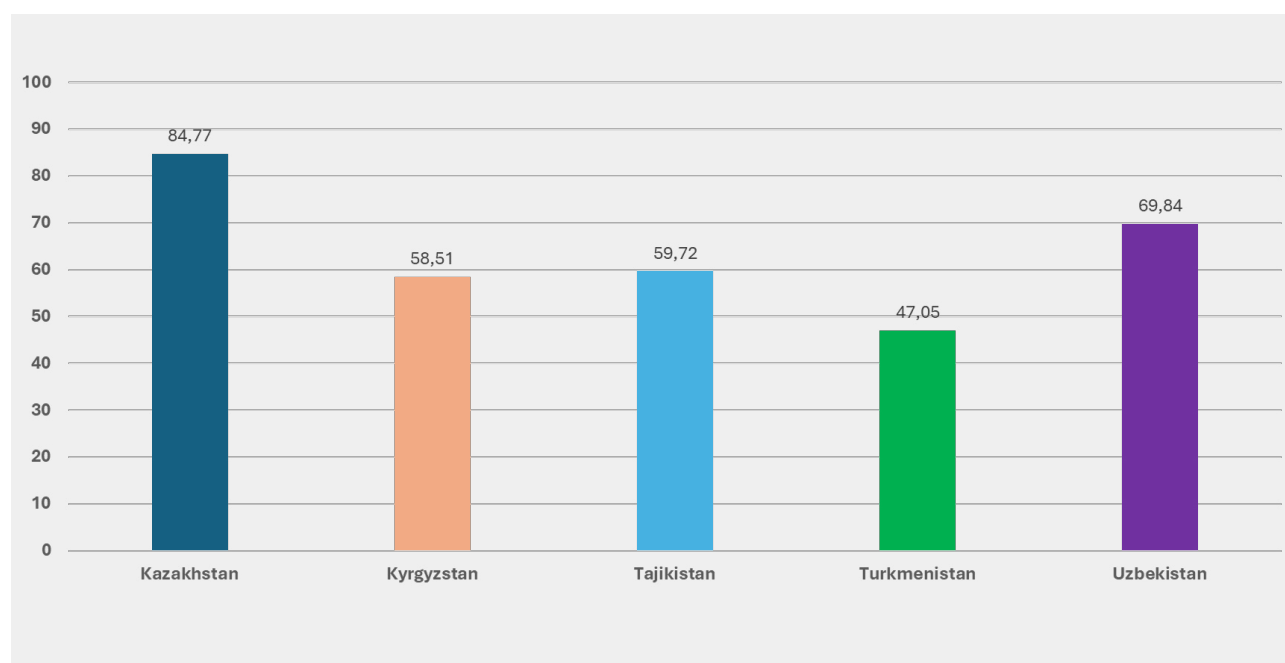


Figure 6–2 illustrates each country's overall score in relation to its adherence to the criteria set within the ecosystem framework.

Figure 6–2: Country Score – Adherence to Investment Ecosystem Criteria by Each Country



The Positives

Each country has unique strengths and opportunities that can be leveraged to attract foreign investors to their renewable energy sectors. These range from strong government support and abundant natural resources to the potential for international partnerships and IPA.

Based on the country scorecard discussed in Chapter 5.2, the key positive elements that can be extracted from each country's investment ecosystem—either by promoting their capabilities or quickly capitalizing on opportunities—are outlined below.

Kazakhstan

Strengths:

- **Political Stability:** Relatively stable political environment.

- **Clear Policies and Government Commitment:** Established, predictable policies supporting renewable energy development, including 6% by 2025, 15% by 2030, and 50% renewables by 2050, with carbon neutrality by 2060.
- **Long-term Strategy:** Well-defined long-term energy strategy with specific renewable energy targets.
- **Institutional Support:** Established regulatory frameworks and dedicated agencies.
- **Experience:** A well-developed renewable energy sector with operating facilities and experience in various types of projects.
- **Digitalization:** Advances in digital processes enhance transparency and efficiency in tendering, permitting, and bureaucratic processes.
- **Growing Market:** Projected 60% increase in electricity consumption over the next decade.
- **Resource Availability:** Abundant wind and solar resources, with 50% of the territory suitable for wind energy generation, complemented by reliable data from the Wind and Solar Atlas.
- **Investment Promotion Agency:** KAZAKH INVEST facilitates foreign investments, with a clear mandate and relevant experience.
- **Ease of Entry:** Foreign companies can easily establish operations, with branches treated as residents.
- **Incentives:** Specific incentives for foreign investors, including tax breaks and subsidies.
- **Energy Auctions:** Renewable energy auctions implemented, with a 5-year schedule approved by the Ministry of Energy.
- **Investment Protection:** Robust legal framework, strong protection under the "Investment Shield," membership in ICSID, international arbitration, free movement of capital, and protection of IP rights.
- **Well-Developed Financial Sector:** Relatively advanced financial sector compared to other Central Asian countries, with access to international funds and potential for innovative financing mechanisms.
- **Capable Workforce:** A relatively well-developed technical workforce and educational institutions.
- **Facility Construction:** Domestic EPC and O&M contractors with experience capable of acting as subcontractors in utility-scale renewable energy projects.

Opportunities:

- **Policy Adjustments:** Regular policy reviews to adapt renewable energy targets in response to market and technological developments, including the potential for green bonds.
- **Further Digitalization:** Ongoing digitalization efforts to improve market participation for foreign investors.
- **Strategic Positioning:** Development of local renewable energy supply chains to attract more FDI.
- **Incentives:** Potential for more tailored incentives to attract FDI.
- **Interconnectivity:** Improved energy system interconnections with neighboring countries.
- **Grid Expansion:** Upgrades and expansions to better integrate renewable energies.
- **Energy Storage:** BESS to support the integration of intermittent renewable energy sources.
- **Public-Private Partnerships:** Development of dedicated PPP frameworks for renewable energy and opportunities for more flexible capacity development.
- **Partnerships:** Opportunities for increased collaboration between domestic and foreign companies.
- **Transparency:** Potential for improved transparency standards through international partnerships.
- **International Cooperation and Support:** Opportunities for partnerships and funding through cooperation with organizations like UNDP, USAID, EBRD, and GEF.

Kyrgyzstan

Strengths:

- **Legal Framework:** The Law on Renewable Energy provides incentives for renewable energy development.
- **Strategic Documents:** The National Energy Program until 2035, the Concept of Carbon Neutrality with carbon neutrality by 2050, and the NDC Action Plan until 2030.
- **Growing Government Interest:** The establishment of a Green Energy Fund to develop the renewable energy sector.

- **Targets:** Specific short-term renewable energy targets (excluding large hydro power plants).
- **Growing Market:** Projected 56% increase in electricity demand by 2035.
- **Data Access:** Official websites provide maps of existing, planned, and future hydropower plants and network infrastructure.
- **Market Access:** The CASA-1000 project opens access to the South-Asian markets for exports.
- **Investment Promotion Agencies:** State-owned IPA with experience in attracting investments.
- **Hydropower Dominance:** Up to 90% of electricity generated from large hydro power plants, indicating a strong foundation in renewable energy.
- **Untapped Potential:** Abundant hydro resources and significant potential for wind and solar energy.
- **Grid Access:** The electricity network is broadly renewable energy-ready, with surplus capacity in specific locations.
- **Ease of Entry:** The Law on Investments does not distinguish between local and foreign investors, and no requirement exists for local equity positions or partnerships.
- **Investment Protection:** Enabling legal framework with recognition of international arbitration and free movement of capital.
- **Growing Developer Interest:** Increasing domestic and international interest in renewable energy development.
- **Public-Private Partnerships:** An authorized PPP Centre under the IPA offers a list of renewable energy projects.
- **Regional Cooperation:** Positive examples of power plant construction and regional energy cooperation.

Opportunities:

- **Regulatory Framework:** The Law on Renewable Energy is being revised to enhance its effectiveness.
- **Institutional Development:** Efforts to create, streamline, and reform institutions dedicated to renewable energy and investment attraction.
- **Diversification Potential:** Significant potential to diversify into renewable sources beyond hydropower, including solar, wind, and biogas.

- **Decentralization:** Increased potential for decentralized renewable energy technologies, particularly small hydropower stations.
- **Hydropower Expansion:** Opportunities to expand both large- and small-scale hydropower capacity.
- **Incentives:** The development of a Green Taxonomy that will provide benefits and preferences to renewable energy investments.
- **Investment Zones:** The possibility of establishing Special Investment Regimes in select regions.
- **IPA Improvement:** Opportunities to merge or better coordinate similar domestic functions and leverage international support to enhance IPA capabilities and expand expertise in renewable energy.
- **Grid Modernization:** Ongoing efforts to modernize the grid, with a Network Code currently in development.
- **International Funding:** Opportunities for international funding and partnerships to provide technical assistance and support renewable energy projects.
- **Knowledge Transfer:** Potential for partnerships with foreign EPC companies to build local capacity.
- **PPP Improvement:** Opportunities to develop specialized PPP frameworks for renewable energy projects.
- **Regional Cooperation:** Enhanced opportunities for energy trade and infrastructure development within the region.

Tajikistan

Strengths:

- **Government Commitment:** The government is committed to renewable energy development and regional energy trade.
- **National Development Strategy:** The strategy aims to modernize hydropower infrastructure, expand cross-border electricity trading, and triple electricity exports by 2030.
- **Green Economy:** The Green Economy Development Strategy (GEDS) prioritizes renewable energy generation, aligning with global sustainability goals.

- **Generation Capacity:** The country aims to increase its green electricity generation capacity by 10,000 MW by 2037.
- **Investment Climate:** The government recognizes FDI in the renewable energy sector as vital for national development. Efforts are underway to improve the investment climate, protect foreign investments, and promote renewable energy, particularly solar energy.
- **Hydropower Resources:** Tajikistan ranks 8th globally for hydropower capacity, which accounts for 98% of electricity generation. There is substantial potential for further hydropower development.
- **Growing Interest:** There is increasing interest in renewable energy development, especially solar power.
- **Solar Developments:** Significant solar energy projects are underway, including a \$1.5 billion investment across multiple phases, featuring a 200 MW solar facility. Plans for floating solar photovoltaic projects are also in progress.
- **Solar Target:** The government aims to reach 1 GW of solar capacity by 2030.
- **Manufacturing Industry:** A solar panel manufacturing project, funded by South Korean investors, is being developed.
- **Market Potential:** Tajikistan is strategically positioned for cross-border electricity trading, particularly through the CASA-1000 project, linking Central and South-Asian electricity markets, thereby enhancing export opportunities.
- **Grid:** The electricity grid is ready to accommodate larger-scale renewable power generation, with plans for further expansion.
- **Open Market:** The market is gradually opening, with increasing foreign involvement. There are no restrictions on foreign investment or requirements for local partnerships.
- **Incentives:** Foreign investors are offered tax breaks and exemptions to ease financial burdens.
- **Renewable Energy Auctions:** The government is exploring renewable energy auctions to attract cost-effective investments by allowing market forces to determine competitive prices.
- **Investment Protection:** International arbitration is recognized by law, and IP rights are conditionally protected.
- **Public-Private Partnerships:** Although a formal framework is lacking, the government encourages PPPs to leverage private sector expertise and capital while sharing investment risks.

- **Environmental Integration:** The government aims to integrate climate action into energy policies. Participation in international environmental agreements and Environmental Performance Reviews ensures alignment with global standards.
- **Regional Cooperation:** Tajikistan is engaged in several strategic regional initiatives, such as CASA-1000.
- **International Collaboration:** Existing international collaborations include projects funded by USAID, ADB, EBRD, and the WB.

Opportunities:

- **Streamlined Regulatory Processes:** Efforts are underway to simplify regulatory procedures and enhance transparency, making the legal framework more investor-friendly.
- **Legal and Regulatory Reforms:** Reforms could improve transparency, investment protection, and the overall business environment, further encouraging foreign investment.
- **Renewable Energy Development:** Only 4% of hydropower potential has been exploited, with a capacity of 527 TWh. Under the National Development Strategy, the government aims to triple electricity exports by 2030 and increase renewable energy capacity by 10 GW by 2037.
- **Evolving Strategy:** The strategy emphasizes diversifying electricity sources, with a focus on solar and wind, in addition to upgrading hydropower infrastructure.
- **Diversification:** The solar energy potential is estimated at 220,000 GWh, with ongoing and planned developments.
- **Renewable Energy Transition:** The goal is to transition fully to renewable energy by 2032, doubling current renewable energy production.
- **Cross-Border Trading:** Tajikistan is well-positioned for cross-border electricity trading, with the goal of tripling exports by 2030.
- **Investment Promotion Agency:** There is potential to establish or enhance an IPA focusing on renewable energy investments.
- **Grid Expansion:** Expanding the grid's technical capabilities is essential to accommodate increased renewable energy generation and facilitate regional trading, including reconnection to the Central Asian Unified Power Grid.

- **Grid Modernization:** Plans to modernize the electricity grid are vital for integrating large-scale renewable energy projects. Expansion and the use of BESS could help balance seasonal variations.
- **Funding:** Improved access to international financing and technical assistance is available.
- **Training:** Partnerships with international institutions provide training opportunities.
- **Knowledge Transfer:** Potential exists for partnerships with international firms to conduct project feasibility studies.
- **Public-Private Partnerships:** There is an opportunity to develop PPP frameworks to attract international investment.
- **Transparency:** International support could improve transparency, particularly in green energy projects.
- **International Support:** Opportunities for international cooperation exist to enhance the legal framework and investment protection mechanisms, including potential partnerships with foreign governments.
- **Regional Cooperation:** There is a strong intention to leverage regional expertise and participate in energy trade.

Turkmenistan

Strengths:

- **Government Acknowledgment:** The government recognizes the importance of renewable energy development and has expanded the national policy and regulatory framework to support this.
- **New Statutes:** The National Strategy for the Development of Renewable Energy in Turkmenistan until 2030 and the state law on Renewable Energy Sources outline the country's commitment to renewable energy.
- **New Regulations:** The government is developing regulatory acts to promote renewable energy use and strengthen international cooperation in the sector.
- **Government Control:** Strong government control could facilitate the development of renewable energy projects.

- **Natural Gas:** Abundant natural gas resources offer the potential to support renewable energy projects.
- **Resource Potential:** Turkmenistan has significant potential for renewable energy, particularly solar and wind, which could attract foreign investment.
- **Raw Materials:** The country has substantial reserves of critical raw materials, such as lithium, iron, and copper.
- **Market Entry:** Turkmenistan offers an open market for foreign investment without local partnership mandates. The law on foreign investment ensures equal treatment for both foreign and domestic investors.
- **Investment Protection:** The country adheres to international arbitration conventions, such as the ICSID and the New York Convention.
- **Public-Private Partnerships:** The government supports the implementation of PPPs, increasing the non-state share in GDP.

Opportunities

- **Government Initiatives:** The government has shown increased interest in diversifying its energy mix to include renewable energy.
- **New Regulatory Acts:** New regulatory acts, including the law "On Renewable Energy Sources" (2021), are being developed to promote the use of renewable energy.
- **Upcoming Plan:** A plan to strengthen international cooperation in the renewable energy sector from 2025–2030 is in the works.
- **Investment Promotion Agency:** Turkmenistan has the potential to establish an IPA focused on diversifying energy investments, with emerging financial tools from institutions like Turkmen Invest and Ashgabat Stock Exchange (ASE).
- **Resource Development:** The country has abundant renewable resources, particularly solar and wind, and critical raw materials for the energy transition.
- **Solar Panels:** Turkmenistan has the potential to become a leading producer of solar panels due to abundant silicon resources.
- **Hydrogen:** The country plans to develop a strategy for green hydrogen.
- **Hybrid Projects:** Combining solar and gas power plants could open the renewable energy sector.
- **Grid Modernization:** The government has the potential to develop the grid to support renewable energy integration.

- **Investment Protection:** There is an opportunity to further strengthen the legal framework for investment protection, enhancing the overall investment climate.
- **Public-Private Partnerships:** There is potential to develop strong PPP frameworks, supported by the state law on PPPs and industry examples.
- **Regional Cooperation:** Opportunities exist for regional cooperation on renewable energy projects and technologies, which could facilitate investment, leveraging existing Central Asian institutions.
- **International Cooperation:** Turkmenistan could benefit from international partnerships and investment in renewable energy projects by opening the sector to foreign investors.

Uzbekistan

Strengths:

- **Political Stability**
- **Government Support:** Strong backing for renewable energy development and investment protection.
- **Recent Reforms:** Significant legal and regulatory reforms aimed at improving the investment climate and energy markets.
- **Long-term Strategy:** A clear long-term energy strategy with specific targets for renewable energy deployment.
- **Ambitious Targets:** Aiming for 40% renewable energy by 2030.
- **Demand Growth:** Rapidly increasing electricity demand with proven drivers.
- **Investment Promotion Agency:** An experienced IPA under the Ministry of Investment and Trade (MIIT), focused on facilitating foreign renewable energy investments.
- **Incentives:** Specific incentives for foreign investors, such as tax breaks and subsidies.
- **Renewable Energy Potential:** Substantial potential for solar and wind energy development, with the theoretical capacity to generate 1,078 TWh of electricity annually from wind power. The country enjoys 320 sunny days per year, with an average global horizontal irradiation ranging from 1,461 to 1,826 kWh/sqm.
- **Grid:** A relatively well-developed electricity grid, ready for renewable energy integration, with emerging BESS.

- **Market Entry:** A non-discriminatory legal environment that allows foreign investors to participate in competitive tenders, auctions, and direct negotiations.
- **Investment Protection:** A robust legal framework for investment protection, including free movement of capital, the right to cease investments, and protection against expropriation. The country recognizes international arbitration and has a system for protecting IP.
- **Financial Environment:** Transitioning to a market-based economy, with green bonds issued in both international and domestic markets.
- **Workforce:** A well-developed technical workforce and educational institutions.
- **Facility Construction:** Domestic EPC and O&M contractors act as subcontractors in utility-scale renewable energy projects.
- **Public-Private Partnerships:** A recently adopted PPP law, with the government promoting PPP projects.
- **Environment:** The country aims to integrate climate action into its energy policies.
- **Technology:** Scaling up R&D and innovation programs, particularly in renewable energy and hydrogen.
- **Regional Cooperation:** Actively promoting regional energy trade and joint renewable energy projects.

Opportunities:

- **Market Growth:** Potential for rapid growth in the renewable energy sector, driven by government initiatives, international partnerships, and economic and population growth.
- **Foreign Direct Investment Attraction:** Efforts to attract FDI in renewable energy, including tax incentives and favorable policies.
- **Grid Modernization:** Ambitious plans to upgrade power lines and substations, including the implementation of a Supervisory Control and Data Acquisition (SCADA) system for enhanced monitoring and control.
- **Upcoming Legal Reforms:** The establishment of an International Commercial Court.
- **Technology Transfer:** Opportunities to develop mechanisms for technology transfer while protecting investors' IP.
- **Public-Private Partnerships:** The potential to further develop comprehensive PPP frameworks for renewable energy projects.

- **Transparency:** Opportunities to improve transparency through collaboration with international partners.
- **International Partnerships:** Increasing potential for collaboration with international entities to enhance renewable energy projects.
- **Regional Leadership:** Potential to become a regional leader in renewable energy development.

Challenges

Each country faces unique challenges that must be addressed to improve the attractiveness of their renewable energy sectors. These challenges include infrastructure, regulatory frameworks, data accessibility, and transparency.

Kazakhstan

Challenges:

- **High Dependence on Fossil Fuels:** Coal accounts for 60% of power generation, and the high energy intensity complicates the transition to renewable energy.
- **Complex Bureaucracy:** Navigating regulations for foreign investors remains difficult despite digitalization efforts.
- **Competition from Traditional Industries:** The focus on extractive fossil fuel industries may overshadow investments in renewable energy.
- **Regulatory Changes:** Potential policy shifts could deter foreign investors.
- **Economic Volatility:** The economy is highly dependent on global energy prices, making investment stability vulnerable to price fluctuations.
- **Data Gaps:** While Kazakhstan leads in Central Asia, incomplete data on some renewable energy resources may affect investment decisions.
- **Market Barriers:** Low electricity prices and high energy subsidies create insufficient financial resources for investors.
- **Grid:** Parts of the grid are aging, and transmission losses remain high. Further modernization is necessary to integrate new renewable energy sources, including BESS.
- **Local Content Requirements:** Policies that may discourage foreign investors and limit financing from international institutions.

- **Skills Availability:** Brain drain among skilled workers.
- **Logistical Challenges:** The country's vast geography complicates the transportation and installation of renewable energy infrastructure.
- **Climate:** Harsh climatic conditions that affect renewable energy projects and infrastructure.

Countermeasures:

- Establish economic policies to reduce dependence on global energy prices.
- Implement policies to gradually decrease reliance on fossil fuels and promote renewable energy.
- Simplify regulatory frameworks and provide clear guidelines for investors.
- Continue the development of a streamlined, competitive electricity market.
- Invest in infrastructure modernization and improve logistics for renewable energy integration, including BESS.
- Adapt local content requirements to international standards.
- Invest in developing specialized knowledge and skills in renewable energy.
- Create working conditions that improve the retention of renewable energy specialists.
- Strengthen renewable energy supply chains to withstand harsh climatic conditions.

Kyrgyzstan

Challenges:

- **Instability:** Institutional instability undermines investor confidence.
- **Regulatory Risks:** Significant gaps in the regulatory framework and inconsistent regulations.
- **Bureaucracy Inefficiencies:** Frequent regulatory changes, duplication of functions, and ineffective collaboration between government entities.
- **Financial Limitations:** Economic constraints that hinder development.
- **Limited Large-Scale Experience:** The country has limited experience attracting large-scale FDI.

- **Limited Diversification:** A narrow range of renewable energy sources limits opportunities.
- **Market Size:** A small market size restricts large-scale investment opportunities.
- **Seasonal Swings:** Electricity shortages in winter, despite summer peaks in renewable energy generation, affect supply stability.
- **Limited Measurement Data:** Incomplete data on potential renewable energy sites.
- **Geographical Limitations:** Difficulties in developing wind energy in populated areas.
- **Market Barriers:** Ineffective pricing policies, low electricity prices, and high energy subsidies that reduce financial resources for investments.
- **Lack of Guarantees:** No assurance for long-term electricity purchase or tariff stability, complicating PPAs.
- **Diffuse IPA:** Multiple government agencies with overlapping functions and unclear guidance for investors.
- **Grid:** Parts of the grid are aging, with high transmission losses and congestion in some areas. The grid lacks BESS.
- **Market Entry:** Auctions and tender procedures for renewable energy infrastructure are not well-established.
- **Limited Digitalization:** A lack of digitalization in tendering and permitting processes. No online data access for investors.
- **Financial Environment:** A limited domestic financial sector and frequent governance changes.
- **Workforce Limitations:** A skills gap due to low demand and brain drain.
- **Project Execution:** A lack of domestic EPC companies with renewable energy expertise.
- **Public-Private Partnerships:** Limited experience with renewable energy PPPs and unclear procurement regimes.
- **Climate Impact:** Variability in hydropower generation affects market stability.
- **Technology:** Limited R&D infrastructure and educational gaps in renewable energy.
- **Regional Cooperation:** Potential differences in energy policies with neighboring countries and geopolitical competition.

Countermeasures

- Mitigate institutional inconsistencies and instabilities.
- Enhance regulatory consistency and transparency, including digitalization.
- Simplify bureaucracy and improve efficiency through digitalization.
- Develop a comprehensive renewable energy strategy, diversifying beyond hydropower to include solar, wind, and biogas.
- Improve data collection and online accessibility for renewable energy sites.
- Reform pricing and tariff policies to ensure financial viability for investors.
- Provide guarantees for long-term electricity purchases and tariff stability.
- Increase market size by planning for electricity exports.
- Streamline IPA functions by merging or better coordinating agencies.
- Continue investing in infrastructure modernization for renewable energy integration, including BESS.
- Establish auction systems and improve tendering procedures for renewable energy projects.
- Digitize auction and tender processes to streamline approvals.
- Expand market opportunities for all renewable energy subsectors with clear investor guarantees.
- Foster cooperation between domestic and IFIs.
- Invest in training programs to develop domestic expertise in solar and wind energy.
- Promote the role of domestic EPC and O&M contractors as subcontractors in utility-scale renewable energy projects.
- Streamline the PPP framework for renewable energy projects, including the procurement regime.
- Pursue further harmonization of energy policies and legislation with neighboring countries.

Tajikistan

Challenges:

- **Inconsistent Renewable Energy Strategy:** The country lacks consistent policies for all renewable energy sources.

- **Heavy Reliance on Hydropower:** Overdependence on hydropower makes Tajikistan vulnerable to climate change and seasonal variations in water flow, particularly from melting glaciers.
- **Unclear Regulations:** The lack of transparency and clear regulations for renewable energy hinders progress.
- **Institutional Gaps:** The current institutional structure is not adapted to a diverse renewable energy environment.
- **Bureaucratic Hurdles:** Complex regulatory processes delay project approvals.
- **Economic Constraints:** Limited financial resources hinder investment in renewable energy infrastructure and restrict the implementation of strategies.
- **Vulnerability to Natural Hazards:** Reliance on hydropower exposes Tajikistan to climate-related risks, such as droughts and changes in glacier melt patterns, which negatively impact electricity generation.
- **Investment Promotion Agency:** There is a lack of a well-developed IPA focused on renewable energy investments.
- **Data Gaps:** Comprehensive and accessible data on some renewable energy sources is lacking.
- **Market Barriers:** Low electricity prices and high energy subsidies hinder investments.
- **Grid Issues:** There is limited data on grid performance, parts of the infrastructure are outdated, and the lack of BESS limits efficiency.
- **Skilled Workforce:** There is a notable skills gap, and the educational system has limited incorporation of renewable energy topics. Although not an immediate issue, there is potential for brain drain.
- **Project Execution:** Bureaucratic challenges, lack of expertise in solar and wind power plant construction, and potential monopoly issues complicate project implementation.
- **Public-Private Partnerships:** There is no formal and legalized PPP framework.
- **Environmental and Social Challenges:** Tajikistan faces significant environmental and social challenges due to its mountainous topography and potential social and cultural barriers.
- **Technology:** Limited domestic R&D and expertise, along with educational gaps, hinder the development of renewable energy.
- **Dependence on Regional Countries:** The reliance on external fossil energy resources creates vulnerabilities.
- **Geopolitics:** Geopolitical issues affect regional cooperation.

Countermeasures:

- Develop a coherent renewable energy strategy.
- Streamline regulatory processes, improve transparency, and expedite project approvals.
- Simplify energy bureaucracy and adapt it to a diverse renewable energy environment.
- Invest in infrastructure to mitigate natural hazards and accommodate higher penetration of intermittent renewable energy sources.
- Establish well-resourced PPPs and IPA functions with clear mandates.
- Intensify cooperation with IFIs to attract more funding.
- Accelerate the transition from fossil fuels to renewable energy to reduce vulnerabilities to imports.
- Invest in capacity building and training for domestic expertise in solar and wind energy.
- Foster regional cooperation to enhance energy security, investment opportunities, and electricity export potential.

Turkmenistan

Challenges:

- **International Exposure:** Limited international exposure distinguishes Turkmenistan from other Central Asian countries.
- **Gas Reliance:** The energy system is heavily reliant on natural gas.
- **Underdeveloped Renewable Energy Sector:** The renewable energy sector is underdeveloped compared to oil and gas, with a lack of clear policies, a regulatory framework, and quantified renewable energy targets.
- **Regulatory Risks:** The underdeveloped regulatory framework for renewable energy affects investor confidence.
- **Data Gaps:** There is insufficient knowledge about energy reserves and project viability.
- **Investment Promotion Agency:** There is limited information on dedicated IPA for renewable energy.

- **Market Barriers:** Low electricity prices and high energy subsidies hinder investments.
- **Power Purchase Agreements:** PPA negotiations may present challenges.
- **Grid Issues:** There is a lack of accessible and comprehensive data on infrastructure, and the grid is not capable of integrating large-scale renewable energy at present. The absence of BESS further limits integration.
- **Investment Protection:** Discrepancies between domestic and foreign arbitration laws may exist. Concerns over the legal system's independence and impartiality may affect investor confidence.
- **Financial Environment:** The economy is highly centralized with limited private sector involvement, and there is a lack of experience in financing renewable energy projects.
- **Workforce:** There is a limited skilled workforce and insufficient renewable energy-focused training programs.
- **Project Execution:** There is limited experience with renewable energy projects and a lack of domestic EPC companies with renewable energy expertise.
- **Environmental Challenges:** The desert climate and seismic zones present specific challenges. Limited experience with Environmental and Social Impact Assessments for renewable energy projects further complicates matters.
- **Technology:** Limited R&D infrastructure and few educational institutions with strong renewable energy programs.
- **Regional Cooperation:** Neutrality may limit Turkmenistan's participation in regional economic blocs.
- **Geopolitical Competition:** External influences complicate investment decisions.

Countermeasures:

- Increase international exposure and improve transparency.
- Develop a clear strategy for renewable energy sector development.
- Establish clear renewable energy policies, guidelines, and quantified targets.
- Create a comprehensive and transparent renewable energy regulatory framework.
- Harmonize domestic energy legislation with international norms.
- Start transitioning from fossil fuels to renewable energy sources.
- Establish or enhance an IPA focused on renewable energy.
- Improve transparency and disclosure mechanisms regarding energy resources.

- Move toward a more competitive electricity market to encourage renewable energy investments.
- Provide clear guidelines and support for PPA negotiations.
- Invest in infrastructure to prepare for higher penetration of intermittent renewable energy, including BESS.
- Diversify the financial environment and increase cooperation with IFIs.
- Invest in capacity building and training for domestic expertise in solar and wind energy.
- Engage more widely in regional cooperation to enhance energy security, investment opportunities, and energy trade.

Uzbekistan

Challenges:

- **Dependence on Fossil Fuels:** A high dependency on natural gas and coal complicates the transition to renewable energy.
- **Regulatory Complexity:** The regulatory environment is complex for foreign investors, with policy inconsistencies due to rapidly changing legislation creating uncertainties.
- **Lack of Coordination:** Conflicting domestic interests and bureaucratic hurdles hinder cooperation among government entities in the renewable energy sector.
- **Investment Promotion Agency Ambiguity:** There is no dedicated IPA for renewable energy, and responsibilities are diffused across government entities and SOEs.
- **Market Barriers:** Low electricity prices, high energy subsidies, and the absence of an efficient energy market hinder investments.
- **Data Accessibility:** There are challenges regarding the availability and coherence of renewable energy and infrastructure data.
- **Aging Infrastructure:** Parts of the infrastructure are outdated, with high losses, requiring modernization.
- **Market Entry:** Local content requirements and regulatory risks complicate market entry for foreign investors.
- **Investment Protection:** Regulatory complexities and inconsistent enforcement may affect investor confidence.

- **Financial Environment:** There is limited experience in financing large-scale domestic renewable energy projects.
- **Workforce:** A skills gap exists, and renewable energy topics are insufficiently incorporated into the national curriculum.
- **Project Execution:** Limited technical and financial capabilities for end-to-end project execution and specialized renewable energy technologies.
- **Public-Private Partnerships:** There is a new law but limited experience with PPPs in the renewable energy sector.
- **Environmental Challenges:** Limited experience with stakeholder engagement and environmental impact assessments, and the country lacks waste management and recycling requirements for renewable energy projects.
- **Technology:** There are educational gaps, regulatory barriers, and limited domestic expertise in advanced renewable energy technologies.
- **Regional and Geopolitical Competition:** Competition from neighboring countries and global powers may affect investment decisions and regional cooperation.

Countermeasures:

- Accelerate the transition from fossil fuels to renewable energy sources.
- Develop a clear, consistent, transparent, and navigable regulatory framework for renewable energy to boost investor confidence.
- Clarify and align renewable energy mandates between state entities.
- Streamline and digitize bureaucratic processes, improve coordination, and enhance data access for foreign investors.
- Continue developing a competitive electricity market.
- Consider making the IPA more independent and autonomous from ministries.
- Promote PPPs in renewable energy projects.
- Adapt local content requirements to international standards.
- Support domestic financial institutions in participating in renewable energy projects.
- Increase the inclusion of renewable energy curricula in educational institutions.
- Invest in R&D to foster innovation in renewable energy technologies.
- Enforce stricter environmental requirements in renewable energy projects.
- Foster international partnerships and engage in regional cooperation to improve energy security, investment opportunities, and energy trade.

07

CHAPTER SEVEN

7. Pseudo-Ecosystem for Renewable Energy Investments in Central Asia

The Central Asian region stands at a critical juncture in its energy transition. Recognizing the urgent need for coherent energy policies and governance frameworks, Central Asian countries are focusing on promoting renewable energy adoption and enhancing energy efficiency.

A comprehensive renewable energy ecosystem is vital for attracting FDI and fostering sustainable development. The Research Project aimed to gather data on the renewable energy landscape across these nations, identifying constraints and challenges and assessing capacities and potential for renewable energy investments.

Table 7-1 outlines key topics for evaluating each Central Asian country's readiness for renewable energy investments. The topics are further described in Chapter 5.1. Together, these topics form a robust framework for assessing the ability of the studied countries to attract renewable energy investments. Therefore, this can be considered a joint, pseudo-ecosystem for foreign investment in renewable energy across the Central Asian region.

Main categories are assigned weightings to emphasize their importance within the overall investment ecosystem. Within each main category, individual ecosystem elements are also weighted, with their total adding up to the category's overall weighting.

Each country possesses distinct strengths, weaknesses, and opportunities and faces different threats. While the topics are extensive, the effectiveness of the evaluation depends on the depth of analysis within each country. Understanding the specific barriers to investment, the actual implementation of policies, and the real-world experiences of investors will be crucial for a comprehensive assessment.

Furthermore, the interaction between these factors—such as how regulatory frameworks influence market conditions or the role of government support in developing a skilled workforce—should also be considered. This will provide a

more nuanced understanding of the investment landscape in each country. Thus, it is essential to delve deeper into each topic to fully capture the complexities of the investment ecosystem.

Table 7-1 lists the main categories and the weightings assigned to each. A country may partially meet the criteria for an element within a category, such as in the solar and wind subsectors but not the bioenergy or small-scale hydroelectric (SS-Hydro) sectors, while other elements may apply across all studied subsectors (wind, solar, bio, and SS-Hydro), thus warranting a tick in the aggregate box. The table, which includes all 202 elements underpinning the 15 main categories, is enclosed in Appendix 3 (Table Appendix 3.1).

The weighting system prioritizes key aspects of the investment ecosystem, emphasizing critical factors for investment decisions while considering a wide range of relevant aspects:

- **High weight (10%)** is assigned to Government Commitment, Regulatory Framework, and Market Conditions, reflecting their importance and aligning with typical investor priorities.
- **Medium weight (6-8%)** is given to categories that directly impact investment risk but are slightly less fundamental for investment decisions.
- **Lower weights (4-5%)** are assigned to more specific or supportive categories, such as Skilled Workforce, Technology and Innovation, and Regional Cooperation.

Table 7-1: Ecosystem – The Main Categories and Their Weighting

		Aggregate	Wind	Solar	Bio	S-S Hydro
10%	1. Government Commitment and Institutional Support					
19 elements						
10%	2. Regulatory Framework and Policy Environment					
8 elements						

Aggregate

Wind

Solar

Bio

S-S Hydro

10%

3. Market Conditions and Potential

23 elements

7%

4. Investment Promotion Agencies

8 elements

8%

5. Resource Availability and Transparency

9 elements

6%

6. Grid Infrastructure

15 elements

7%

7. Market Access

11 elements

7%

8. Investment Protection

13 elements

6%

9. Financial Environment

19 elements

5%

10. In-country Skilled Workforce

9 elements

5%

11. Developers and Engineering, Procurement, and Project Construction Companies

15 elements

Aggregate

Wind

Solar

Bio

S-S Hydro

5%

12. Public-Private Partnerships

16 elements

5%

13. Environmental and Social Factors, Stakeholder Engagement

15 elements

5%

14. Technology and Innovation

12 elements

4%

15. Regional Cooperation

10 elements

Source: Author

The use of relative category weighting (totaling 100%) enables easy comparison between categories and countries, which is a core objective of the Research Project.

The extent to which Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan align with the investment ecosystem elements in Table 7-1 will strongly indicate how attractive each country will be to foreign investors considering renewable energy investments.

7.1 Leveling Ecosystem Components Between Countries

While there are common denominators, distinct differences exist regarding each country's strengths, weaknesses, opportunities, and threats. Table 7-1, when fully populated, contains 202 elements, and each country's alignment is illustrated based on its score for each element within each main category.

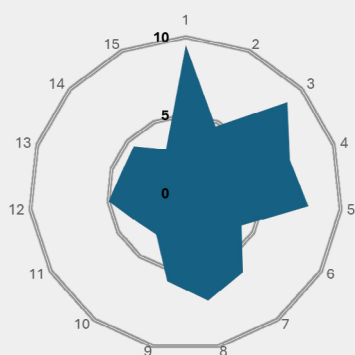
The radar plots in Figure 7-1 show how well each country adheres to the criteria set for each category, based on the exact score. The numbers on the circles' perimeters, from 1 to 15, correspond to the numbers assigned to each main category in Table 7-1.

Two versions of the plots are provided for each country. The plot on the left shows the actual score within the category, while the plot on the right shows the normalized score relative to the maximum achievable score for each category. The latter provides the clearest comparison of how countries perform relative to each other.

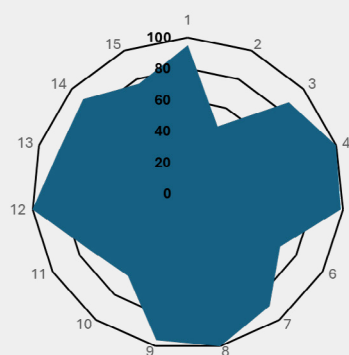
Figure 7-1: Comparison of Each Country's Score by Ecosystem Category

Kazakhstan

Score per Category

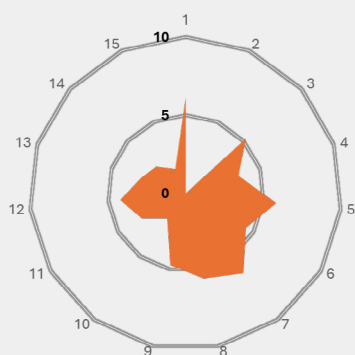


Against Max Achievable per Category

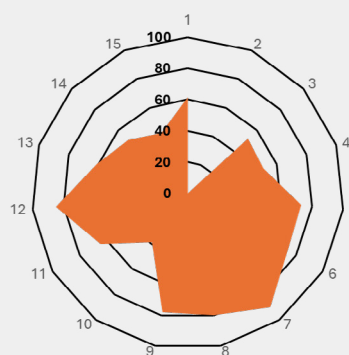


Kyrgyzstan

Score per Category

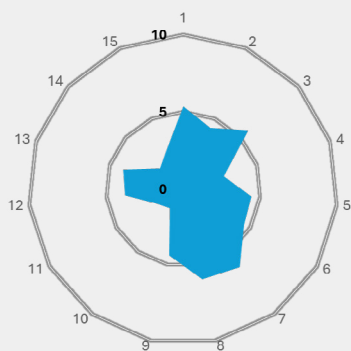


Against Max Achievable per Category

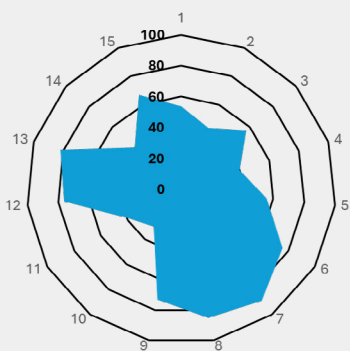


Tajikistan

Score per Category

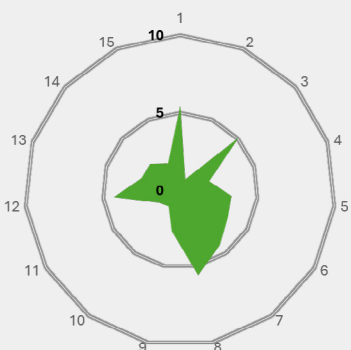


Against Max Achievable per Category

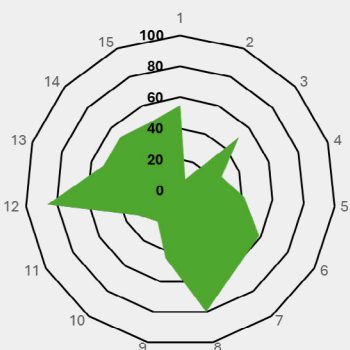


Turkmenistan

Score per Category

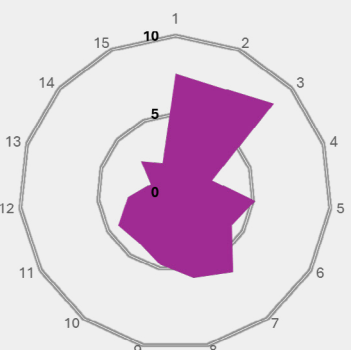


Against Max Achievable per Category

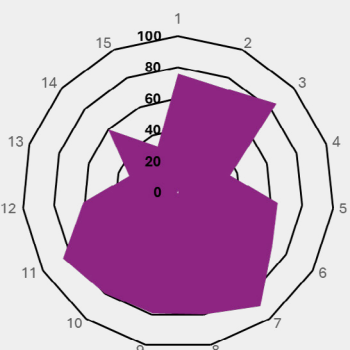


Uzbekistan

Score per Category



Against Max Achievable per Category

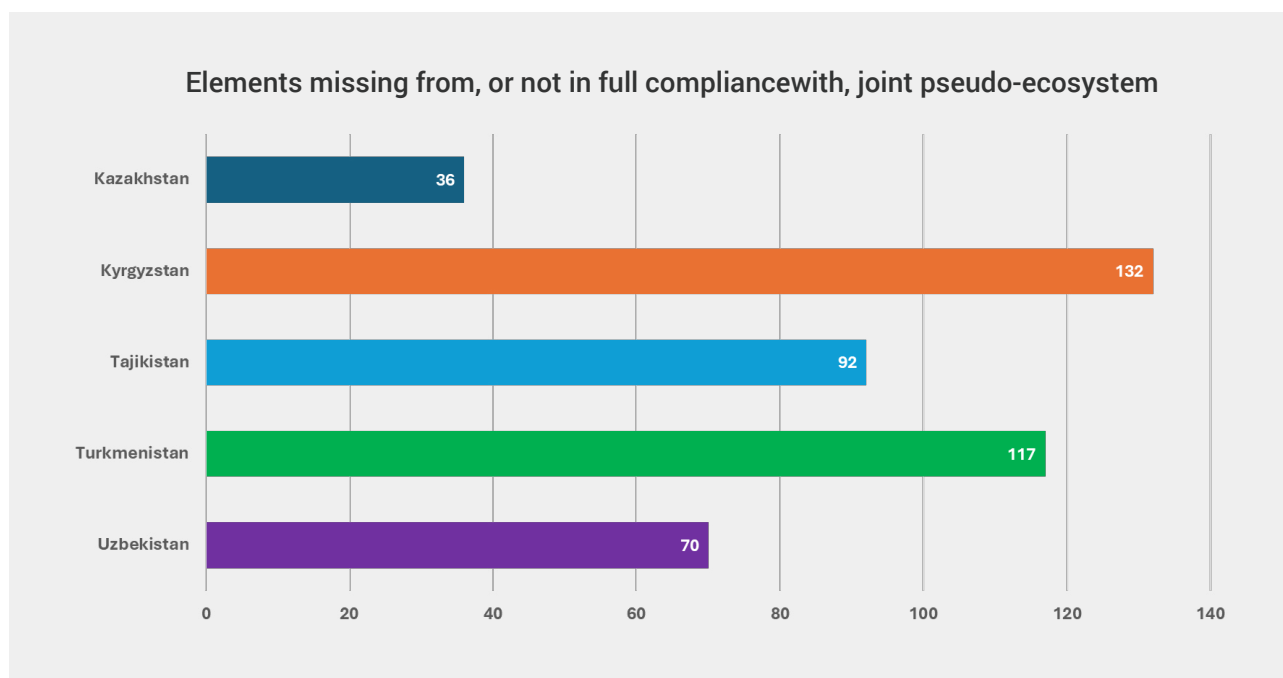


7.2 Need to Adapt Each Country's Ecosystem Elements for Compliance and Parity

When analyzing each country's investment ecosystem, it is possible to identify the elements that are missing or need enhancement from a foreign investor's perspective to fully comply with the joint pseudo-ecosystem. The weighting of each non-compliant or partially compliant criterion can be identified and summarized to assess the overall alignment of the domestic ecosystem.

The number of such elements for each country is illustrated below. Although Kyrgyzstan has the highest number of elements that do not comply with the criteria, Turkmenistan has an overall lower score, as described at the beginning of Chapter 6, due to the relative weighting of the missing or non-compliant elements.

Figure 7-2: Ecosystem Elements Missing or not Compliant by Country



Below, the missing or non-compliant elements are listed for each country, along with the corresponding weightings. Using color coding, it is also indicated whether each main category is investor-friendly as it stands or requires further

development. Categories that are fully compliant with the joint pseudo-ecosystem are not included in the following tables. For a complete, one-page comparison of the main categories between the countries, refer to Chapter 6.

Each color reflects a different ecosystem score, differentiated by 20% intervals: <20% = red (not compliant), 20%-40% = orange, 40%-60% = yellow, 60%-80% = light green, and >80% = dark green (compliant).

Table 7-2: Kazakhstan – Ecosystem Elements Missing or not Compliant

Elements	Percentage deducted
Government Commitment and Institutional Support	0,50
- Specific climate targets, linked with renewable energy targets - Government apparatus able to adapt renewable sector to changing externalities	0,30 0,20
Regulatory Framework and Policy Environment	5,30
- Consistent, robust, and complete regulatory framework, in aggregate and per sub-sector - Regulatory environment easy to navigate by foreign investors - Bureaucracy structure facilitates swift renewable energy investments - Good coordination between Government bodies involved in the renewable energy sector	2,00 1,50 1,00 0,80
Market Conditions and Potential	1,25
- Nation needs foreign investments to reach renewable energy targets (not bioenergy) - Market size attractive to foreign investors in wind, solar, bioenergy, and SSHP (not bioenergy) - Renewable energy can be exported at negotiated terms - Utilities have targets or mandates as regards renewable energy - Green taxonomy linked to incentives exist - Traditional energy industry not creating impediments to renewable energy investments	0,15 0,40 0,20 0,20 0,20 0,10

Resource Availability and Transparency	0,10
Potential for a green hydrogen industry based on renewable energies exists (not bioenergy)	0,10
Grid Infrastructure	1,89
- All regions covered by transmission and distribution networks - Necessary regional autonomy and redundancy in place - Entire domestic electricity grid fully interconnected - Connected to CASA-1000 - Energy storage supporting intermittent RE sources in the 100 MW scale exists or is being developed (only for solar)	0,90 0,54 0,30 0,06 0,09
Market Access	0,75
- Foreign investors can be invited to direct negotiations for RE projects - No limitations for RE projects in certain geographies and on societal grounds (excludes SS-Hydro)	0,70 0,05
Financial Environment	0,24
- Other risk-mitigation instruments for foreign investors (under financial environment) - Domestic currency investment bindings that could affect returns on investment	0,12 0,12
In-country Skilled Workforce	1,40
- Sufficient availability of in-country RE specialists - Domestic R&D capabilities in RE are adequate - Domestic educational system for a renewable workforce is fit for purpose	0,60 0,20 0,60
Project Developers and EPC Companies	1,37
- Domestic experience in RE project execution (not bioenergy) - Existing, mature domestic industry of project developers and EPC companies for RE projects - Existing domestic industry to manufacture RE technology components - National strategy to develop domestic RE industry	0,12 0,75 0,25 0,25

Environmental and Social Factors, Stakeholder Engagement	0,52
• Communities can stop or suspend RE projects	0,20
• No danger of renewable projects, per se, leading to serious environmental degradation	0,16
• Waste management system from RE projects and operations exists	0,16
Technology and Innovation	0,52
• Culture of innovation and entrepreneurship in the RE sector	0,40
Regional Cooperation	0,92
• Regional issues do not adversely affect electricity trade	0,32
• Regional issues do not adversely affect RE initiatives	0,32
• Geopolitics does not affect regional RE projects	0,28
• Additional score needed for full compliance with joint pseudo-ecosystem	15,52

SSHP= small-scale hydropower, EPC= engineering, procurement, and construction, RE= renewable energy
Source: Author

Table 7-3: Kyrgyzstan – Ecosystem Elements Missing or not Compliant

Elements	Percentage deducted
Government Commitment and Institutional Support	3,85
• Country perceived to be politically stable (WB WGI and EIU DI)	1,00
• Established RE sector (only SS-Hydro)	0,45
• Prioritized subsectors (only solar and SS-Hydro)	0,20
• Documented track record on achieving targets	0,40
• Inter-ministerial coordination mechanisms for RE policy	0,40
• No ambiguities regarding state bodies' competencies and mandates for RE	0,40
• Stable institutional structure for RE	0,40
• Documented track record on honoring energy agreements with foreign investors	0,60

Regulatory Framework and Policy Environment

10,0

- Consistent, robust, and complete regulatory framework, in aggregate and per sub-sector 2,00
- Regulatory environment easy to navigate by foreign investors 1,50
- Bureaucracy structure facilitates swift RE investments 1,00
- Bureaucratic processes are streamlined and coordinated 1,50
- Tendering for RE projects is digitalized 1,20
- Digitalized licensing and permitting processes for RE projects 1,20
- Good coordination between Government bodies involved in the RE sector 0,80
- Relevant regulations always implemented before RE project execution 0,80

Market Conditions and Potential

4,80

- Double-digit annual growth in demand for RE over the next decade 0,20
- Competitive electricity market 0,60
- Traditional off-takers (TSOs, DSOs, large corporations) are robust in terms of creditworthiness and payment history 0,50
- Electricity prices conducive to RE generation and distribution investments 1,00
- Electricity price-range predictable and guaranteed over lifecycle 1,00
- PPAs are freely negotiated and legally protected 1,00
- Utilities have targets or mandates as regards RE 0,20
- Clear rules for award of renewable energy projects to investors 0,30

Investment Promotion Agencies

3,43

- IPA with RE expertise and experience exist 1,40
- IPA well-resourced 1,05
- No scope for ambiguity between IPA for RE and other public bodies 0,56
- IPA actively and systematically promoting RE opportunities (only SS-Hydro) 0,21
- IPA creating synergies between RE investments and investments in other sectors 0,21

Resource Availability and Transparency

2,16

- Quality data on RE resources and being potentially regularly updated 0,80
- Quality RE data maintained by the central, reliable, and authorized body 0,56
- Open and online access to data on renewable resources and potential 0,80

Grid Infrastructure	1,56
• Necessary regional autonomy and redundancy in place	0,54
• All data on the electricity grid available to foreign investors	0,30
• Network Code developed	0,30
• Network Code in use	0,30
• Energy storage supporting intermittent RE sources in the 100 MW scale exists or is being developed	0,12
Market Access	0,70
• SEZs for RE projects exist	0,35
• SEZs for RE projects open to foreign investors	0,35
Investment Protection	1,40
• Measures protecting against the expropriation of assets or mitigation thereof exist	0,70
• Mechanisms to mitigate operational matters outside the foreign investors' control exist (e.g., consequences of the market being unable to absorb electricity production)	0,35
• Legal system independence and impartiality	0,35
Financial Environment	1,32
• Domestic financial institutions capable of \$50 million RE project funding	0,30
• Domestic funds capable of \$10 million RE project funding	0,12
• No risk factors (e.g. market, political, foreign relations) that adversely impact the financial environment for RE projects	0,12
• State programs or initiatives specifically designed to attract foreign RE investment	0,24
• State guarantees for investment in renewable projects with foreign investors	0,30
• Domestic currency non-volatile	0,12
• Domestic currency investment bindings that could affect returns on investment	0,12
In-country Skilled Workforce	2,40
• Sufficient availability of skilled in-country workers for wind, solar, bioenergy, and small-scale hydro projects (only for bio and SS-Hydro)	0,40
• Sufficient availability of in-country RE specialists (only for bio and SS-Hydro)	0,30

- | | |
|--|------|
| • Workforce in-country retention is adequate | 0.40 |
| • Domestic R&D capabilities in RE are adequate (only for bio and SS-Hydro) | 0.10 |
| • Sufficient domestic training programs closing skills gaps in RE | 0.60 |
| • Mechanisms formalized to bring expertise from abroad to compensate for the lack of qualified local resources | 0.20 |
| • Government investing in local skills, knowledge, and industry capacity building | 0.40 |

Project Developers and EPC Companies

1,78

- | | |
|--|------|
| • Domestic experience in RE project execution (only for bio and SS-Hydro) | 0,25 |
| • Existing, mature domestic industry of project developers and EPC companies for RE projects (only for SS-Hydro) | 0,57 |
| • Existing domestic industry to manufacture RE technology components (not for wind) | 0,06 |
| • National strategy to develop domestic RE industry | 0,25 |
| • No local content required for RE projects | 0,25 |
| • Logistics infrastructure is sufficiently developed for RE projects | 0,25 |
| • Climatic conditions do not threaten RE projects and operations | 0,15 |

PPPs

0,64

- | | |
|---|------|
| • PPP agency has RE competence | 0,12 |
| • PPP opportunities in RE are systematically promoted online | 0,12 |
| • Risk-sharing mechanisms between public and private partners are clearly defined for RE projects | 0,40 |

Environmental and Social Factors, Stakeholder Engagement

1,56

- | | |
|--|------|
| • ESIA law includes provisions that can stop or suspend RE projects | 0,20 |
| • Institutionalized collaboration between government, RE industry, and communities | 0,20 |
| • Communities can stop or suspend RE projects | 0,20 |
| • Strong standards to mitigate the negative impacts of large-scale renewable projects | 0,32 |
| • All-encompassing fines and penalties for foreign investors are described in ESIA law | 0,16 |
| • Climate and nature preservation policy integrated with energy policy | 0,16 |
| • Mandatory consultation with neighboring countries on cross- or near-border projects | 0,16 |
| • Waste management system from RE projects and operations exists | 0,16 |

Technology and Innovation	1,97
• Domestic R&D institutions and networks dedicated to RE exist (only for bio and SS-Hydro)	0,30
• Universities and educational institutions with strong programs in RE (only for SS-Hydro)	0,45
• Domestic companies developing renewable technologies (only for bio and SS-Hydro)	0,10
• Domestic RE professionals are sufficiently incentivized to stay and work in-country	0,20
• Culture of innovation and entrepreneurship in the RE sector	0,40
• No requirements for foreign investors to use domestic technology in RE projects	0,32
• The domestic RE ecosystem can absorb technologies and solutions already studied and accepted in-country	0,20
Regional Cooperation	2,32
• Law on regional energy trade exists	0,60
• Regulations on regional harmonization of RE policies exist	0,40
• Bilateral or multilateral cooperation with neighboring countries on RE institutionalized	0,40
• Regional issues do not adversely affect electricity trade	0,32
• Regional issues do not adversely affect RE initiatives	0,32
• Geopolitics does not affect regional electricity trade	0,28
• Additional score needed for full compliance with joint pseudo-ecosystem	42,29

RE= renewable energy, EPC= engineering, procurement, and construction, PPPs= public private partnerships

Source: Author

Table 7-4: Tajikistan – Ecosystem Elements Missing or not Compliant

Elements	Percentage deducted
Government Commitment and Institutional Support	4,65
• Law on RE exists (applies to SS-Hydro)	0,75
• Government commitment to international climate and RE agreements (for solar an SS-Hydro)	0,50
• Long-term, holistic energy strategy exists, integrating RE policies into the overall energy mix (for wind, solar an SS-Hydro)	0,20
• Established RE sector (for solar an SS-Hydro)	0,30
• Specific RE targets, aggregate and per sub-sector (for solar an SS-Hydro)	0,30
• Cabinet minister with specific responsibility for RE portfolio	0,40
• Inter-ministerial coordination mechanisms for RE policy	0,40
• No ambiguities regarding state bodies' competencies and mandates for RE	0,40
• Stable institutional structure for RE	0,40
• Documented track record on honoring energy agreements with foreign investors (for SS-Hydro)	0,45
• Long-term climate and green economy strategy, in symbiosis with energy strategy (for solar an SS-Hydro)	0,15
• Regular reviews by authorities of statutes, regulations, policies, and RE targets and strategies (SS-Hydro)	0,30
• Government apparatus able to adapt renewable sector to changing externalities (for solar an SS-Hydro)	0,10
Regulatory Framework and Policy Environment	5,65
• Consistent, robust, and complete regulatory framework, in aggregate and per sub-sector (solar and hydro)	1,00
• Regulatory environment easy to navigate by foreign investors	1,50
• Bureaucracy structure facilitates swift RE investments (for SS-Hydro)	0,75
• Tendering for RE projects is digitalized	1,20
• Digitalized licensing and permitting processes for RE projects	1,20
Market Conditions and Potential	4,32
• Double-digit annual growth in demand for RE over the next decade (not for bioenergy)	0,05
• Electricity subsidies prevalent	0,10
• Guaranteed electricity offtake, throughout the year and over the lifecycle	0,75
• Traditional off-takers (TSOs, DSOs, large corporations) are robust in terms of creditworthiness and payment history	0,37
• Dispatching of RE electricity production is the priority	0,10

- RE can be exported at negotiated terms 0,15
- Electricity price-range predictable and guaranteed over lifecycle 1,00
- PPAs are freely negotiated and legally protected 1,00
- Incentives granted on an ad-hoc, project-by-project basis 0,20
- Green taxonomy linked to incentives exist 0,20
- Clear rules for award of renewable energy projects to investors 0,30
- Traditional energy industry not creating impediments for renewable energy investments 0,10

Investment Promotion Agencies

4,22

- IPA with RE expertise and experience exists (only for SS-Hydro) 1,05
- IPA well-resourced 1,05
- IPA serving foreign investors through business registration, pre-investment, investment, and operational lifecycle matters, reducing 'red tape' (only for SS-Hydro) 1,05
- IPA with the mandate to enact RE projects nationwide throughout the full lifecycle (only for SS-Hydro) 0,79
- IPA actively and systematically promoting RE opportunities 0,28

Resource Availability and Transparency

3,56

- Quality data on available RE resources exist (for solar, wind, and SS-Hydro, not bio) 0,30
- Quality data on the potential for RE exist (for solar, wind, and SS-Hydro, not bio) 0,30
- Quality data on RE resources and being potentially regularly updated 0,80
- Quality RE data maintained by a central, reliable, and authorized body 0,56
- Open and online access to data on renewable resources and potential 0,80
- Potential for the raw material industry essential for renewable technologies exists 0,40
- Potential for a green hydrogen industry based on renewable energies exists 0,40

Grid Infrastructure

1,44

- Necessary regional autonomy and redundancy in place 0,54
- All data on the electricity grid are available to foreign investors 0,30
- One-stop shop to connect new RE practices 0,30
- Advanced monitoring and control of the entire domestic electricity network implemented 0,30

Market Access

0,77

- Local stakeholders are not required as partners for RE projects 0,35
- No restrictions on specific RE projects that can be opened to foreign investors 0,21

- No limitations for RE projects in certain geographies and on societal grounds

0,21

Investment Protection

1,05

- Free remittance and movement of capital, including profits and dividends

1,05

Financial Environment

1,62

- MDBs already partaking in real, RE investments
- Domestic financial institutions capable of \$50 million RE project funding
- No risk factors (e.g. market, political, foreign relations) that adversely impact the financial environment for RE projects
- Other risk-mitigation instruments for foreign investors
- State participation in RE projects with foreign investors
- Domestic currency is freely convertible
- Domestic currency non-volatile
- Domestic currency investment bindings that could affect returns on investment

0,60

0,30

0,12

0,12

0,12

0,12

0,12

0,12

In-country Skilled Workforce

2,80

- Sufficient availability of skilled in-country workers for wind, solar, bioenergy, and small-scale hydro projects
- Sufficient availability of in-country RE specialists (only for bio and SS-Hydro)
- Domestic R&D capabilities in RE are adequate
- Domestic educational system for a renewable workforce is fit for purpose
- Sufficient domestic training programs closing skills gaps in RE

0,80

0,60

0,20

0,60

0,60

Project Developers and EPC Companies

3,08

- Domestic experience in RE project execution (only for SS-Hydro)
- Existing, mature domestic industry of project developers and EPC companies for RE projects (only for SS-Hydro)
- Existing domestic industry to manufacture RE technology components
- National clusters and networks of RE development companies
- Real business activity of foreign project developers and operators in the country's RE sector
- No local content required for RE projects
- No mandatory collaboration between domestic and foreign EPC companies in the RE sector

0,37

0,56

0,25

0,25

0,75

0,25

0,25

- Logistics infrastructure sufficiently developed for RE projects - Climatic conditions do not threaten renewable energy projects and operations	0,25 0,15
PPPs	0,96
- No barriers or challenges to forming PPPs in the RE sector exist - Compilation of approved PPP opportunities exist - PPP opportunities in RE are systematically promoted online - Risk-sharing mechanisms between public and private partners are clearly defined for RE projects - Track record of PPPs in the country available online	0,20 0,12 0,12 0,40 0,12
Environmental and Social Factors, Stakeholder Engagement	0,72
- Institutionalized collaboration between government, RE industry, and communities - Communities can stop or suspend RE projects - Climate and nature preservation policy integrated with energy policy - Mandatory consultation with neighboring countries on cross- or near-border projects	0,20 0,20 0,16 0,16
Technology and Innovation	2,39
- Domestic R&D institutions and networks dedicated to RE exist - Universities and educational institutions with strong programs in RE - Domestic companies developing renewable technologies - Domestic RE professionals are sufficiently incentivized to stay and work in-country - Culture of innovation and entrepreneurship in the RE sector - No requirements for foreign investors to use domestic technology in RE projects - The domestic RE ecosystem can absorb technologies and solutions already studied and accepted in-country	0,60 0,60 0,20 0,20 0,40 0,24 0,15
Regional Cooperation	1,32
- Bilateral or multilateral cooperation with neighboring countries on RE institutionalized - Regional issues do not adversely affect electricity trade - Regional issues do not adversely affect RE initiatives - Geopolitics does not affect regional RE projects - Additional score needed for full compliance with joint pseudo-ecosystem	0,40 0,32 0,32 0,28 40,04

RE= renewable energy, EPC= engineering, procurement, and construction, PPPs= public private partnerships

Source:Author

Table 7-5: Turkmenistan – Ecosystem Elements Missing or not Compliant

Elements	Percentage deducted
Government Commitment and Institutional Support	4,50
• Long-term, holistic energy strategies exist, integrating RE policies into the overall energy mix	0,80
• Energy strategy integrating broader economic, environmental, and societal goals	0,40
• Established RE sector	0,60
• Prioritized subsectors (wind, solar)	0,20
• Specific RE targets, aggregate and per sub-sector	0,60
• Documented track record on achieving targets	0,40
• Stable institutional structure for RE	0,40
• Documented track record on honoring energy agreements with foreign investors (for wind and solar)	0,30
• Long-term climate and green economy strategy, in symbiosis with energy strategy	0,30
• Specific climate targets, linked with RE targets	0,30
• Government apparatus able to adapt renewable sector to changing externalities	0,20
Regulatory Framework and Policy Environment	9,20
• Consistent, robust, and complete regulatory framework, in aggregate and per sub-sector	2,00
• Regulatory environment easy to navigate by foreign investors	1,50
• Bureaucracy structure facilitates swift RE investments	1,00
• Bureaucratic processes are streamlined and coordinated	1,50
• Tendering for RE projects is digitalized	1,20
• Digitalized licensing and permitting processes for RE projects	1,20
• Good coordination between Government bodies involved in the RE sector	0,80
Market Conditions and Potential	4,90
• Market size attractive to foreign investors in wind, solar, bioenergy, and small-scale hydro (wind and solar)	0,40
• Double-digit annual growth in demand for RE over the next decade	0,20
• Competitive electricity market	0,60
• Dispatching of RE electricity production is the priority	0,20
• RE can be exported at negotiated terms	0,20

- Electricity prices conducive to RE generation and distribution investments 1,00
- Utilities have targets or mandates as regards RE 0,20
- Incentives tailored to RE (e.g., tax breaks, subsidies, favorable tariffs, land rights, and climate-related). Be concrete 0,80
- Incentives time-bound 0,20
- Incentives event-triggered 0,20
- Incentives made generally applicable to RE projects by the Government 0,20
- Incentives granted on an ad-hoc, project-by-project basis 0,20
- Green taxonomy linked to incentives exist 0,20
- Authorities systematically and publicly marketing RE project opportunities 0,20
- Traditional energy industry not creating impediments for renewable energy investments 0,10

Investment Promotion Agencies

5,04

- IPA with RE expertise and experience exists 1,40
- IPA well-resourced 1,05
- IPA with the mandate to enact RE projects nationwide throughout the full lifecycle 1,05
- IPA with enforcement mechanisms to protect investors' granted rights 1,05
- IPA actively and systematically promoting RE opportunities 0,28
- IPA creating synergies between RE investments and investments in other sectors 0,21

Resource Availability and Transparency

4,68

- RE resources and potential exist in amounts that can be commercialized (wind and solar) 1,00
- Quality data on available RE resources exist 1,20
- Quality data on the potential for RE exists (wind and solar) 0,60
- Quality data on RE resources and being potentially regularly updated (wind and solar) 0,40
- Quality RE data maintained by a central, reliable, and authorized body (wind and solar) 0,28
- Open and online access to data on renewable resources and potential 0,80
- Potential for raw material industry essential for renewable technologies exists (wind and solar) 0,20
- Potential for a green hydrogen industry based on renewable energies exists (wind and solar) 0,20

Grid Infrastructure	2,46
• Grid capable of integrating intermittent RE projects on a 100 MW scale	1,20
• One-stop shop to connect new RE practices	0,30
• Network Code developed	0,30
• Network Code in use	0,30
• Connected to the Central Asian Unified Power Grid	0,06
• Connected to CASA-1000	0,06
• Energy storage supporting intermittent RE sources on a 100 MW scale exists or is being developed	0,12
• Plans for grid upgrades, expansion, or modernization to accommodate RE exist	0,12
Market Access	2,66
• Foreign investors can participate in RE auctions	1,40
• State participation is not required for RE projects	0,35
• SEZs for RE projects exist	0,35
• SEZs for RE projects open to foreign investors	0,35
• No limitations for RE projects in certain geographies and on societal grounds	0,21
Investment Protection	1,40
• Measures protecting against the expropriation of assets or mitigation thereof exist	0,70
• Mechanisms to mitigate operational matters outside the foreign investors' control exist (e.g. consequences of the market being unable to absorb electricity production)	0,35
• Legal system independence and impartiality	0,35
Financial Environment	3,33
• Stable financial market	0,90
• MDBs already partaking in real, RE investments	0,60
• Established access to international development organizations and funds (for wind and solar)	0,30
• Domestic financial institutions familiar with RE projects (wind and solar)	0,15
• Domestic financial institutions capable of \$50 million RE project funding	0,30
• Domestic funds capable of \$10 million RE project funding	0,12
• No limitations on foreign investors to acquire financing in the country for RE projects	0,12

- | | |
|--|------|
| • State programs or initiatives specifically designed to attract foreign RE investment | 0,24 |
| • State guarantees for investment in renewable projects with foreign investors | 0,30 |
| • Other risk-mitigation instruments for foreign investors | 0,12 |
| • State participation in RE projects with foreign investors (wind and solar) | 0,06 |
| • Domestic currency investment bindings that could affect returns on investment | 0,12 |

In-country Skilled Workforce

3,00

- | | |
|--|------|
| • Sufficient availability of skilled in-country workers for wind, solar, bioenergy, and small-scale hydro projects | 0,80 |
| • Sufficient availability of in-country RE specialists | 0,60 |
| • Domestic R&D capabilities in RE are adequate | 0,20 |
| • Domestic educational system for a renewable workforce is fit for purpose | 0,60 |
| • Sufficient domestic training programs closing skills gaps in RE | 0,60 |
| • Mechanisms formalized to bring expertise from abroad to compensate for the lack of qualified local resources | 0,20 |

Project Developers and EPC Companies

3,43

- | | |
|---|------|
| • Domestic experience in RE project execution (wind and solar) | 0,25 |
| • Existing, mature domestic industry of project developers and EPC companies for RE projects | 0,75 |
| • Existing domestic industry to manufacture RE technology components | 0,25 |
| • National clusters and networks of RE development companies | 0,25 |
| • Real business activity of foreign project developers and operators in the country's RE sector | 0,75 |
| • Real business activity of foreign EPC companies in the country's RE sector (wind and solar) | 0,25 |
| • No local content required for RE projects | 0,25 |
| • Public procurement requirements for RE projects exist | 0,20 |
| • Public construction standards for RE projects exist | 0,15 |
| • Logistics infrastructure sufficiently developed for RE projects | 0,25 |
| • Climatic conditions do not threaten renewable energy projects and operations (wind and solar) | 0,08 |

PPPs	0,56
• Incentives offered to private investors participating in PPPs • PPP agency has RE competence • PPP opportunities in RE are systematically promoted online	0,32 0,12 0,12
Environmental and Social Factors, Stakeholder Engagement	1,92
• ESIA law includes provisions that can stop or suspend RE projects • Institutionalized collaboration between government, RE industry, and communities • Mandatory stakeholder dialogue at the community level for RE projects • Communities can stop or suspend RE projects • Strong standards to mitigate the negative impacts of large-scale renewable projects • All-encompassing fines and penalties for foreign investors are described in ESIA law • Climate and nature preservation policy integrated with energy policy • Mandatory consultation with neighboring countries on cross- or near-border projects • No danger of renewable projects, per se, leading to serious environmental degradation • Waste management system from RE projects and operations exists	0,20 0,20 0,20 0,20 0,32 0,16 0,16 0,16 0,16 0,16
Technology and Innovation	1,94
• Universities and educational institutions with strong programs in RE • Government funding R&D for RE technologies and capacity building (solar, wind, and bio) • Domestic companies developing renewable technologies • Domestic RE professionals are sufficiently incentivized to stay and work in-country • Culture of innovation and entrepreneurship in the RE sector • Formal collaboration with international institutions and corporations in RE technologies • The domestic RE ecosystem can absorb technologies and solutions already studied and accepted in-country	0,60 0,10 0,20 0,20 0,40 0,24 0,20

Regional Cooperation	2,08
• Law on regional energy trade exists	0,60
• Participation in regional RE projects above \$10 million	0,40
• Regulations on regional harmonization of RE policies exist	0,40
• Bilateral or multilateral cooperation with neighboring countries on RE institutionalized	0,40
• Geopolitics does not affect regional electricity trade	0,28
• Additional score needed for full compliance with joint pseudo-ecosystem	53,94

EPC= engineering, procurement, and construction, PPPs= public private, RE=renewable energy, IPA=

Source: Author

Table 7–6: Uzbekistan – Ecosystem Elements Missing or not Compliant

Elements	Percentage deducted
Government Commitment and Institutional Support	2,40
• Law on RE exists	1,00
• Long-term, holistic energy strategy exists, integrating RE policies into the overall energy mix (for wind, solar, and SS-Hydro)	0,20
• Energy strategy integrating broader economic, environmental, and societal goals	0,40
• No ambiguities regarding state bodies' competencies and mandates for RE	0,40
• Stable institutional structure for RE	0,40
Regulatory Framework and Policy Environment	2,70
• Regulatory environment easy to navigate by foreign investors	1,50
• Tendering for RE projects is digitalized	1,20

Market Conditions and Potential	1,50
• Competitive electricity market	0,60
• Utilities have targets or mandates as regards RE	0,20
• Incentives made generally applicable to RE projects by the Government	0,20
• Green taxonomy linked to incentives exists	0,20
• Clear rules for award of renewable energy projects to investors	0,30
Investment Promotion Agencies	4,55
• IPA with RE expertise and experience exists	1,40
• IPA well-resourced	1,05
• IPA with the mandate to enact RE projects nationwide throughout the full lifecycle (only for SS-Hydro)	1,05
• IPA with enforcement mechanisms to protect investors' granted rights	1,05
Resource Availability and Transparency	2,84
• RE resources and potential exist in amounts that can be commercialized (wind, solar, and SS-Hydro)	0,50
• Quality data on available RE resources exists (wind, solar, and SS-Hydro)	0,30
• Quality data on the potential for RE exists (wind, solar, and SS-Hydro)	0,30
• Quality data on RE resources and being potentially regularly updated (wind and solar)	0,80
• Quality RE data maintained by a central, reliable, and authorized body (wind and solar)	0,14
• Open and online access to data on renewable resources and potential	0,80
Grid Infrastructure	1,80
• Necessary regional autonomy and redundancy in place	0,54
• Assessment of national and regional grid quality and losses exists	0,30
• One-stop shop to connect new RE practices	0,30
• Network Code developed	0,30
• Network Code in use	0,30
• Connected to CASA-1000	0,06
Market Access	0,70
• SEZs for RE projects exist	0,35
• SEZs for RE projects open to foreign investors	0,35

Investment Protection	1,40
Measures protecting against the expropriation of assets or mitigation thereof exist	0,70
Mechanisms to mitigate operational matters outside the foreign investors' control exist (e.g., consequences of the market being unable to absorb electricity production)	0,35
Legal system independence and impartiality	0,35
Financial Environment	1,26
Stable financial market	0,90
Other risk-mitigation instruments for foreign investors	0,12
State participation in RE projects with foreign investors	0,12
Domestic currency investment bindings that could affect returns on investment	0,12
In-country Skilled Workforce	0,80
Sufficient availability of skilled in-country workers for wind, solar, bioenergy, and small-scale hydro projects (for wind, solar, and SS-Hydro)	0,20
Sufficient availability of in-country RE specialists (for wind, solar, and SS-Hydro)	0,15
Workforce in-country retention is adequate (for wind, solar, and SS-Hydro)	0,10
Domestic R&D capabilities in RE are adequate	0,20
Domestic educational system for the renewable workforce is fit for purpose (for wind, solar, and SS-Hydro)	0,15
Project Developers and EPC Companies	0,75
Existing domestic industry to manufacture RE technology components	0,25
National strategy to develop domestic RE industry	0,25
National clusters and networks of RE development companies	0,25
PPPs	1,56
Competitive PPP processes established	0,40
Competition in PPP procurement processes is transparent	0,32
No barriers or challenges to forming PPPs in the RE sector exist	0,20
Compilation of approved PPP opportunities exist	0,12

- Risk-sharing mechanisms between public and private partners are clearly defined for RE projects 0,40
- Track record of PPPs in the country available online 0,12

Environmental and Social Factors, Stakeholder Engagement

2,68

- Law on ESIA exists 0,60
- ESIA law includes provisions that can stop or suspend RE projects 0,20
- Strong enforcement of ESIA law and bylaws 0,40
- Communities can stop or suspend RE projects 0,20
- Mandatory and formalized environmental performance review on RE projects 0,32
- Strong standards to mitigate the negative impacts of large-scale renewable projects 0,32
- All-encompassing fines and penalties for foreign investors are described in ESIA law 0,16
- Climate and nature preservation policy integrated with energy policy 0,16
- Mandatory consultation with neighboring countries on cross- or near-border projects 0,16
- Waste management system from RE projects and operations exists 0,16

Technology and Innovation

1,60

- Universities and educational institutions with strong programs in RE 0,60
- Government funding R&D for RE technologies and capacity building 0,40
- Domestic companies developing renewable technologies 0,20
- Culture of innovation and entrepreneurship in the RE sector 0,40

Regional Cooperation

1,96

- Law on regional energy trade exists 0,60
- Participation in material and regional energy trade is established 0,40
- Regulations on regional harmonization of RE policies exist 0,40
- Geopolitics does not affect regional RE projects 0,28
- Geopolitics does not affect regional electricity trade 0,28
- Additional score needed for full compliance with joint pseudo-ecosystem 31,23

EPC= engineering, procurement, and construction, PPPs= public private, RE=renewable energy

Source: Author

The background is a vibrant green with a gradient from a lighter shade at the top to a darker shade at the bottom. It features several large, overlapping, wavy shapes in different shades of green. Thin, white, curved lines sweep across the background, adding a sense of motion and depth. In the center, the number '08' is displayed in a large, bold, white sans-serif font.

08

CHAPTER EIGHT

8. Priority Renewable Energy Subsectors for Each Country

Central Asia's vast geography and abundant natural resources present a unique opportunity for renewable energy development. The region's increasing energy demand, coupled with the need to reduce its carbon footprint, requires a strategic shift toward renewable energy sources.

The transition to renewable energy in Central Asia is critical for addressing environmental challenges, enhancing energy security, and fostering economic growth. The region possesses significant untapped potential in solar and wind power. However, apart from Kyrgyzstan and Tajikistan, fossil fuels dominate the energy landscape, with up to 95% of the total energy supply in some countries coming from non-renewable sources.

To achieve a sustainable and carbon-neutral energy future, these countries must redirect investments toward renewables, enhance electricity transmission and distribution infrastructure, and implement energy efficiency measures. This transition requires only a modest increase in overall energy investment, as discussed in Chapter 4, making it an economically viable option.

The following brief assessment prioritizes renewable energy subsectors for each country in the study based on factors such as resource availability, technical feasibility, economic viability, and policy alignment.

Regional Overview

Although each country has unique priorities based on its natural resources and infrastructure, a coordinated approach to renewable energy development would benefit the entire region. This includes improving grid infrastructure to accommodate intermittent renewable sources, developing energy storage solutions, removing market barriers, and fostering regional cooperation in energy trade.

Central Asia offers diverse renewable energy opportunities, including solar, wind,

hydro, and biomass. The priorities of this study focus on these energy sources. However, the specific characteristics of each country—such as geography, climate, and infrastructure—affect the relative attractiveness of different subsectors.

Country-Specific Prioritization

Kazakhstan

- **Priority 1: Wind** – Kazakhstan’s vast, flat plains and consistent winds make it ideal for wind power generation, particularly in the northern and central regions. The country has already made notable progress in wind energy development, and further investments can enhance its energy independence and reduce GHG emissions.
- **Priority 2: Solar** – Although Kazakhstan’s solar potential is somewhat limited by its northern latitude, abundant sunlight in the southern regions makes solar energy a viable option. Solar can contribute to meeting peak demand and provide off-grid energy solutions.
- **Priority 3: Small-Scale Hydro** – While smaller than wind or solar, small-scale hydropower can serve local energy needs in mountainous areas and support rural development.
- **Priority 4: Biomass** – Biomass potential is lower compared to other renewables, but Kazakhstan’s agricultural sector produces significant biomass waste that can be converted into biofuels or used for heat and power generation.

Rationale: Kazakhstan has experienced significant growth in renewable energy capacity, particularly in wind and solar. The country has already installed 2.9 GW of renewable capacity between 2017 and 2024, with substantial investments in the sector. Prioritizing wind and solar aligns with the nation’s Carbon Neutrality Strategy 2060 and positions it as a regional leader in the energy transition.

Kyrgyzstan

- **Priority 1: Small-Scale Hydropower** – Kyrgyzstan’s mountainous terrain and abundant water resources make it well-suited for hydropower. The country has a long history of hydropower development and can further capitalize on its water resources to meet domestic needs and increase electricity exports.

- **Priority 2: Solar** – Although Kyrgyzstan’s mountainous terrain and higher latitudes limit its solar potential, certain regions with high solar irradiance can support solar energy projects. Solar can complement hydropower generation and provide both grid-connected and off-grid energy solutions.
- **Priority 3: Wind** – Although wind resources are less significant than hydro and solar, there are still opportunities for wind power development in specific areas of Kyrgyzstan.
- **Priority 4: Biomass** – Biomass resources are relatively limited, but they are considered a priority mitigation strategy for reducing emissions. Efforts to expand biomass potential could focus on unproductive land and could support local heat and power generation, particularly in rural areas.

Rationale: Up to 90% of Kyrgyzstan’s electricity is generated from hydropower, yet the country uses only 13% of its hydropotential. Investing in small-scale hydropower projects can help maximize the use of its water resources. Solar and wind should be secondary priorities to diversify the energy mix and reduce dependence on large hydropower plants.

Tajikistan

- **Priority 1: Small-Scale Hydropower** – Like Kyrgyzstan, Tajikistan’s mountainous terrain and water resources make it well-suited for hydropower. Further development of this sector could meet domestic energy needs and enable electricity exports.
- **Priority 2: Solar** – Solar energy is viable due to high solar irradiance in many regions. Although mountainous terrain and higher latitudes limit its potential in some areas, solar can still play a significant role in complementing hydropower and providing off-grid energy solutions.
- **Priority 3: Wind** – Wind resources are less abundant in Tajikistan than in Kyrgyzstan, but certain regions offer opportunities for wind power development.
- **Priority 4: Biomass** – Biomass resources are limited but could be developed to support local heat and power generation, especially in rural areas.

Rationale: Similar to Kyrgyzstan, Tajikistan generates over 90% of its electricity

from hydropower, but it uses less than 5% of its hydro potential. Prioritizing small-scale hydropower can help Tajikistan maximize its water resources while minimizing environmental impact. Solar and wind should complement hydropower to enhance energy security, particularly during dry seasons.

Turkmenistan

- **Priority 1: Solar** – Turkmenistan’s desert climate and abundant sunlight make it ideal for solar energy generation. The country has significant potential to develop large-scale solar power plants and export electricity to neighboring countries.
- **Priority 2: Wind** – Wind energy potential, particularly in the Caspian Sea zone and parts of the western region, is significant. While not as abundant as solar resources, wind power can still be developed in some regions.
- **Priority 3: Biomass** – The agricultural sector generates substantial biomass waste, which can be converted into biofuels or used for heat and power generation, especially in agricultural areas.
- **Priority 4: Small-Scale Hydro** – Although small-scale hydropower is less significant than solar or wind, it can meet local energy needs and support rural development. Given future water scarcity projections for downstream countries, simultaneous development of hydropower and restoration of small rivers may be pursued.

Rationale: As a major natural gas exporter, Turkmenistan could benefit from diversifying its energy portfolio. Solar and wind energy should be prioritized due to favorable geographic and climatic conditions. Developing renewable energy sources could help Turkmenistan transition to a lower-carbon economy while maintaining its role as an energy exporter.

Uzbekistan

- **Priority 1: Solar** – Uzbekistan’s desert climate and abundant sunlight make it well-suited for solar power generation. The country has high solar irradiance and significant potential to develop large-scale solar power plants to meet its growing energy demand.

- **Priority 2: Wind** – Wind energy potential, particularly in central and western regions, is substantial. While wind resources are not as abundant as solar, there are still considerable opportunities for development.
- **Priority 3: Small-Scale Hydro** – Although smaller than solar and wind, small-scale hydropower can serve local energy needs and support rural development in mountainous areas or along watercourses.
- **Priority 4: Biomass** – Uzbekistan’s agricultural sector generates significant biomass waste, which can be converted into biofuels or used for heat and power generation.

Rationale: Uzbekistan has initiated several large-scale solar and wind projects, attracting foreign investments. The country’s geography is well-suited for solar energy development, and Uzbekistan is also developing a low-carbon energy transition strategy, including a national hydrogen strategy. Prioritizing solar and wind aligns with Uzbekistan’s current initiatives and investment trends.

Rationale for Prioritization

The prioritization of renewable energy subsectors for each Central Asian country is based on several key factors:

1. **Resource Availability:** The abundance and quality of renewable energy resources—such as sunlight, wind, water, and biomass—differ across the region.
2. **Technical Feasibility:** The technical challenges and costs associated with developing and deploying various renewable energy technologies vary.
3. **Economic Viability:** The economic benefits of renewable energy, including job creation, energy security, and reduced energy costs, must be evaluated.
4. **Policy Alignment:** Government policies and regulations must align with renewable energy development to attract investment and support growth.

By considering these factors, each Central Asian country can prioritize renewable energy subsectors that offer the greatest potential for sustainable energy development, FDI attraction, and economic growth.

The background is a vibrant green with a gradient from a lighter shade at the top to a darker shade at the bottom. It features several large, overlapping, wavy shapes in different shades of green. Thin, white, curved lines sweep across the background, adding a sense of motion and depth. In the center, the numbers '09' are rendered in a large, bold, white font with a slight 3D effect and a shadow.

09

CHAPTER NINE

9. Pilot Country Recommendation

The decision on which country to select as a pilot for an investment promotion program in specific renewable energy subsectors ultimately rests with the Research Project's owners and sponsors.

There are two primary approaches to selecting the recommended country:

1. Most-in-Need

2. Best Positioned

The final recommendation may be a hybrid, based on a variety of factors, including political considerations, some of which may fall outside the scope of this Research Project.

Based on the analysis presented in Chapter 7, the additional score required for each country to achieve full compliance with the joint pseudo-ecosystem described in Chapter 5 and Appendix 3 can be derived.

As shown in Figure 9-1 (%-deficiency), Kazakhstan is well-positioned with an established renewable energy sector across all four priority areas: wind, solar, bioenergy, and small-scale hydro. The country also has a functional framework supporting further development.

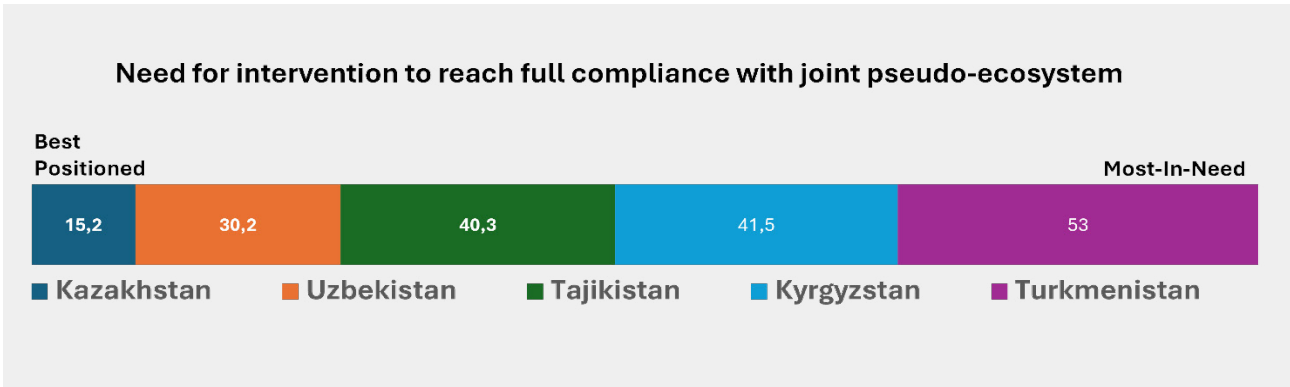
Conversely, while Turkmenistan has effective systems in place for its fossil fuel sector, it requires significant improvements in its renewable energy investment ecosystem.

Uzbekistan boasts a rapidly growing renewable energy sector that spans all priority areas. While its framework for sector development and governance is still maturing, it is progressing quickly.

Kyrgyzstan and Tajikistan share similarities in that both have energy systems dominated by hydropower. Both countries are actively developing their small-scale hydro sectors, with Tajikistan increasing its focus on solar and Kyrgyzstan starting

nascent solar and wind activities. At the aggregate level, their compliance with the joint pseudo-ecosystem is comparable, as illustrated in Figure 9-1.

Figure 9-1: Intervention Required for Compliance with Ecosystem by Country



The case for recommending a pilot country is multifaceted.

9.1 Pros and Cons

Below is a detailed evaluation of the pros and cons for each country’s candidacy, based on the selection criteria.

Table 9-1: Pros and Cons for Kazakhstan to Become a Pilot Country

Kazakhstan	Regulatory Framework and Policy Environment
Pros	- Stable political environment - Clear policies and government commitment to RE development, with targets for renewables (6% 2025, 15% 2030, and 50% 2050) and carbon neutrality by 2060 - Well-defined long-term energy strategy with specific renewable energy targets - Established regulatory frameworks - Strong institutional support with dedicated agencies supporting RE
Cons	- Potential for regulatory changes that could deter foreign investors. - Despite digitalization efforts, navigating complex bureaucracy may challenge foreign investors.

Kazakhstan

Investment Potential and Market Readiness

Pros

- Growing market with an expected 60% increase in electricity consumption over the next decade
- Abundant wind and solar resources, with 50% of the territory suitable for wind energy generation
- Well-developed renewable energy sector with operating facilities and experience in various types of projects
- Investment promotion agency with RE focus
- Energy auctions
- Ease of entry, foreign companies can easily establish operations, with branches treated as residents
- Specific incentives for foreign investors, including tax breaks and subsidies
- Robust legal framework, strong investor protection, member of ICSID, international arbitration, free movement of capital, and protection of IP rights

Cons

- Some data gaps
- High dependence on fossil fuels, with coal constituting 60% of power generation
- Market barriers such as low electricity prices and high energy subsidies may stymie investments
- Low TI CPI score leaves a mark on the business environment
- Potential volatility due to the economy being very dependent on global energy prices, which can impact investment stability
- Local content requirements

Kazakhstan

Technical and Operational Capacity

Pros

- Relatively well-developed technical workforce and education in RE
- Domestic Engineering, Procurement, and Construction and O&M contractors with experience in utility-scale RE projects
- Operating RE facilities
- Ongoing grid upgrades
- High level of digitalization

Cons

- Aging Infrastructure
- Logistical challenges
- BESS is only in a nascent stage
- Brain drain of skilled workers
- Potential need for further RE specialized knowledge
- Harsh climatic conditions

Kazakhstan

Need for and Receptiveness to Technical Assistance

Pros

- Need for RE technologies
- Able to execute RE projects
- Openness to international cooperation and support, with opportunities for partnerships and funding through cooperation with organizations like UNDP, USAID, EBRD, and GEF
- Advances in digital processes enhance the ability to receive technical assistance

Cons

- Already has a relatively well-developed RE sector, potentially reducing the need for extensive technical assistance
- Complex bureaucracy may hamper the effective implementation of technical assistance

Kazakhstan

Existing Project Pipeline

Pros

- Ongoing projects and experience in wind, solar, bioenergy, and small-scale hydro projects.
- Implemented RE auctions with a 5-year schedule approved by the Ministry of Energy.
- Digitalization enhances transparency and efficiency in tendering, permitting, and bureaucratic processes

Cons

- Competition from traditional energy industries
- Some gaps in data on RE resources may complicate the development of new projects
- PPP frameworks to support RE may not be developed to their full potential

Kazakhstan

Regional Integration Potential

Pros

- High cooperation potential
- Attractive partner for neighboring countries
- Potential for better energy system interconnections with neighboring countries
- Development of local RE supply chains can attract more FDI

Cons

- Infrastructure gaps
- Aging parts of the grid may require modernization to fully integrate renewable energies
- Regional and geopolitical sensitivities

Kazakhstan

Financial Sector Readiness

Pros

- Well-developed financial sector compared to other Central Asian countries
- Financial incentive mechanisms; taxonomy, green bonds with AIFC
- Access to multiple international funds and potential for innovative financing mechanisms

Cons

- Economic volatility due to dependence on global energy prices may impact investment stability

Kazakhstan

Energy Access Needs Climate Change Commitments

Pros

- High, particularly in remote areas
- Clear commitment to increasing energy access through RE development

Cons

- Dominance of coal may hamper transition
- Existing energy subsidies may complicate the transition to a more sustainable energy access model

Kazakhstan

Climate Change Commitments

Pros

- Clear commitment to carbon neutrality by 2060
- Ambitious RE targets aligned with climate goals

Cons

- High dependence on fossil fuels may complicate the transition to renewables

Kazakhstan

Macroeconomic Stability

Pros

- Relatively stable political environment, conducive to long-term investments
- Robust legal framework for investment protection.

Cons

- Economy is highly dependent on global energy prices, which can lead to volatility.

RE=renewable energy

Source: Author

Kazakhstan presents a strong case for being selected as the pilot country due to its established renewable energy sector, technical capacity, clear policy and regulatory framework, and investment potential. However, challenges such as bureaucratic complexities, fossil fuel dependence, the need for infrastructure modernization, and latent economic volatility must be addressed to maximize the success of an investment promotion program.

Table 9–2: Pros and Cons for Kyrgyzstan to Become the Pilot Country

Kyrgyzstan

Regulatory Framework and Policy Environment Investment Potential and Market Readiness

Pros

- Law on RE provides incentives for RE development
- National Energy Program until 2035 with goals and a list of projects
- Concept of Carbon Neutrality, with carbon neutrality by 2050
- NDC Action Plan until 2030
- Ongoing improvements to the regulatory framework for RE

Cons

- Considerable gaps in the regulatory framework and inconsistent regulations.
- Frequent changes in bureaucracy, duplication of functions, and ineffective collaboration between governing structures

Kyrgyzstan

Investment Potential and Market Readiness

Pros

- Expected 56% increase in electricity demand by 2035
- Abundant hydro resources and substantial wind and solar potential
- Existence of state-owned investment promotion agencies experienced in attracting investments
- Legislation and clear rules for PPP projects
- Existence of an authorized PPP Centre under the Investment promotion agency
- Law on Investments does not distinguish between local and foreign investors, no requirement for local equity positions or partnerships
- Investment protection with enabling legal framework recognizing international arbitration and free movement of capital

Cons

- Relatively small market limits large-scale investment opportunities
- Ineffective pricing policies with low electricity prices and high energy subsidies leading to shortages of financial resources
- No assurance for long-term electricity purchase and tariff stability
- Limited experience in large-scale FDI attraction
- Diffuse responsibilities between investment promotion agencies

Kyrgyzstan

Technical and Operational Capacity

Pros

- Up to 90% of electricity is generated from large hydroelectric power plants, which forms a strong foundation for further RE development
- Electricity network is broadly RE-ready with surplus capacity in specific locations

Cons

- Skills deficiencies and limited skilled workforce due to low demand, brain drain, and educational gaps
- Lack of domestic EPC companies with RE expertise
- Parts of the grid are aging with high transmission losses and congestion in certain areas
- No BESS

Kyrgyzstan

Need for and Receptiveness to Technical Assistance

Pros

- Need for RE technologies
- Opportunities for international funding and partnerships to provide technical assistance
- Potential for partnerships with foreign EPC companies to build local capacity

Cons

Limited R&D infrastructure and gaps in RE curricula.

Kyrgyzstan

Existing Project Pipeline

Pros

- Active development in small-scale hydro and interest in diversifying into wind, solar, and bioenergy
- Growing developer interest, also from abroad
- Official websites have maps of existing, planned, and future hydropower plants and network infrastructure
- PPP Centre offers investors a list of projects in the field of RE

Cons

- Limited diversification in renewable energy sources beyond hydropower
- Limited measurement data on potential renewable sites may hinder project development
- Limited experience with RE PPPs and unclear procurement regime
- Challenges in developing wind energy in populated areas

Kyrgyzstan

Regional Integration Potential

Pros

- High cooperation potential
- CASA-1000 project opens access to the markets of South Asia for export
- Positive examples in the implementation of power plant construction

Cons

- Potential differences in energy policies with neighboring countries
- Geopolitical competition

Kyrgyzstan

Financial Sector Readiness

Pros

- Established Green Energy Fund to develop the RE sector
- Investment protection with enabling legal framework recognizing international arbitration and free movement of capital
- Access to international funds

Cons

- Limited domestic financial resources and an underdeveloped financial sector
- Frequent changes in governing structures

Kyrgyzstan

Energy Access Needs

Pros

- High, particularly in remote areas
- Growing electricity demand is expected to increase by 56% by 2035, indicating a need for expanded energy access
- Potential for decentralized RE technologies, especially small hydropower stations

Cons

- Seasonal swings in electricity generation may affect supply stability
- Electricity shortages in winter despite summer peaks in renewable generation

Kyrgyzstan

Climate Change Commitments

Pros

- Concept of Carbon Neutrality, with carbon neutrality by 2050.
- NDC Action Plan until 2030

Cons

- Limited diversification in RE sources may complicate meeting climate goals
- Variability in hydropower generation affects market stability, which may complicate climate commitments

Kyrgyzstan

Macroeconomic Stability

Pros

- The legal framework provides investment protection, which can enhance macroeconomic stability
- Law on Investments does not distinguish between local and foreign investors
- No requirement for local equity positions or partnerships

Cons

- Political and institutional instability affecting investor confidence[1].
- Economic constraints hindering development

RE= renewable energy, EPC= engineering, procurement, and construction, BESS= battery energy storage systems, PPP=public private partnership

Source: Author

Kyrgyzstan offers a mixed landscape as a potential pilot country. Its strong hydropower base, growing market, supportive legal framework, and existing renewable energy policies are promising. The government's climate commitments, growing interest in renewable energy projects, and opportunities for regional electricity trade further enhance its prospects. However, challenges such as regulatory inconsistency, institutional instability, limited financial sector readiness, lack of experience with large-scale FDI, market size limitations, and skills gaps need to be addressed. Despite these challenges, Kyrgyzstan's untapped market and renewable energy potential position it as a noteworthy candidate for larger-scale FDI.

Table 9–3: Pros and Cons for Tajikistan to Become a Pilot Country

Tajikistan

Regulatory Framework and Policy Environment

Pros

- Strong central government
- Government committed to RE and regional energy trade
- NDS with a commitment to improving the investment climate and protecting foreign investments
- GEDS being developed
- GEDS aligned with global sustainability efforts
- Recognition of FDI as an important component of national development
- Working on developing a coherent RE strategy, diversifying electricity sources
- Exploring RE auctions to attract cost-effective investments

Cons

- Lack of consistent policies for all RE sources, beyond hydro
- Inconsistent RE strategy
- Regulatory gaps, and a complex regulatory framework
- Unclear regulations for RE
- Institutional structure not fully adapted to a diverse RE environment

Tajikistan

Investment Potential and Market Readiness

Pros

- Significant hydropower resources contributing 98% of the electricity generation
- Only 4% of hydropower energy is exploited, with a potential of 527 TWh (global rank: 8th)
- Growing interest in RE development
- Solar rapidly increasing, with a goal of 1 GW by 2030 and plans of \$1.5 billion in phased investments
- Plans floating solar PV
- Solar energy potential is estimated at up to 220,000 GWh
- Positioned for cross-border electricity trading, enhancing market opportunities
- NDS targets expanded cross-border electricity trading (tripling of export by 2030) and aim to modernize facilities
- GEDS targets the RE capacity increase by 10,000 MW by 2037
- Access to South-Asian markets through CASA-1000
- Market gradually opening up, with no restriction on foreign investment nor mandate for local stakeholder equity or partnerships
- Foreign investors offered incentives like tax breaks and exemptions to reduce financial burdens
- Recognizes international arbitration and, conditionally, IP rights
- Manufacturing solar industry attracting foreign investors

Cons

- Economic constraints and limited financial resources restricting investment in renewable infrastructure
- Low electricity prices and high energy subsidies hindering investments
- Lack of a well-developed IPA focused on RE
- Lack of a formal and legalized PPP framework
- Heavy reliance on hydropower makes the country vulnerable to climate change, with seasonal variations in water flow and electricity generation

Tajikistan

Technical and Operational Capacity

Pros

- Electricity grid is considered broadly ready to accommodate larger-scale renewable power
- Objective of reconnecting to the Central Asian Unified Power Grid
- Plans for grid expansion and modernization to handle intermittent RE sources
- Solar facilities are being constructed, with significant plans for further developments

Cons

- Still limited domestic expertise in solar and wind power plant construction
- Notable RE skills gap beyond hydro in the workforce
- Parts of the grid are aging with transmission losses, requiring modernization
- Lack of domestic Engineering, Procurement, and Construction companies with RE expertise
- No BESS

Tajikistan

Need for and Receptiveness to Technical Assistance

Pros

- Need for RE technologies
- Focus on capacity building and training for domestic expertise
- Willingness to engage in international cooperation and enhance legal frameworks and investment protection mechanisms
- Opportunities for international funding and partnerships to provide technical assistance to build local capacity
- Potential for partnerships with foreign companies for project feasibility studies

Cons

- Limited R&D infrastructure
- Limited incorporation of RE in domestic curricula

Tajikistan

Existing Project Pipeline

Pros

- Developments in small-scale hydro
- Interest in diversifying into wind and solar
- Growing developer interest
- Ongoing pilot projects in solar energy
- Despite lacking a framework, the government promotes PPPs to leverage private sector expertise and capital while sharing risks

Cons

- Limited diversification in RE sources beyond hydropower
- Limited measurement data on potential renewable sites
- Limited information provided on specific existing projects
- Bureaucratic hurdles and complicated regulatory processes

Tajikistan

Regional Integration Potential

Pros

- High cooperation potential
- Well-positioned for cross-border electricity trading
- CASA-1000 project opens access to the markets of South Asia for export
- Plans for reconnection to the Central Asian Unified Power Grid

Cons

- Potential differences in energy policies with neighboring countries
- Dependence on regional countries for fossil energy resources can create vulnerabilities and complicate integration efforts
- Geopolitical matters affecting regional cooperation

Tajikistan

Financial Sector Readiness

Pros

- Investment protection with enabling legal framework
- Government working to improve access to international financing and technical assistance
- Access to international funds

Cons

- Limited domestic financial resources
- Underdeveloped financial sector
- Market barriers, such as low electricity prices and high energy subsidies, can hinder investment

Tajikistan

Energy Access Needs

Pros

- Moderate, building capacity mostly for export
- Goal of universal green electricity generation by 2037
- Potential for decentralized RE technologies, especially small hydropower stations.

Cons

- Vulnerability to natural hazards and climate change may impact energy infrastructure and access
- No specific information provided on other current energy access challenges

Tajikistan

Climate Change Commitments

Pros

- Integrating climate action into energy policies
- Participation in international environmental agreements
- Committed to transitioning away from fossil fuels
- Full transitioning to renewable energy by 2032, doubling current production
- Environmental Performance Reviews align national policies with global standards

Cons

- Limited diversification in RE sources may affect the pace of meeting climate goals
- Variability in hydropower generation can affect market stability, which may complicate climate commitments
- Vulnerability to natural hazards affecting hydropower generation and RE infrastructure

Tajikistan

Macroeconomic Stability

Pros

- Dedicated to improving the investment climate and protecting foreign investments, which can enhance macroeconomic stability.
- Recognition of FDI as a critical component of national development strategy

Cons

- Economic instability and constraints, limiting the ability to implement strategies

RE=renewable energy, NDS= national development strategy, PPPs= public private partnerships, GDES= green economy development strategy, BESS= battery energy storage systems, IPA=

Source: Author

Accordingly, Tajikistan presents a mixed but promising landscape for becoming the pilot country. The country balances being “most-in-need” with being “best positioned.” There are significant opportunities in renewable energy potential and a commitment to sector development. However, challenges such as regulatory inconsistencies, financial constraints, and gaps in technical expertise,

infrastructure, and capacity must be addressed to improve its attractiveness for foreign investment.

Table 9-4: Pros and Cons for Turkmenistan to Become the Pilot Country

Turkmenistan	Regulatory Framework and Policy Environment
Pros	- Government acknowledgment of the importance of RE development through expanding national policy and regulatory framework. - National Strategy for the Development of Renewable Energy in Turkmenistan until 2030. - State law on RE Sources. - Upcoming plans for strengthening international cooperation in renewables during 2025-2030. - Regulatory acts are being developed to promote the practical use of RE under the law adopted in 2021
Cons	- Underdeveloped regulatory framework for renewables - Policies with clear directions for RE development are needed - Lack of quantified RE targets - Very limited institutional structures adapted to the RE sector - Data sources not made generally available
Turkmenistan	Investment Potential and Market Readiness
Pros	- Significant potential for renewable solar and wind energy resources - Substantial reserves of critical raw materials like lithium, iron, and copper - Law on foreign investment exists with no discrimination of foreign vs. domestic investors, without local partnership mandates - Investment protection with enabling legal framework - Adheres to international arbitration conventions like ICSID and the New York Convention - Potential to establish IPA focused on diversifying energy investments, with potential emerging tools from domestic financial institutions - Law on PPP, with the government facilitating PPP implementation, increasing non-state share in GDP

Cons

- No RE sector today
- Insufficient detailed knowledge about energy reserves and project viability
- Low electricity prices and high energy subsidies hindering investments
- Lack of a well-developed IPA focused on renewable energy
- Development discrepancies between domestic and foreign arbitration laws may exist
- Legal system's independence and impartiality may be questioned

Turkmenistan

Technical and Operational Capacity

Pros

- Abundant natural gas resources that can be leveraged to support RE projects
- Potential to become a leading solar panel producer due to the abundance of silicon in desert sands.

Cons

- Limited domestic expertise in solar and wind power plant construction
- Limited skilled workforce and insufficient training programs focused on RE
- Lack of domestic Engineering, Procurement, and Construction companies with RE expertise
- Notable RE skills gap
- No BESS.

Turkmenistan

Need for and Receptiveness to Technical Assistance

Pros

- Need for RE technologies
- Recent interest in diversifying energy mix to include RE
- Recognition of the need for capacity building and training in solar and wind energy
- Plan to strengthen international cooperation in the field of RE sources (2025-2030)
- Opportunities for international funding and partnerships to provide technical assistance to build local capacity

Cons

- Challenges with consistent data accessibility in the energy industry and project viability may hinder effective technical assistance
- Limited R&D infrastructure for the RE sector
- Limited incorporation of RE in domestic curricula
- Limited international exposure compared to other Central Asian countries

Turkmenistan

Existing Project Pipeline

Pros

- Potential for hybrid projects combining solar and gas power plants
- Planned development of strategy for green hydrogen
- Government testing PPPs with ME company to leverage private sector expertise and capital while sharing risks

Cons

- Very limited diversification into RE sources
- Lack of accessible comprehensive data on infrastructure
- Limited information provided on specific existing projects
- Bureaucratic hurdles and complicated regulatory processes

Turkmenistan

Regional Integration Potential

Pros

- Some cooperation potential
- Opportunities for regional cooperation on RE projects and technologies, in particular on solar
- Opportunities for international partnerships and investment in RE projects

Cons

- Potential differences in energy policies with neighboring countries
- Oil and, especially, gas overshadowing renewable energies
- Neutral stance may limit participation in regional economic blocks
- Geopolitical matters affecting regional cooperation

Turkmenistan

Financial Sector Readiness

Pros

- Government facilitating PPP implementation, increasing non-state share in GDP
- Potential to establish an IPA focused on diversifying energy investments
- Adherence to international arbitration conventions enhances investment protection
- Access to international funds

Cons

- Underdeveloped financial sector
- Highly centralized economy with limited private sector involvement
- Lack of experience in RE financing
- Market barriers, such as low electricity prices and high energy subsidies, can hinder investment

Turkmenistan

Energy Access Needs

Pros

- Moderate, good gas power supply
- Government initiatives to diversify the energy mix indicate a recognition of energy access needs
- Potential to develop a grid to better support intermittent RE integration
- Potential for decentralized RE technologies, especially off-grid solar

Cons

- Very high reliance on natural gas in its energy system may limit immediate energy access improvements through renewables
- Grid is not sufficiently prepared to integrate large-scale renewable power at this stage

Turkmenistan

Climate Change Commitments

Pros

- Government commitment to RE through national policy and regulatory framework (see Regulatory Framework and Policy Environment above) aligns with global climate change goals
- Planned development of a strategy for green hydrogen

Cons

- Very high reliance on natural gas in its energy system will complicate achieving climate targets
- Limited information on specific climate change commitments
- Limited experience with ESIA for RE projects
- Desert climate and seismic zones may represent specific challenges

Turkmenistan

Macroeconomic Stability

Pros

- Strong government control which could facilitate RE development
- Stable political environment
- Improvements in combating money laundering and terrorist financing
- Positive financial outlook and forecast

Cons

- Centralized economy may pose risks to macroeconomic stability and investor confidence
- Limited data availability

RE=renewable energy, PPPs= public private partnerships, BESS= battery energy storage systems, IPA=
Source: Author

Turkmenistan, despite facing challenges in developing its renewable energy sector, offers unique opportunities for growth and investment. However, the country faces substantial obstacles, including high reliance on natural gas, a centralized financial environment, an underdeveloped regulatory framework, a lack of existing projects, market barriers, and limited technical capacity. Addressing these challenges could enhance its suitability for foreign investment. A hybrid approach considering both its needs and positioning may be beneficial for its potential selection as a pilot country.

Table 9–5: Pros and Cons for Uzbekistan to Become the Pilot Country

Uzbekistan

Regulatory Framework and Policy Environment

Pros

- Significant legal and regulatory reforms aimed at improving the investment climate and energy markets.
- Strong government support for RE development and investment protection.
- Clear long-term energy strategy with specific targets for RE deployment.

Cons

- Regulatory complexity and inconsistent enforcement may complicate navigation for investors
- Policy inconsistencies due to fast-changing legislation may create uncertainties
- Potential lack of coordination between state entities
- Bureaucratic hurdles.

Uzbekistan

Investment Potential and Market Readiness

Pros

- Accelerating demand for electricity with proven drivers
- Ambitious target of 40% renewable energy by 2030
- Significant potential for renewable solar and wind energy resources and developments
- Experienced IPA, with a focus on facilitating foreign RE investments
- Recently adopted PPP law, promoting PPP projects
- Non-discriminatory legal environment for foreign investors with investment protection
- Investors can participate in competitive tenders and auctions, and direct negotiations
- Specific incentives for foreign investors, such as tax breaks and subsidies
- Recognizes international arbitration and has a system for protecting intellectual property

Cons

- Absence of an efficient energy market can hamper investments
- Low electricity prices and high energy subsidies
- Local content requirements potentially complicating market entry
- Potential lack of a dedicated IPA for RE
- Diffuse responsibilities between MIIT, other government entities, and SOEs promoting investments
- PPP framework not specifically addressing RE projects
- Limited experience with PPPs in the RE sector

Uzbekistan

Technical and Operational Capacity

Pros

- Relatively well-developed technical workforce and educational institutions
- Domestic Engineering, Procurement, and Construction and O&M contractors available for utility-scale projects, initially as subcontractors
- Relatively well-developed electricity grid, broadly ready for renewables
- Emerging BESS sector

Cons

- Parts of the infrastructure are outdated with high losses, requiring modernization
- Limited technical and financial capabilities for end-to-end project execution
- Potential skills gaps in specialized RE technologies

Uzbekistan

Need for and Receptiveness to Technical Assistance

Pros

- Need for RE technologies
- Acknowledgment of the need for capacity building and technical assistance in the RE sector
- Increasing potential for collaboration with international entities to enhance RE projects
- Scaling up R&D and innovation programs in RE and hydrogen
- Opportunities for technology transfer

Cons

- Potential lack of coordination among government entities may hinder the effective implementation of assistance
- Limited RE incorporation into the national curriculum

Uzbekistan

Existing Project Pipeline

Pros

- Fast-growing RE sector with ongoing and planned projects in prioritized areas
- Relatively well-developed electricity grid, ready for renewables with emerging BESS
- Ambitious plans to upgrade power lines and substations, including grid-scale SCADA

Cons

- Bureaucratic hurdles and complicated regulatory processes
- Fossil fuels, especially gas, may overshadow renewable energies
- Issues regarding easy access to coherent RE and infrastructure data
- Parts of the infrastructure are outdated with high losses and require modernization

Uzbekistan

Regional Integration Potential

Pros

- High cooperation potential
- Actively promoting regional energy trade and joint RE projects
- Strategic location for regional energy integration
- Potential to become among regional leaders in RE development

Cons

- Competition from neighboring countries and global powers may affect investment decisions and regional cooperation
- Geopolitical matters affecting regional cooperation

Uzbekistan

Financial Sector Readiness

Pros

- Transitioning to a more market-based economy with initiatives to attract FDI
- Issuing green bonds in international and domestic markets
- Investment protection with enabling legal framework
- Government facilitating PPP implementation
- Potential to establish a dedicated IPA focused on RE investments
- Adherence to international arbitration conventions enhances investment protection
- Access to multiple international funds and financial institutions and MDBs

Cons

- Limited experience in domestic large-scale RE project financing
- Need to encourage and support more domestic financial institutions to partake in RE projects
- Market barriers, such as low electricity prices and high energy subsidies, can hinder investment

Uzbekistan

Energy Access Needs

Pros

- High
- Accelerating demand for electricity, indicating a need for diversified energy sources
- Government initiatives to diversify the energy mix indicate a recognition of energy access needs
- Potential and ongoing efforts to develop a grid to better support intermittent RE integration
- Potential for decentralized RE technologies in off-grid solar, bio, and small-scale hydro.

Cons

- High reliance on fossil fuels in its energy system may limit immediate energy access improvements through renewables
- Grid may not be sufficiently prepared to integrate large-scale renewable power at this stage
- Low electricity prices and high energy subsidies can hamper investments.

Uzbekistan

Climate Change

Pros

- Long-term energy strategy with specific targets for RE deployment (40% in 2030)
- Aiming to integrate climate action into energy policies
- Planned development of a strategy for green hydrogen

Cons

- High reliance on fossil fuels in its energy system may complicate achieving climate targets
- Limited experience in stakeholder engagement and environmental impact assessments
- Lacks waste management and recycling requirements

Uzbekistan

Commitments

Pros

- Long-term energy strategy with specific targets for RE deployment (40% in 2030)
- Aiming to integrate climate action into energy policies
- Planned development of a strategy for green hydrogen

Cons

- High reliance on fossil fuels in its energy system may complicate achieving climate targets
- Limited experience in stakeholder engagement and environmental impact assessments
- Lacks waste management and recycling requirements

Uzbekistan

Macroeconomic Stability

Pros

- Relatively stable political environment conducive to RE investment
- Growing economy and population driving demand for electricity

Cons

-

RE=renewable energy, PPPs= public private partnerships, BESS= battery energy storage systems, IPA= Source: Author

Uzbekistan, with a balanced mix of strengths and challenges, presents a compelling case as a pilot country. Its growing renewable energy sector, supportive government policies, and significant renewable energy potential make it a promising candidate. The country's openness to technical assistance and international partnerships, along with its ambitious climate commitments, further strengthen its suitability. However, challenges such as regulatory complexity, market barriers, financial sector readiness, and infrastructure issues must be resolved to fully realize its potential in attracting foreign investment in renewable energy.

9.2 Assessment

The evaluation of the advantages and disadvantages of each country's candidacy in Chapter 9.1 provides a basis for assessing its eligibility to become the Pilot Country across three key axes:

1. Need

The extent to which a country requires external assistance to establish the joint ecosystem and achieve progress in renewable energy FDI.

2. Implementation

2.1 Scope

The extent to which elements of the joint ecosystem are absent and need to be implemented, or how much of the existing investment environment must be modified to reach parity.

2.2 Pace

The speed at which the joint ecosystem can be fully implemented.

2.3 Duration

The time required to implement the full scope of the joint ecosystem.

2.4 Resources/Cost

The efforts and resources needed to implement the full scope of the joint ecosystem.

3. Impact

3.1 Domestic

The extent to which full implementation of the joint ecosystem will impact the domestic renewable energy sector.

3.2 Regional

The extent to which full implementation of the joint ecosystem will improve regional energy trade and the execution of joint renewable energy projects.

4. Kazakhstan

1. Need: Low

Kazakhstan is largely self-sufficient in advancing its FDI ecosystem for renewable energies. Although external assistance would be beneficial, the country can likely achieve full compliance with the pseudo-ecosystem independently.

2. Implementation

2.1 Scope: Small

Most elements of the pseudo-ecosystem are already in place.

2.2 Pace: High

Due to the small scope, implementation can proceed rapidly.

2.3 *Duration: Relatively Short*

The short duration is facilitated by the small scope and high pace of implementation.

2.4 *Resources/Cost: Moderate to Low*

Reflecting the small scope and high pace, the resources and costs required are modest.

3. *Impact*

3.1 *Domestic: Low*

Most of the ecosystem elements are already established.

3.2 *Regional: Moderate to High*

Kazakhstan would be better integrated into regional renewable energy markets. Its ecosystem could be easily replicated in other Central Asian countries.

Appraisal: While Kazakhstan would benefit from becoming the Pilot Country and receiving additional external assistance, its renewable energy sector will likely continue to progress rapidly, even without further support from international development partners.

5. *Kyrgyzstan*

1. *Need: High*

Kyrgyzstan would greatly benefit from external assistance to establish the joint pseudo-ecosystem. At present, it lacks the enabling framework and institutional capacity necessary to advance its renewable energy sector swiftly.

2. *Implementation*

2.1 *Scope: Wide-ranging*

Kyrgyzstan excels in hydroelectric power but has limited activities in other renewable energy subsectors.

2.2 *Pace: Moderate to Low*

The country faces significant gaps and a multitude of tasks that may slow down progress.

2.3 Duration: Long

Several foundational elements (strategy, institutions, regulations, market) require significant time to develop.

2.4 Resources/Cost: High

The required efforts and resources are substantial, reflecting the scope, pace, and duration.

3. Impact

3.1 Domestic: High

Implementation could significantly improve the domestic renewable energy ecosystem and mitigate seasonal electricity supply deficiencies.

3.2 Regional: Moderate to High

Kyrgyzstan could increase electricity exports to the region, though the transformation pace may not significantly affect other CA countries in the short to medium term.

Appraisal: Kyrgyzstan would benefit greatly from becoming the Pilot Country, receiving targeted support from international donors. However, its transformation may not be rapid enough to have a substantial regional impact.

6. Tajikistan

1. Need: High

Tajikistan has ambitious renewable energy goals but faces economic constraints. The country lacks some critical framework components and institutional capacity needed to expand its renewable energy sector swiftly. External support would be essential.

2. Implementation

2.1 Scope: High

Tajikistan is a leader in hydroelectric power, with increasing activity in solar energy, though wind and bioenergy remain underdeveloped.

2.2 Pace: Moderate

While committed, the country faces gaps that will require time-consuming efforts to address.

2.3 Duration: Long

Several fundamental elements (institutions, regulations, market) require considerable time to develop.

2.4 Resources/Cost: High

The resources required are significant, as reflected by the scope, pace, and duration.

3. Impact

3.1 Domestic: High

Full implementation could elevate Tajikistan's renewable energy FDI ecosystem to one of the strongest in the region and diversify energy sources.

3.2 Regional: High

Tajikistan could substantially increase electricity exports, improving regional energy security. However, the pace of transformation may not be sufficient to support other countries' energy and climate objectives in the short term.

Appraisal: Becoming the Pilot Country would strongly benefit Tajikistan's domestic renewable energy sector and improve regional energy security. However, its transformation may not occur quickly enough to impact the wider Central Asian region.

7. Turkmenistan

1. Need: High

Turkmenistan requires significant external assistance to establish a joint ecosystem for renewable energy FDI, as many necessary components are absent.

2. Implementation

2.1 Scope: High

A considerable portion of the joint pseudo-ecosystem is missing.

2.2 Pace: Slow

Addressing the gaps will require a well-planned process.

2.3 Duration: Long

It could take an extended period to establish all required components of a renewable energy ecosystem.

2.4 Resources/Cost: High

The required resources are substantial, reflecting the scope, pace, and duration.

3. Impact**3.1 Domestic: High**

The development of the renewable energy sector could create a significant new economic sector.

3.2 Regional: Moderate to Low

Turkmenistan could increase electricity exports in the medium to long term, but the pace of ecosystem implementation may be too slow to have an impact on other regional countries in the short term.

Appraisal: While establishing an ecosystem for FDI in Turkmenistan's renewable energy sector could yield substantial benefits, the timeline for full implementation may be lengthy.

8. Uzbekistan**1. Need: Moderate**

Uzbekistan has ambitious renewable energy objectives and a rapidly evolving renewable energy sector. While the country is making progress independently, external assistance could accelerate development.

2. Implementation**2.1 Scope: Moderate**

The renewable energy sector covers all subsectors, but improvements to the framework are needed.

2.2 Pace: High

Uzbekistan is accustomed to significant reforms, which can be adapted to the renewable energy sector.

2.3 Duration: Relatively Short

The process involves improvements rather than radical changes.

2.4 Resources/Cost: Moderate to Low

The resources required are moderate, reflecting the scope, pace, and duration.

3. Impact

3.1 Domestic: High

Uzbekistan could streamline its FDI ecosystem to attract more investment rapidly.

3.2 Regional: High

Improvements in Uzbekistan's renewable energy sector could benefit neighboring countries, especially as a net electricity importer. The high transformation pace could facilitate regional sharing of improvements.

Appraisal: Uzbekistan would benefit significantly from becoming the Pilot Country. Given its already advanced renewable energy sector, rapid progress could also improve regional cooperation and interactions.

9. Conclusion and Selection of Pilot Country

In conclusion, while each of the studied countries would benefit from becoming the pilot country to varying degrees, the following ranking reflects where additional support would have the greatest overall impact on the Central Asian region:

1. Uzbekistan 2. Tajikistan 3. Kyrgyzstan 4. Kazakhstan 5. Turkmenistan

The research project recommends Uzbekistan as the pilot country. InvestUzbekistan (IPA) and the Ministry of Industry, Investment, and Trade (MIIT) have shown positive interest during the consultation process, expressing their willingness to strengthen the capacity of the IPA and diversify both the investor base and renewable energy technologies.

9.3 Stylized Facts of Pilot Country

Uzbekistan has demonstrated remarkable progress in attracting FDI in the renewable energy sector, positioning itself as a compelling destination for global investors. Renewable energy projects now comprise up to 9% of total FDI projects, reflecting Uzbekistan's growing appeal to international partners. Between January 2023 and February 2025, the country secured about 41 renewable energy FDI projects, including 22 solar, 8 wind, 7 electric power generation, and 4 hydropower projects, amounting to over USD 16.49 billion and generating approximately 2,829 jobs (fDi Market data). Notably, these figures exclude 6 solar power projects initially proposed by Sky Power Canada. The project has been put on hold due to contractual terms, government guarantee and investment conditions. If included with the original data from fDi markets, the total FDI in this sector falls at 17.794 billion.

Within the renewable energy landscape, Saudi Arabia's ACWA Power and UAE's Masdar have emerged as leading investors, channeling significant capital into solar and wind projects. ACWA Power stands out with a substantial USD 5.37 billion investment across 9 projects, creating 925 jobs. Masdar follows with USD 2.31 billion across 7 projects, contributing 315 jobs. Other prominent players include China Southern Power Grid with USD 1.64 billion in hydroelectric projects and Korea Western Power (KOWEPO) with a USD 456 million biomass investment.

Top 10 Investing Companies by Total Investment in Uzbekistan:

1. ACWA Power, Saudi Arabia: 9 projects (3 solar, 6 wind/hybrid) - USD 5.37 billion, 925 jobs
2. Masdar, UAE: 7 projects (6 solar, 1 wind) - USD 2.31 billion, 315 jobs
3. China Southern Power Grid, China: 3 hydroelectric projects - USD 1.64 billion, 500 jobs
4. Sky Power, Canada: 6 solar projects - USD 1.3 billion, 66 jobs (currently stalled)
5. Znshine Solar, China: 1 project - USD 1 billion, 53 jobs
6. China Energy Engineering, China: 2 solar projects - USD 736 million, 39 jobs
7. China Shuifa Singyes Energy, Hong Kong: 1 project - USD 714 million, 37 jobs
8. Volitalia, France: 3 hybrid projects - USD 679 million, 117 jobs
9. PowerChina, China: 2 projects - USD 659 million, 90 jobs
10. KOWEPO, South Korea: 1 biomass project - USD 456 million, 500 jobs

Despite the influx of high-value investments, Uzbekistan's renewable energy sector remains concentrated in large-scale, PPP-driven projects financed predominantly by Multilateral Development Banks (MDBs). To build a more diversified and resilient RE landscape, it is crucial to attract medium-scale investors seeking manageable project sizes, innovative technologies, and supportive investment environments.

Equally important is the integration of domestic Small and Medium Enterprises (SMEs) into the renewable energy supply chain. By fostering linkages with foreign firms, SMEs can gain technical expertise, access new markets, and stimulate local industry development. This dual approach expanding the investment base and integrating local SMEs – will not only boost economic development but also mitigate risks associated with a narrow investment profile.

Following country consultations, the proposed investment promotion program outlined in the subsequent section aims to establish a comprehensive framework for attracting diversified FDI in the renewable energy sector. Initially piloted in Uzbekistan, the program is designed to be replicable across other sectors and Central Asian countries, promoting regional investment growth and cooperation. It will focus on strengthening institutional capacity, diversifying investment, and actively involving both foreign and local SMEs in the renewable energy sector's value chain.

10

CHAPTER TEN

10. Investment Promotion Program

The framework outlined in this chapter provides a structure that can be adapted to prioritize renewable energy technologies in the selected pilot country or any other studied country. It incorporates the key elements of the renewable energy ecosystem as defined by the Research Project and applies the selection criteria specific to the pilot country.

I. Executive Summary

- Overview of the program's goals and objectives
- Target sectors
- Target investors
- Key benefits for stakeholders
- Key differentiators from other initiatives
- Summary of the program's components and expected outcomes
- Target audience

II. Background and Context

- Overview of the renewable energy landscape in the target country, including its current status, challenges, investment climate, energy potential, opportunities, and recent developments.
- Government commitment to renewable energy development and its significance for the country.
- Case studies of successful renewable energy projects in the region and the target country, highlighting the investment potential.

III. Target Country Validation

Adherence to Selection Criteria:

1. Regulatory Framework and Policy Environment
2. Investment Potential and Market Readiness
3. Technical and Operational Capacity
4. Need for and Receptiveness to Technical Assistance
5. Existing Project Pipeline
6. Regional Integration Potential
7. Financial Sector Readiness
8. Energy Access Needs
9. Climate Change Commitments
10. Macroeconomic Stability

The selection criteria most relevant to the specific context of the target country should be prioritized. The country's performance should be compared with regional and international benchmarks to highlight strengths and areas for improvement.

IV. Program Objectives

- Attract FDI in prioritized renewable energy subsectors
- Develop a robust renewable energy ecosystem
- Strengthen the capacity of the National Investment Agency
- Enhance collaboration among key stakeholders in renewable energy projects
- Improve energy security and sustainability
- Strengthen the national economy
- Support national climate targets and mitigation efforts

Where possible, targets should be SMART: Specific, Measurable, Achievable, Relevant, and Time-bound.

The program's alignment with the target country's national development goals—such as climate targets and energy strategy—should be clearly demonstrated.

V. Target Sectors (likely narrowed down)

1. Wind Energy
2. Solar Energy
3. Biomass Energy
4. Small-scale Hydroelectric

Prioritization of renewable energy subsectors should be based on factors such as:

- **Resource Availability:** The abundance and quality of renewable energy resources (e.g., sunlight, wind, water, biomass) vary across regions.
- **Technical Feasibility:** The technical challenges and costs associated with developing different renewable energy technologies differ.
- **Economic Viability:** The economic benefits, including job creation, energy security, and reduced energy costs, must be considered.
- **Policy Alignment:** Government policies and regulations must support renewable energy development to attract investment.

A market analysis for each prioritized sub-sector should include demand forecasts, supply chain analysis, and the competitive landscape.

VI. Key Investment Areas (likely narrowed down)

1. Renewable energy production and storage
2. Electricity transmission and distribution infrastructure
3. Energy efficiency measures

Key investment areas should be focused on the most promising opportunities, based on the target country's specific needs and potential. Concrete examples of investment opportunities, including potential project sizes and expected returns, should be provided.

VII. Ecosystem Development or Refinement (as applicable)

Interventions should prioritize the most critical areas for ecosystem development or refinement based on the target country's specific needs and challenges. Detailed action plans for each intervention should include timelines, responsible parties, and required resources. Existing initiatives and programs should be leveraged to maximize the impact of the investment promotion program.

A. Government Commitment and Institutional Support

Develop a national renewable energy strategy and targets

- Appoint a dedicated renewable energy government entity
- Implement inter-ministerial coordination mechanisms

B. Regulatory Framework and Policy Environment

- Enact investor-friendly renewable energy laws and regulations
- Implement incentive schemes with long-term stability and predictability
- Streamline and digitalize tendering, licensing, permitting, and approval processes

C. Market Conditions and Potential

- Conduct market assessments and identify demand-supply dynamics and growth potential
- Identify and promote specific project opportunities and incentives
- Facilitate PPAs, ensuring long-term positive economics, including through exports

D. Investment Promotion Agencies

- Establish or strengthen a dedicated renewable energy IPA with pre-inception and lifetime functions
- Identify investment opportunities and develop targeted marketing materials and campaigns
- Maintain a list of renewable energy investment projects
- Organize investment roadshows, matchmaking events, and facilitate partnerships

E. Resource Availability and Transparency

- Conduct and publish detailed resource assessments
- Develop publicly accessible tools mapping resource potential and project feasibility
- Establish data-sharing protocols between agencies and investors

F. Grid Infrastructure

- Assess grid capacity and stability, ensuring its ability to integrate renewable energy
- Develop grid expansion and modernization plans, including storage solutions
- Implement smart grid technologies to improve the integration and management of renewable energy

G. Market Access

- Ensure the legal establishment of entities without undue restrictions
- Guarantee non-discriminatory access to renewable energy projects, including tendering, auctions, and negotiations
- Develop clear, preferential grid connection procedures and standards for renewable energy projects

H. Investment Protection

- Strengthen legal frameworks for investor protection, including property rights
- Provide guarantees against expropriation and financial and legal jeopardy
- Ensure internationally recognized dispute resolution mechanisms

I. Financial Environment

- Ensure the availability of financing options, including loans, grants, and equity investments
- Promote partnerships with both domestic and IFIs
- Offer financial incentives and establish risk-mitigation instruments (e.g., guarantees)

J. In-country Skilled Workforce

- Develop renewable energy training programs and curricula
- Implement internships or knowledge exchange programs at relevant facilities
- Facilitate knowledge transfer through partnerships

- Establish certification schemes for renewable energy professionals

K. Project Developers and Engineering, Procurement, and Construction Companies

- Support the development of local project development capabilities and EPC companies
- Facilitate partnerships with international developers, when possible
- Implement capacity-building programs and clusters for local EPC companies

L. Public-Private Partnerships

- Develop specific PPP frameworks and models for renewable energy projects
- Identify and promote PPP opportunities, including examples of successful partnerships
- Provide technical assistance for structuring and implementing PPPs

M. Environmental and Social Factors, Stakeholder Engagement

- Develop statutes and guidelines for environmental and social impact assessments
- Implement stakeholder engagement strategies and protocols
- Identify and promote benefit-sharing mechanisms for local communities

N. Technology and Innovation

- Establish renewable energy R&D centers, in partnership with corporations
- Promote technology transfer and localization through international partnerships
- Create innovation hubs and support pilot projects for innovative technologies

O. Regional Cooperation

- Promote cross-border renewable energy projects
- Facilitate regional power trading
- Develop harmonized standards and regulations

VIII. Implementation Strategy

- Establish a detailed action plan with timelines
- Conduct a thorough risk assessment to identify potential challenges and develop mitigation strategies
- Create a robust monitoring and evaluation framework to track progress, measure outcomes, and make necessary adjustments

A. Phased Approach: Clear Phases with Specific Deliverables and Milestones

- **Phase 1:** Ecosystem Assessment and Strategy Development
- **Phase 2:** Policy and Regulatory Reforms
- **Phase 3:** Capacity Building and Technical Assistance
- **Phase 4:** Investment Promotion and Project Implementation
- **Phase 5:** Monitoring, Evaluation, and Scaling

B. Stakeholder Engagement

- Government agencies
- Private sector investors and developers
- International development partners
- Local communities and civil society organizations

C. Project Opportunity Identification and Promotion

This process will begin in Phase 2 of the program and continue throughout subsequent phases. The IPA and MIIT will play a key role throughout all phases.

1. Strengthen Institutional Capacity and SME Support

- Provide targeted training for IPA staff to enhance both strategic and operational capabilities.
- Improve internal systems, investment servicing mechanisms, and coordination frameworks.
- Foster potential partnerships between SMEs and foreign investors to promote knowledge transfer and capacity building

2. Investment Promotion Strategies

- Develop targeted investment promotion strategies for each prioritized sub-sector.
- Identify key target markets and investors.
- Outline marketing and communication activities.
- Create investment promotion materials (e.g., brochures, fact sheets, presentations).
- Create investment manual of renewable energy sub sectors.

3. Project Pipeline Development

- Conduct a comprehensive survey of existing and planned renewable energy projects across the target subsectors (wind, solar, biomass, and small-scale hydroelectric).
- Collaborate with government agencies, utilities, private developers, and heavy industries to identify potential project sites and opportunities.

4. Project Screening and Prioritization

- Evaluate identified projects based on readiness, financial viability, and alignment with program objectives.
- Prioritize projects with strong offtake potential and solid financial structures.

5. Investment Prospectus Creation

- Develop detailed investment prospectuses for high-priority projects, including:
 - Technical specifications and resource assessments
 - Financial projections and expected returns
 - Regulatory and policy support available
 - Environmental and social impact assessments

6. Project Matchmaking and Promotion

- Organize investment forums and roadshows to showcase prioritized projects to potential investors.

- Facilitate matchmaking sessions between project developers and financiers.
- Utilize online platforms and databases to promote project opportunities to a global investor audience.

7. Support for Project Development

- Provide technical assistance to project developers to refine proposals and address any gaps in project readiness.
- Help structure projects to enhance bankability and investor appeal.

8. Continuous Pipeline Management

- Regularly update the project pipeline to reflect new opportunities and the progress of existing projects.
- Monitor market trends and investor preferences to guide future project identification and promotion.

By implementing this structured approach, the investment promotion program will bridge the gap between available renewable energy potential and concrete investment opportunities. This will attract FDI by presenting well-prepared, bankable projects that align with investor requirements and market demands.

IX. Monitoring and Evaluation

- Data collection and analysis system
- Key performance indicators (KPIs) to measure the program's effectiveness in attracting investment
- Reporting mechanisms
- Feedback loops for continuous improvement

X. Risk Management

- Scenario planning
- Identification of potential risks and mitigation strategies
- Contingency planning

XI. Budget and Resources

- Estimated budget for the investment promotion program implementation
- Cost-benefit analysis
- Potential funding sources and partnerships

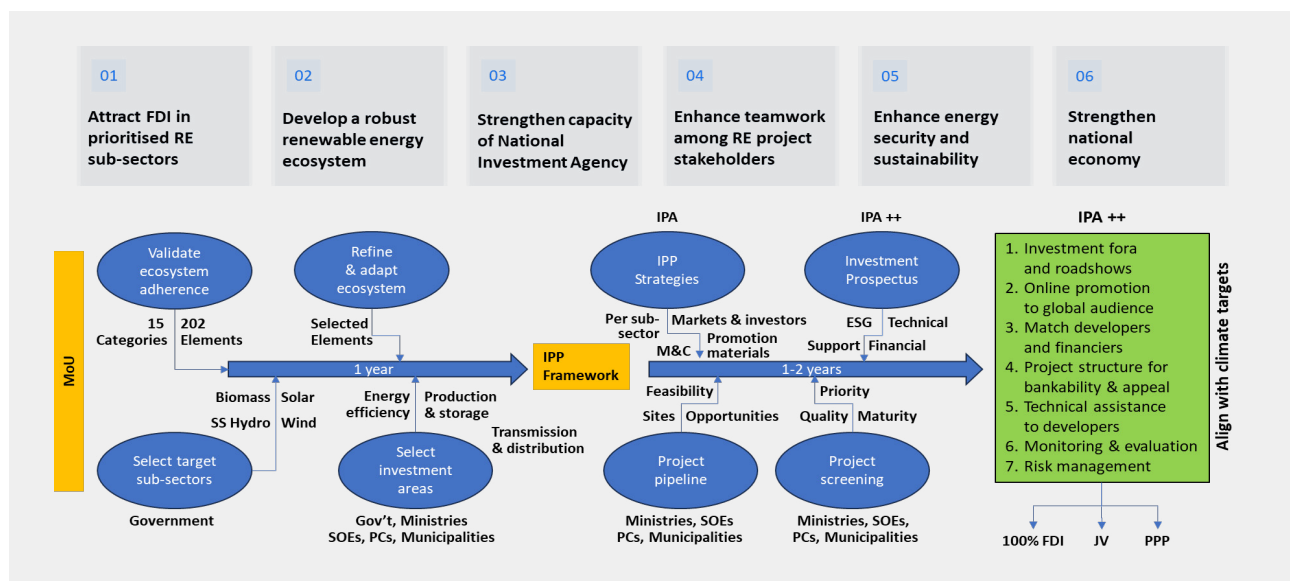
XII. Conclusion

- Summary of expected outcomes and long-term impact of the investment promotion program
- Call to action for potential investors
- Next steps

Figure 10-1 illustrates the implementation framework of the investment promotion program. The overarching objectives outlined above represent the key characteristics of an optimal investment promotion program. However, its formal implementation is subject to both financial and institutional constraints.

Since the IPA and MIIT do not have direct mandates for specific regulatory reforms, their role is more focused on advocating for necessary changes and providing feedback to relevant authorities. Through effective coordination across stakeholders, a conducive and diversified investment environment in the renewable energy sector can be achieved.

Figure 10-1: Execution of Investment Promotion Program



11

CHAPTER ELVEN

11. Next Steps

The CAREC Institute and the IsDB team have visited Uzbekistan and engaged with key ministries, including the IPA, MIIT, and the Ministry of Economy and Finance, to reach a broader agreement on the proposed investment promotion program. Both institutions are now transitioning from the research phase to concrete implementation actions, focusing on establishing a robust renewable energy investment ecosystem while continuing to engage with other participating countries in the Central Asian region. The following steps outline the process:

1. De-brief and Seek Formal Endorsement from Participating Countries and Research Project Sponsors

- Present key findings through workshops and presentations
- Discuss the implications of the research results
- Address concerns and questions from participating countries
- Gather feedback on the proposed next steps
- Build consensus on the path forward

2. Agree on Premises for the Next Stage with Key Government Officials and Stakeholders in the Pilot Country

- Present the rationale for the Pilot Country's selection
- Discuss the benefits and responsibilities of hosting the project
- Address any concerns or reservations
- Draft and sign a Memorandum of Understanding (MoU)
- Define the scope of the Investment Promotion Program, which includes:
 - Policies and regulations
 - Technical support
 - Business models
 - Investment facilitation
 - Funding
 - Other relevant aspects
- Establish roles and responsibilities for all parties involved
- Define expected outcomes and KPIs

- Set a timeline for implementation
- Appoint dedicated personnel for the program
- Identify necessary regulatory and policy adjustments
- Allocate financial resources, if applicable

3. Detail the Investment Promotion Program with the Pilot Country, Building on Chapter 8 of the Research Report

4. Secure Resources for Program Execution from Project Sponsors and the Pilot Country

- Secure funding for program implementation
- Budget for marketing and promotional activities
- Allocate resources for capacity-building initiatives
- Ensure the availability of human and technical resources

5. Execute the Investment Promotion Program in the Pilot Country Set a 1- to 3-year implementation timeline for the program:

- Organize a high-profile launch event:
 - Announce the program to potential investors
 - Showcase investment opportunities in the Pilot Country
 - Demonstrate government commitment to development
- Participate in international renewable energy conferences and exhibitions
- Organize investor roadshows in key target markets
- Develop promotional materials and investment guides
- Conduct regular capacity-building activities
- Provide end-to-end support for potential investors

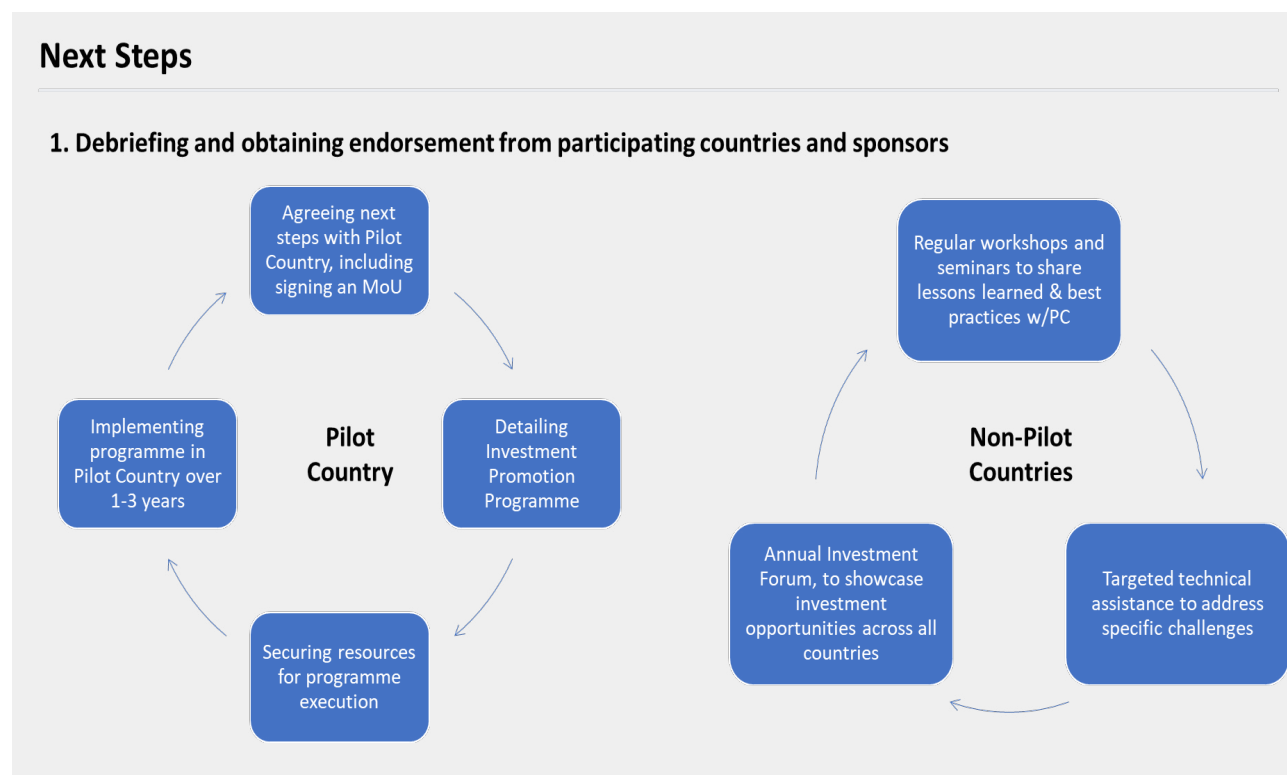
6. Maintain Support for Non-Pilot Countries

- Organize workshops and seminars to share lessons learned from the Pilot Country's experience
 - Provide progress updates from the Pilot Country
 - Discuss challenges and solutions in renewable energy development
 - Facilitate peer-to-peer learning among participating countries

- Offer targeted technical assistance to non-pilot countries, focusing on their specific renewable energy challenges:
 - Conduct a needs assessment for each country's renewable energy sector
 - Develop country-specific action plans
 - Provide expert consultations on policy and regulatory issues
- Organize an annual Energy Transition Investment Forum to showcase investment opportunities across all participating countries:
 - Facilitate networking between investors and project developers
 - Share success stories and best practices from the region

Figure 11-1 illustrates the next steps.

Figure 11-1: Next Steps



12

CHAPTER TWELVE

12. Technical and Market Aspects

This study evaluates various renewable energy technologies and their potential in Central Asia, focusing on wind, solar, biomass, and small-scale hydropower. It details the core components, technological advancements, manufacturers, capacity markets, and market support mechanisms associated with each technology. The findings are presented in the “Technical and Market Report,” which complements this Research Report.

1. Technical Aspects: The “Technical and Market Report (T&MR)” explores the core components of renewable energy technologies, addressing their design, efficiency, and lifespan. It highlights the potential of these technologies to produce sustainable energy.

- **Wind Energy:** The report examines onshore wind turbine components, such as the nacelle, tower, and blades. It also highlights technological innovations aimed at improving efficiency and reducing costs, listing major global wind turbine manufacturers, including Vestas and Goldwind.

- **Solar Energy:** The report covers photovoltaic (PV) principles, modules, and concentrated solar power technologies, such as parabolic troughs and power towers. It discusses the potential for solar energy in Central Asia and identifies leading solar panel manufacturers.

- **Biomass Energy:** The document addresses various biomass conversion technologies, including combustion, pyrolysis, gasification, anaerobic digestion, fermentation, and transesterification. It emphasizes efficiency improvements through advanced technologies and the versatility of syngas. Key players in the biomass sector, such as Biogreen, Ensyn, and Sierra Energy, are highlighted.

- **Small-Scale Hydropower:** This section focuses on the core components and systems of small-scale hydropower, including turbine types and pumped storage systems. It also examines the potential for small-scale hydropower in Central Asia and technological innovations expected within the next 5–10 years.

- **Technological Innovations:** The report emphasizes the role of digitalization and automation in enhancing operational efficiency, reducing costs, and optimizing performance across all renewable energy sources. It also explores hybrid systems that combine different renewable energy sources to improve reliability and efficiency.

2. Market Dynamics: The T&MR analyzes the investment ecosystem, providing insights into the market positions of key players, capacity markets, and trends for each technology. It also discusses the financial and regulatory environment influencing renewable energy projects in the region and the available support mechanisms. The report underscores the critical role of governments in establishing market support and financial incentives to attract investments, as well as the importance of community support for renewable energy projects.

3. Challenges and Opportunities: The document identifies challenges faced by the renewable energy sector, such as infrastructure limitations and policy barriers, while also highlighting opportunities for growth and development in the market.

In conclusion, the document underscores the significant potential for renewable energy in Central Asia, driven by technological advancements, market expansion, and supportive policies.

A decorative graphic on the left side of the page. It features a vertical teal bar on the far left. To its right, there are three more vertical bars of decreasing height, colored in a gradient from teal to light green. Below these, a large teal circle is partially visible, with a white outline. The word "Appendices" is written in white and yellow text across the middle of the page, with the 'A' being yellow and the rest of the letters in white. The background is white.

Appendices

Appendix 1 Questionnaire

This questionnaire helps assess the overall investment climate for renewable energy FDI, identifying both the strengths and potential areas for improvement of the country's FDI ecosystem.

1. Regulatory Framework and Policy Environment

- Does the country have a clear, long-term renewable energy strategy with specific targets and timelines?
- Are there specific incentives or enabling regimes for renewable energy investments (e.g., tax breaks, subsidies, and feed-in tariffs)?
- How stable and predictable is the regulatory environment for renewable energy?
- Are there streamlined permitting processes for renewable energy projects?
- To what extent does the regulatory framework promote investor transparency, predictability, and stability?
- To what extent does the government prioritize attracting foreign investment in the renewable energy sector?
- Are there any specific policies or programs in place to target foreign renewable energy investors?
- Is there a government agency or body responsible for promoting FDI in renewable energy?
- To what extent is the tendering process digitized?
- How would the overall political stability of the country be rated?
- Are there any upcoming changes in government policies, regulations, or market conditions that could affect the attractiveness of the renewable energy sector to foreign investors?

2. The Investment Promotion Agencies (see also Section 14.2)

- Role of national Investment Promotion Agencies (IPAs) in renewable energy development and attracting FDI to the sector;
- The IPAs modus operandi;

- The IPA contributions to the investment environment and the national economies;
- Areas for further consideration and improvement.

3. Market Conditions

- What is the current and projected demand for renewable energy in a country (from businesses, consumers, government, or exports/imports)?
- What are the current electricity prices in the country, and how do they compare to the cost of renewable energy generation?
- Has the government outlined future directions for the prices of electricity and its distribution?
- How competitive is the electricity market? Domestically and regionally.
- Are there any government mandates or policies encouraging the use of renewable energy?
- Are there any renewable energy mandates or targets for utilities?
- What types of PPA are available for renewable energy projects (e.g., fixed, variable, or take-or-pay)?
- How are PPAs structured in terms of duration, pricing, and currency?
- Are PPAs backed by government guarantees or support mechanisms?
- How reliable are off-takers (e.g., utilities) in terms of creditworthiness and payment history?
- What is the process for negotiating and securing a PPA?
- Are there any legal or regulatory barriers to signing PPAs with foreign investors?

4. Resource Availability and Transparency

- Which renewable energy resources (solar, wind, hydro, or biomass) are abundant in the country?
- Is there reliable data, centrally or distributed, on resource potential and availability?
- Does the government publish data on market trends, electricity prices, and project performances in the renewable energy sector?
- Is there a centralized source of reliable data on renewable energy resources in production (wind, solar, biomass, and geothermal) available in the country?
- How accessible is this data to potential foreign investors?

5. Infrastructure

- What is the current state of the electricity grid?
- How reliable is the existing energy infrastructure?
- Is energy storage available?
- To what extent is a grid capable of integrating large-scale renewable energy projects?
- Are there plans for a grid upgrade, expansion, or modernization to accommodate renewable energy?
- Is there an existing infrastructure in place or plans to accommodate alternative forms of energy, such as pipelines for hydrogen and geothermal, or other forms of transport and storage? If so, which energy segments and capacities?

6. Financial Environment

- What financing options are readily available for renewable energy projects in the country (e.g., loans, grants, project financing)?
- Are there any government programs or initiatives specifically designed to attract foreign investment in renewables?
- Are there local financial institutions familiar with renewable energy project financing?
- Do international financing institutions have a domestic or remote presence in the country?
- What is the role of the multilateral development banks in financing renewable energy projects?
- How easy is it for foreign investors to access financing for renewable energy projects in a country?
- What risk factors (e.g., market, political, and foreign relations) could affect the financial environment for renewable energy projects?
- What risk mitigation instruments are available for foreign investors?
- Are there restrictions on capital movement or repatriation?
- Is currency fully convertible and nonvolatile? What impact do exchange rate fluctuations have on investment feasibility and returns?
- Are there any recent or upcoming regulatory changes that could affect the financing for renewable energy projects?

7. Skilled Workforce

- What is the level of technical expertise in renewable energy technologies?
- Does the country have a sufficient pool of skilled workers (engineers, technicians, construction workers, etc.) to support the development and operation of renewable energy projects?
- Are there training programs or initiatives in place to address skill gaps in the renewable energy workforce?
- Is renewable energies incorporated into the national educational system's curriculum?

8. Project Developers and Engineering, Procurement, and Construction (EPC) Companies

- How well is the market for domestic project developers and EPC companies with experience in renewable energy projects?
- Are any foreign EPC companies currently active in the country's renewable energy sector?
- How is the environment for partnering between domestic and foreign EPC companies?

9. Public-Private Partnerships (PPPs)

- Have frameworks and guidelines for PPPs in the renewable energy sector been established?
- What is the track record of PPPs in the country's renewable energy sector?
- Are there any successful case studies or examples of PPPs in renewable energy?
- What are the roles and responsibilities of public and private partners in PPP projects?
- How are risks shared between public and private partners in PPPs?
- What incentives are offered to private investors participating in PPPs?
- How transparent and competitive is the PPP procurement process?
- Are there any barriers or challenges to forming PPPs in the renewable energy sector?

10. Investment Protection

- How easy is it for foreign companies to establish a presence and operate in a country?
- What legal protections exist for foreign investors?
- Is the country a signatory to international arbitration conventions?
- Can arbitration and dispute resolution processes be freely agreed upon?
- How are IP rights protected?
- Does Korea have a transparent and fair legal system that upholds contracts and protects property rights?

11. Environmental and Social Factors

- How should a country's overall level of public awareness and support for renewable energy be rated?
- Are there any environmental, social, or cultural barriers that could pose a challenge to the development of renewable energy projects in Brazil?
- What environmental impact assessment processes are in place?
- What is the legal importance of EIAs?
- How are local community interests considered in renewable energy projects?

12. Technology and Innovation

- Are there policies to encourage technology transfer in the renewable energy sector?
- Does the government provide funding or support for research and development (R&D) in renewable energy technologies?
- Are technologies and solutions already being studied and accepted by programs jointly developed with international development institutions incorporated into the country's long-term sustainability programs or strategies?
- Is there a culture of innovation and entrepreneurship in the renewable energy sector?
- What research and development capabilities exist in the country?
- Are there universities or research institutions with strong renewable energy programs? If so, what are the main programs, and what disciplines are covered?

13. Government Commitment

- How committed is the government to transitioning to renewable energy?
- How has the government organized its overall renewable energy efforts?
- Are the government's renewable energy structures given appropriate stature?
- Are there inter-ministerial coordination mechanisms for renewable energy policy?
- What is the track record of honoring agreements with foreign investors?

14. Market Access

- Are there opportunities for foreign companies to participate in energy auctions?
- Does the participation of foreign companies require local partnerships?
- What local content requirements exist for renewable energy projects?

15. Regional Cooperation

- Are there opportunities for cross-border renewable energy trade?
- Is the country part of any regional renewable energy initiatives?

Appendix 2 Countries' Adherence to Ecosystem's Key Determinants

A foreign investor looking to invest in renewable energy in an emerging market would seek certain favorable conditions while avoiding specific risks. All the aspects considered by investors before making an investment decision will in aggregate constitute an investment ecosystem. Appendix 2 describes each country's main strengths, weaknesses, opportunities, and threats in relation to the components of the proposed ecosystem for foreign direct investments (FDI) in renewable energy in Central Asia.

1. Government Commitment and Institutional Support

Kazakhstan

Strengths

- **Political Stability:**

Kazakhstan has a relatively stable political environment with a strategic commitment to renewable energy goals, including a target to reach 50% renewable energy by 2050.

- **Government Commitment:** Strong governmental support for transitioning to renewable energy, as evidenced by its commitment to international agreements like the Paris Agreement, I-REC adherence, and strategy on carbon neutrality by 2060.

- **Institutional Support:**

Established regulatory frameworks and dedicated agencies for renewable energy development, such as the Ministry of Energy and the Kazakhstan Electricity and Capacity Market Operator, Korem, Settlement and Financial Centre for Renewable Energy source.

- **Track Record:** Kazakhstan has a history of honoring agreements with foreign investors, which enhances investor confidence.

Weaknesses

- **Energy Dependency:**

High dependency on hydrocarbon/fossil fuel energy sources (low production cost of coal that stimulates its use), which complicates the transition to renewables.

- **Infrastructure Challenges:** Logistical and technological challenges, especially in transporting and installing renewable energy infrastructure due to the country's vast and varied geography.

- **Economic Factors:**

Volatility in global energy prices and high energy intensity in industries.

- **Legislative Measures:**

Kazakhstan has 148 renewable energy facilities, but citizens do not get credits for energy bills in the form of discounts and bill deductions due to the lack of Virtual Net-metering measures.

Opportunities

- **Resource Potential:**

Abundant renewable resources, particularly in wind and solar energy.

- **International Support:**

Opportunities for international cooperation and investment, supported by organizations like the UNDP, USAID, EBRD, and GEF.

- **Incentives:**

Potential for tailored incentives to attract FDI while ensuring local value creation.

Threats

- **Market Barriers:**

Financial and policy barriers, including low electricity prices and insufficient policy instruments to mitigate investment risks.

- **Climate Extremes:**

Harsh climatic conditions that can affect the performance and longevity of renewable energy infrastructure.

Kyrgyzstan

Strengths

- **Government Commitment:**

The government has committed to achieving carbon neutrality by 2050 and has shown interest in renewable energy, which is already a significant part of its energy mix.

- **Natural Resources:**

Abundant hydropower resources due to its mountainous terrain and significant resources of solar and wind energy.

- **International Support:**

Active participation in international environmental agreements and initiatives.

Weaknesses

- **Political Instability:**

Periodic political instability, which can deter long-term investments.

- **Institutional Weaknesses:**

Lack of a robust regulatory framework and weak potential of Green Energy Fund, insufficient level of collaboration between authorized bodies.

- **Economic Constraints:**

Limited financial resources and reliance on external funding for energy projects.

Opportunities

- **Institutional Development:**

creating and reforming institutions in the field of renewable energy sources and investment attraction (Green Energy Fund, Climate Finance Center under the Ministry of Natural Resources, State Development Bank, National Investment Agency, and PPP Center)

- **Regional Cooperation:**

Opportunities for regional cooperation in energy trade and infrastructure development.

- **International Support:**

Opportunities for international cooperation and investment, supported by the World Bank, EBRD, etc., as well as raising interest from Masdar, ACWA Power, and private investors.

Threats

- **Climate Change:**

Vulnerability to climate change impacts, which can affect hydropower generation.

- **Regulatory Risks:**

Inconsistent regulatory environment that can affect investor confidence.

- **Market Barriers:**

Low electricity prices and insufficient policy instruments to mitigate investment risks.

Tajikistan

Strengths

• **Significant Hydropower Resources:**

Tajikistan possesses abundant hydropower resources, which contribute approximately 98% of the country's electricity generation. The Vakhsh River, among others, holds significant potential, making it a cornerstone of Tajikistan's energy security and economic growth.

• **Government Initiatives:**

The Tajik government has introduced several initiatives to attract foreign investment in renewable energy, especially hydropower, these include:

• **Tax Incentives and Exemptions:**

Foreign investors are offered tax breaks and exemptions to reduce financial burdens and encourage the development of new energy projects.

• **Streamlined Regulatory Processes:**

Efforts are underway to simplify regulatory procedures, making the legal framework more transparent and investor-friendly.

National Development Strategy (NDS) 2030:

This strategy aims to modernize hydropower facilities, expand cross-border electricity trading, and triple electricity exports by 2030.

• **Public-Private Partnerships (PPP):**

The government promotes PPPs to leverage private sector expertise and capital while sharing investment risks.

• **Renewable Energy Auctions:**

Competitive bidding processes are being explored to attract cost-effective investments by allowing market forces to determine the most competitive prices

Weaknesses

• **Political and Economic Instability:**

Political and economic instability poses a risk to attracting and retaining foreign investment. Challenges such as weak governance, and a lack of transparency can deter potential investors.

• **Institutional Gaps:**

There is a notable absence of comprehensive renewable energy policies and dedicated institutions in Tajikistan. This gap hampers the efficient implementation and oversight of energy projects, leading to delays and increased costs.

Opportunities

• **Hydropower Development:**

With over 50% of its hydropower potential still untapped, Tajikistan has the opportunity to significantly expand its hydropower capacity. The government's goals under the NDS 2030 include more than tripling electricity exports, which could bring in much-needed revenue.

• **Cross-Border Electricity Trading:**

Tajikistan is strategically positioned to benefit from cross-border electricity trading, particularly with neighbors like Afghanistan, Uzbekistan, and Kyrgyzstan. Developing regional electricity markets could maximize the value of its surplus hydropower and foster regional cooperation.

• **International Funding:**

Access to international funding and technical assistance for renewable energy projects.

Threats

- **Geopolitical Risks:**

Regional tensions and geopolitical challenges can impact cross-border energy projects and cooperation, leading to instability in energy supply and potential conflicts over shared water resources.

- **Climate Change:**

Changes in weather patterns and reduced water flow due to climate change pose significant risks to hydropower generation, potentially leading to energy shortages.

- **Environmental Concerns:**

Hydropower projects can lead to environmental degradation, including the impact on local ecosystems and water management issues, which could provoke public opposition and regulatory hurdles.

Turkmenistan

Strengths

- **Government Control:**

Strong central government control, which can facilitate the implementation of large-scale projects.

- **Government Commitment:**

The national policy framework and commitments for multilateral environmental agreements (MEA) have been taking a more distinct course on clean energy (e.g. reduction of 20% emissions under BAU relative to 2010 levels, net zero growth as of 2030; planned development of a national strategy for green hydrogen energy development), which could pave the way for renewables.

- **Natural Gas Resources:**

Abundant natural gas resources, which can be leveraged to support renewable energy projects.

- **High State Emphasis on Power Infrastructure:** Modernized power infrastructure (due to the high strategic importance for the economy and higher share of investments) which can be integrated for renewables without extra cost for repairs or upgrade.

Weaknesses

- **Lack of Diversification:**

Heavy reliance on natural gas exports with limited diversification into renewable energy.

- **Renewable Energy Regulatory Environment:** Underdeveloped regulatory framework for renewable energy.

- **Institutional Structure:** Current institutional structure of the government aggravates its dependence on carbon-intensive energy production.³

³ UNECE. (2024). Turkmenistan Policy Brief. <https://unece.org/sites/default/files/2024-07/turkmenistan-policy-brief%20%283%29.pdf>

Opportunities

- **Solar and Wind Energy Potential:**

High potential for solar and wind energy development due to favorable climatic conditions.

- **Government Initiatives:**

Recent government interest in diversifying the energy mix to include renewables.

- **International Support:**

Opportunities for enhanced international support are provided by numerous state programs aimed at international cooperation (with UN, IRENA, OSCE, ADB, etc.) and by the growing interest from leading RE companies like Masdar.

- **Developed Power System:**

Opportunity for low-cost integration of renewables given the large-scale power infrastructure development program (enabled by countrywide plant upgrades and strengthened national power grid).

- **International Development Funding:**

High potential for attracting international financing given the smallest number of the most diverse project portfolios with international climate finance, and higher GHG emissions indicators (among CA states).

- **State Funding:**

Given the energy sector's high revenues and emissions, there is a good potential to support clean energy commitments by allocating a certain flow of traditional energy revenues to renewables.

Threats

- **Limited Cooperation:**

Limited international and regional exposure to clean energy, which can limit access to technology and financing.

- **Infrastructure Requirements:**

Energy infrastructure focused on traditional energy can hinder the development and integration of renewable energy projects.

- **Market Barriers:**

Low electricity prices and limited policy instruments to mitigate investment risks.

Uzbekistan

Strengths

- **Government Reforms:**

Recent government reforms aimed at improving the investment climate and promoting renewable energy.

- **Government Commitment:**

Strong governmental support for transitioning to renewable energy, as evidenced by its commitment to international agreements like the Paris Agreement and strategy on carbon neutrality by 2050.

Special attention is being paid to the development of a “green economy,” in particular “green energy.” In this regard, a step was taken to increase the volume of electricity production based on renewable energy sources.

- **Ambitious Targets:**

Uzbekistan targets to reach 40% renewable energy by 2030.

- **Institutional Support:**

Established regulatory frameworks and dedicated agencies for renewable energy development, such as the Ministry of Energy and the Agency for Development and Regulation of the Energy Market (industry regulator), “Uzenergosotish” JSC – responsible for centralized purchase and sale of electricity.

- **International Support:**

Active participation in international environmental agreements and initiatives.

- **Renewable Energy Auctions:**

Competitive bidding processes are being explored to attract cost-effective investments by allowing market forces to determine the most competitive prices.

Weaknesses

- **Regulatory Challenges:**

Regulatory and bureaucratic hurdles that can delay project implementation.

- **Energy Dependency:**

High dependency on natural gas and coal, which complicates the transition to renewables.

Opportunities

- **Resource Potential:**

Abundant renewable resources, particularly in wind and solar energy.

- **International Support:**

Opportunities for international cooperation and investment, supported by organizations like the ADB, IFC, World Bank, and EBRD.

- **FDI Attraction:**

Potential for tailored incentives to attract FDI while ensuring local value creation.

• **Openness to Negotiations:** Openness of the Government for direct negotiations with RE potential investors.

- **Regional Leadership:**

Potential to become a regional leader in renewable energy development.

Threats

- **Market Barriers:**

Financial and policy barriers, including low electricity prices and insufficient policy instruments to mitigate investment risks.

- **Infrastructure Requirements:**

Energy infrastructure focused on traditional energy can hinder the development and integration of renewable energy projects.

- **Framework Instability:**

Not stable legislation and high dependence on political figures.

2. Regulatory Framework and Policy Environment

Kazakhstan

Strengths

- **Clear Policies:**

Kazakhstan has established clear and predictable policies supporting renewable energy development, including a goal to achieve 15% by 2030 and 50% renewables by 2050.

- **Long-term Strategy:**

The country has a well-defined long-term energy strategy with specific targets for renewable energy deployment.

- **Auction Mechanism Focus:**

The Ministry of Energy has established a 5-year plan for the organization and conduct of auctions (selection of projects for the construction of renewable energy sources [RES] facilities).

- **Incentives:**

There are specific incentives for foreign investors, such as tax breaks and subsidies, to promote renewable energy investments.

- **Permitting Processes:**

Streamlined and digitized permitting processes facilitate easier submission of bids and management of bureaucratic processes.

Weaknesses

- **Regulatory Complexity:**

Despite clear policies, the regulatory environment can be complex and challenging to navigate for foreign investors.

- **Local Industry:**

Lack of local manufacturers of renewable energy technology makes it difficult to meet subsidy targets indicated in the Law on renewable energy sources (RES). This is particularly relevant for small-scale renewable up to 5kW.

- **Dependence on Fossil Fuels:**

High reliance on coal and other fossil fuels complicates the transition to renewables.

Opportunities

- **Policy Adjustments:**

Potential for regular reviews and adjustments of policies based on market developments and technological advancements.

- **National Collaboration:**

For instance, Qazaq Green Association works with SMEs making proposals for a legislative framework to enhance the investment climate).

- **International Cooperation:**

Opportunities for international partnerships and funding to further enhance the renewable energy sector.

Threats

- **Policy Changes:**

Upcoming changes to government policies or market conditions could impact the attractiveness of the renewable energy sector for foreign investors. Possible sudden changes in policies and regulatory frameworks may deter investors.

- **Examples:**

- Recycling measures of WPP, SPP technologies (this may affect the operating facilities);
- Taxonomy classifier has no threshold for RE projects (EU Taxonomy has DNSH criteria)
- Policy does not cover the production and use of all possible alternative energy sources (for instance, hydrogen)

- **Economic Volatility:**

Fluctuations in global energy prices and economic conditions could affect investment stability.

Kyrgyzstan

Strengths

- **Strategic Documents:**

In 2024, the Concept of Carbon Neutrality until 2050 and the NDC Action Plan until 2030 were developed, and the development of RES and large hydropower are among the priority tasks. Also in 2024, the National Energy Program until 2035 was approved, which includes goals and a list of ongoing, committed, and planned projects in the field of renewable energy and hydropower.

- **Hydropower Focus:**

Strong emphasis on hydropower, which is a significant part of its renewable energy strategy.

- **Government Support:**

Government initiatives to promote renewable energy, including international agreements and cooperation.

Weaknesses

- **Policy Instability:**
Periodic political instability can lead to unpredictable policy shifts.
- **Institutional Instability:**
There are frequent changes to the institutional structure, frequent changes in management, high employee turnover, and lack of continuity.
- **Regulatory Gaps:**
Lack of comprehensive regulatory frameworks and streamlined processes for renewable energy projects.

Opportunities

- **Hydropower Expansion:**
Potential to expand hydropower capacity and develop other renewable sources like solar and wind.
- **International Funding:**
Access to international funding and technical assistance for renewable energy projects.
- **Development of Regulatory and Institutional Framework:**
Work is underway to improve the Law on Renewable Energy and by-laws regulating activities for the generation and supply of electricity using RES. The Green Energy Fund is endowed with functions and powers in the field of renewable energy.

Threats

- **Regulatory Risks:**
Inconsistent regulatory environment can deter foreign investors.
- **Climate Impact:**
Vulnerability to climate change impacts, which can affect hydropower generation.

Tajikistan

Strengths

- **Hydropower Resources:**
Significant hydropower resources and government initiatives to attract investment in renewable energy.
- **Environmental Policy Integration:**
Active participation in international environmental agreements and thorough Environmental Performance Reviews align national policies with global environmental standards, fostering sustainability across all sectors.
- **Robust Regulatory Updates:**
Ongoing efforts to restructure the state-owned electric utility and update regulatory and tariff regimes enhance market responsiveness and financial viability, supporting a robust energy sector.

Weaknesses

- **Policy and Economic Instability:**
Political and economic instability which can deter foreign investment.
- **Regulatory Complexity:**
Despite improvements, the regulatory framework remains complex, with lengthy permitting processes that can deter new investments and delay the implementation of energy projects.
- **Dependence on International Agreements:** Heavy reliance on international frameworks and agreements may limit flexibility in domestic policy-making, particularly in rapidly changing sectors like renewable energy.

Opportunities

- **Hydropower Development:**
Potential to further develop hydropower infrastructure and explore other RES.
- **International Cooperation:**
Opportunities for international partnerships and funding.
- **Policy Enhancement and International Cooperation:**
There is potential to optimize resource use and enhance energy security through recommendations for cross-border electricity trading and consolidation of energy policies. Improvements in data management for strategic policy directions are also crucial.
- **Environmental Performance Reviews:**
These reviews provide actionable recommendations to continually improve environmental management, aligning with sustainable development goals and enhancing the country's commitment to global environmental governance.

Threats

- **Geopolitical Tensions:**
Regional geopolitical tensions that can impact energy projects.
- **Environmental Issues:**
Risks related to environmental degradation and water resource management.

Turkmenistan**Strengths**

- **Government Control:**
Strong central government control, which can facilitate the implementation of large-scale projects.
- **Natural Resources:**
Abundant natural gas resources and large potential solar and wind energy ranked 2 in the CA region which can support renewable energy projects and stimulate related regulatory structure.
- **Developing Policy Framework:**
Since 2016, Turkmenistan has made notable progress in developing a clean **energy policy framework by:** joining UNFCCC PA, IRENA, GGGI, and GMP; setting renewed commitments for multilateral environmental agreements; approving national strategy for the development of renewable energy until 2030 and adopting the state law on RES.
- **Regulatory Environment:** Regular amendment of state laws to meet international standards.

Weaknesses

• **Regulatory Environment:**

Despite improvements to meet international standards, there is a need for a well-functioning regulatory framework, including that for FDI flow support.

• **Institutional Structure:**

Despite developments in clean energy policy, separate high-level designated bodies and regulations with clear mechanisms for renewable energy development are needed.

• **Lack of Targets:**

Except for Turkmenistan, the countries in Central Asia have adopted quantified renewable energy generation targets.⁴

• **Dependence on Fossil Fuels:**

Heavy reliance on natural gas and limited diversification into renewable energy.

Opportunities

• **Solar and Wind Potential:**

High potential for solar and wind energy development due to favorable climatic conditions.

• **Policy Development:**

Recent government interest in diversifying the energy mix to include renewables.

• **Upcoming Plan:**

The upcoming Plan to strengthen international cooperation in the field of RES (2025-2030)⁵ may stimulate future financial and technology inflow.

• **New Regulatory Acts:**

Regulatory acts are being developed to promote the practical use of renewable energy in various economic sectors under the law “on Renewable Energy Sources” adopted in 2021.^{6, 7}

Threats

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4 OSCE. (2024, January 23). <https://www.osce.org/files/f/documents/f/f/561811.pdf>

5 NCA. (2024, July 22). Turkmenistan aims to foster international cooperation in renewable energy. <https://www.newscentralasia.net/2024/07/22/turkmenistan-aims-to-foster-international-cooperation-in-renewable-energy/>

6 (2024, April 14). Future green energy. <https://turkmenistan.gov.tm/index.php/en/post/82525/future-green-energy#:~:text=In%202021%2C%20the%20President%20of,sectors%20of%20the%20country's%20economy>

7 CAREC. (2030). Energy Outlook 2030. p. 273. <https://www.adb.org/sites/default/files/publication/850111/carec-energy-outlook-2030.pdf>

Uzbekistan

Strengths

- **Clear Policies:**

The Government is aware of the need to meet the demand for energy from the population and sectors of the economy, while also responding to climate change impacts through decarbonisation levers. These core objectives are reflected in the Concept Note for Ensuring Electricity Supply in Uzbekistan 2020–2030, which is expected to be updated to reflect revised sector development targets, including an increased share of RE capacity in the energy mix.

- **New Legislation:**

The government adopted new legislation on PPP and an updated law on the use of RE resources, along with a new tariff policy, supported by a revised policy geared toward attracting increased foreign investment in RE.

- **Reforms to establish the energy market:**

The power sector reforms envisage a transition to a competitive wholesale market in the short term with enhanced tariff policies, which should provide for fair and unobstructed access to the grid. Reforms include the establishment of two **new entities in the power market:**

- Energy Regulator Agency (the Agency for Development and Regulation of the Energy Market) – a regulator entity, financially independent from the state, that will oversee regulating, licensing, and control functions in the electricity market; and
- Electricity Market Operator (“Uzenergosotish” JSC) – a state-owned company responsible for all electricity trade operations in the wholesale market.

- **Incentives:**

In the context of large investment projects, and as part of investment agreements, the Government provides special incentives to investors, including negotiated special rates for electricity, as well as tax and customs exemptions for a fixed period.

Weaknesses

- **Regulatory Challenges:**

Despite existing policies, the regulatory environment can be complex and challenging to navigate for foreign investors.

- **Regulatory Independence:** Despite the establishment of the Energy Regulating Agency, it is not independent of the Government, which may cause inefficiencies and may become an obstacle to establishing an efficient energy market in Uzbekistan.

- **Energy Dependency:**

High dependency on natural gas and coal for energy production.

Opportunities

• **Policy Adjustments:**

Potential for regular reviews and adjustments of policies based on market developments and technological advancements.

• **Investment opportunities:**

The country's increased RE capacity targets are ambitious and large-scale, which necessitate equally large investments to realize these objectives. There are also associated needs for maintaining power system stability considering the integration of large-scale RE into the grid. The introduction of new RE capacities decreases the capability of the power system to handle power fluctuations. This, in turn, requires the integration of energy storage capacities, such as Battery Energy Storage Systems (BESS). Thus, the RE market in Uzbekistan is untapped and presents immense opportunities for prospective investors.

• **International Cooperation:**

Opportunities for international partnerships and funding to further enhance the renewable energy sector.

Threats

• **Policy Risks:**

Policy risks and governance issues that can affect investor confidence.

• **Policy inconsistency:**

Frequent changes in legislation can create uncertainty and challenges for businesses and investors, making it difficult to plan long-term strategies. Constant updates may lead to increased compliance costs, disruptions in operations, and a need for continual adaptation to new regulations. This can discourage investment, slow down growth, and undermine confidence in the regulatory environment.

• **Market Barriers:**

Financial and market barriers, including access to financing and technology.

3. Investment Promotion Agencies

Kazakhstan

Strengths

• **Well-established** IPA (KAZAKH INVEST) with a focus on facilitating foreign investments.

• **Clear mandate** to promote FDI in various sectors, including renewable energy. Experience in assisting with pre-investment, investment, and operational matters.

• **Enforcement:**

Under the "Investment Shield" framework, the Prosecutor's office and the Investment Committee (MOFA RK) address challenges faced by investors and safeguard their interests.

Investment Headquarters under the first Deputy Prime Minister of Kazakhstan is functioning (reviews projects at higher governmental levels)

Weaknesses

- Historical focus on extractive industries, which may limit expertise in renewable energy.
- Potential lack of specialized knowledge in complex renewable energy projects.

Opportunities

- Increasing government focus on diversifying the economy, including the renewable energy sector.
- Potential to develop specialized renewable energy expertise within the IPA.

Threats

- Competition from other countries' IPAs for renewable energy investments.
- Possible bureaucratic hurdles in coordinating with other government agencies (and other domestic IPAs)

Kyrgyzstan**Strengths**

- Existence of state-owned investment agencies with experience in attracting investments.
- Studies were carried out and sites for the construction of renewable energy power plants were identified, which can be offered to potential investors.

Weaknesses

- Several government agencies working to attract investments with partially overlapping functions.
- Lack of a clear step-by-step guide (manual) for the investor.
- Insufficient information on the websites of the authorized bodies.
- Limited experience in large-scale FDI attraction compared to some neighboring countries.
- Potential lack of resources for comprehensive investor support throughout the project lifecycle.

Opportunities

- Potential to leverage international support (e.g., Green Climate Fund) to enhance IPA capabilities.
- Opportunity to specialize in niche renewable energy sectors suitable for Kyrgyzstan's geography.

Threats

- The development of the regulatory framework does not keep pace with the implemented policies and commitments for the development of renewable energy sources.
- Political instability may undermine IPA efforts and investor confidence.
- Limited national budget may restrict IPA's ability to provide comprehensive services.
- Possible bureaucratic hurdles in coordinating with local authorities on the sites

Tajikistan

Strengths

- Recognition of FDI attraction as a critical component of national development strategy.
- Growing awareness of the importance of IPAs in attracting FDI.

Weaknesses

- Lack of information on a well-developed IPA specifically for renewable energy.
- Potential gaps in providing comprehensive support throughout the investment lifecycle.

Opportunities

- Potential to establish or enhance an IPA with a focus on renewable energy investments.
- Opportunity to learn from global and regional best practices in investment promotion.

Threats

- Increased global competition for FDI in the post-COVID environment.
- Possible challenges in coordinating investment promotion efforts across government agencies

Turkmenistan

Strengths

- Strong government control which could potentially facilitate IPA operations if established.
- Abundant natural resources that could support renewable energy projects, and access to the Caspian Sea for potential exports of renewable energy and products to the West.
- Developed legal structure in Intellectual Property and extended membership in the international Arbitration organization.

Weaknesses

- Limited information on the existence or effectiveness of a dedicated IPA.
- Underdeveloped regulatory framework for renewable energy, which may hinder IPA efforts.
- Significant energy subsidies hold back investments in renewable energy production and energy efficiency.
- Limited information on active incentives for foreign investors.
- Despite significant improvements in certain areas (intellectual property rights, membership in international arbitration agencies) the investment-related legislation might need a clear guide for investors.

Opportunities

- Potential to establish an IPA focused on diversifying energy investments, including renewables, given the emerging CJSs as “Turkmen Invest” and “Ashgabat Stock Exchange” (ASE), which are on track to explore green finance and investment schemes.
- Opportunity to leverage natural resources to attract renewable energy FDI.
- High potential for streamlining the entry and registration processes, given the long period and requirement of approval from various agencies.

Threats

- Limited international exposure may limit the effectiveness of IPA efforts.
- Lack of transparency may deter potential investors despite IPA efforts.
- Lack of clear, multi-year strategy for IPA

Uzbekistan**Strengths****Established IPA:**

UzIPA under the Ministry of Investment, Industry, and Trade has a focus on facilitating foreign investments.

Clear Mandate:

To promote FDI in various sectors, including renewable energy.

Experience:

In assisting with pre-investment, investment, and operational matters.

Enforcement:

Under the “Investment Shield” framework, the Special Government Commission on Investments and Foreign Trade, and the Foreign Investors Council under the President of Uzbekistan address challenges faced by investors and safeguard their interests. The Deputy Prime Minister is the head of the Commission and Ministry for Investment, Industry, and Trade.

Weaknesses

- Potential lack of a dedicated IPA and diffuse responsibilities specifically for renewable energy investments.
- Possible bureaucratic hurdles in coordinating between different government entities and SOEs.

Opportunities

- Potential to establish or enhance an IPA leveraging existing government initiatives in renewable energy.
- Opportunity to streamline investor services, including assistance with permitting and licensing processes.
- Strengthening and increasing the opportunities and responsibilities of IPA under the new draft Investment Law, which is now discussed in the Parliament of Uzbekistan.

Threats

- Competition from neighboring countries with more established IPAs.
- Potential challenges in maintaining consistent policies to support IPA efforts

While each country has unique strengths and challenges, there is a common opportunity across the region to establish or enhance IPAs or dedicated entities within existing structures, specifically focusing on renewable energy FDI. These agencies can play a crucial role in attracting investments, streamlining bureaucratic processes, and providing expert support throughout the investment lifecycle. However, success depends on addressing common threats such as policy inconsistency, bureaucratic hurdles, and regional competition for investments.

4. Market Conditions and Potential

Kazakhstan

Strengths

- **Clear renewable energy targets:**
Goal to achieve 15% by 2030 and 50% renewables by 2050.
- **Growing demand for electricity:** Expected 60% increase in the next decade.
- **Supportive policy environment:** National Energy Program and Strategy for Fuel and Energy Sector Development

Weaknesses

- **High dependence on fossil fuels:** Coal accounts for 60% of power generation.
- Energy tariffs not reflecting real costs, hindering renewable energy investments.
- Lack of Holistic Approach:**
Investment environment is adapted to large-scale renewables, whereas little attention is paid to small-scale programs and remote areas and households (lack of small-scale incentives: governmental grants, subsidies), and only one legislative measure is present – Netto-mechanism.
- Limitations on Maneuvering Capacity**

Opportunities

- **Significant renewable energy potential:**
Need to increase renewable generation by a factor of 140 (roughly 500 TWh) to meet demand and carbon neutrality goals.
- Potential for energy system flexibility and interconnectivity with neighboring countries.
- Multi-Faceted Programs:** Development of programs for small-scale renewables that will have elements of raising awareness, campaigns, assistance on grants applications, and training.
- BESS Incentives:**
Government may incentivize the battery energy storage systems (due to country targets on RE)

Threats

- Competition from traditional fossil fuel industries.
- Lack of flexible generating capacity to balance intermittent renewables.
- To ensure grid stability there could be more regulatory amendments (due to maneuvering capacity issues)

Kyrgyzstan

Strengths

– **Renewable energy targets:**

The share of renewable energy (excluding large hydropower plants) should be at least 10% of the installed capacity of power plants by 2027 with the commissioning of at least 50 MW of small hydropower plants and 420 MW of solar power plants,

– **Electricity Demand Growth:**

According to the forecasts given in the National Energy Program, the growth in demand for electricity by 2035 will be 56%.

– **Untapped Potential:**

Considerable untapped renewable energy potential, especially in hydropower.

– **Existing Legal Framework:**

Law on Renewable Energy provides incentives for renewable energy development.

Weaknesses

– Lack of guarantees for the purchase of the entire volume of electricity and the preservation of the established tariff for a long period by a single buyer.

– Lack of measurement data on potential sites.

– Difficulties with the provision of land plots and water resources regulation.

– Lack of a Renewable Energy Development Strategy.

– Lack of clearly defined updated requirements and procedures for project management, as well as guarantees for the payment of feed-in tariffs.

– Limited development of other renewable sources like solar and wind.

Opportunities

– Potential for decentralized renewable energy technologies, especially small hydropower stations.

– Opportunities in solar energy and biogas development

Threats

– Geographical limitations for wind energy development in populated areas.

– Potential challenges in PPA negotiations and enforcement due to limited experience.

– Ineffective pricing and tariff policy for electricity, leading to a shortage of financial resources in the energy sector and a corresponding decrease in the flow of investments

Tajikistan

Strengths

– Government commitment to expanding renewable energy capacity: Goal of 10,000 MW and universal green electricity generation by 2037.

– Approved Green Economy Development Strategy (GEDS) up to 2027.

– Only about 4% currently exploit hydropower energy. This establishes a strong foundation for energy production and export capabilities

– The government has committed to fully transitioning to renewable energy sources by 2032 and aims to double the current renewable production capacity, indicating strong policy support for renewable initiatives

Weaknesses

- Vulnerability to natural hazards and loss of glaciers threatening hydropower generation.
- While there are ambitious plans for expanding solar and wind energy, significant investment is required to develop the necessary infrastructure to support these technologies

Opportunities

- Potential for climate-friendly policies and comprehensive climate fiscal framework.
- Opportunity to update public procurement policies and construction standards with green economy principles.
- Global entities are actively partnering with Tajikistan to fund and develop its renewable energy projects, which is crucial for introducing advanced renewable technologies and enhancing capacity

Threats

- Climate challenges and risks that could lead to irreversible economic, social, and environmental damage.
- Potential fiscal space constraints affecting renewable energy investments

Turkmenistan

Strengths

Untapped Potential:

- Abundant potential of solar and wind energy and critical raw materials needed for renewable energy technologies.

Developing Policy Framework:

- Enhancing national policy framework for clean energy by joining MEAs commitments and elaborating national programs for international cooperation in the development of renewables and hydrogen.
- Government acknowledgment of potential in both oil/gas and renewables sectors

Weaknesses

Traditional Energy Incentives:

- Abundant reserves of hydrocarbons, income they generate and low cost of gas-fed electricity deter impetus for development of RE market.

Immature RE sector:

- Underdeveloped renewable energy sector leading to the rudimentary regulatory framework and market mechanism of RE compared to oil and gas.

Market Entry:

- Market-entry restrictions in the energy sector hinder the potential investments in renewable energy projects.⁹

Opportunities

- Potential for lithium extraction, especially in Western Turkmenistan.
- Opportunities in iron and copper ore extraction for renewable energy infrastructure.
- Potential to become a leading solar panel producer due to the abundance of silicon in the Karakum sands.¹⁰
- Huge potential to deploy large-scale roof-top solar energy on new buildings (in particular in Ashgabat city) given the state's continuing programs focused on residential and industrial building construction.
- Strategic agreement signed with Masdar to explore renewable energy opportunities stimulates further activities in the RE sector

Threats

- Risks to investors due to lack of transparency and information.
- Potential challenges in PPA negotiations and enforcement due to limited experience in renewable energy projects

Uzbekistan**Strengths****- Clear RE Targets:**

Goal to achieve 40% by 2030.

- Growing Demand for Electricity:

Expected 50% increase in 2030. The Ministry of Energy estimates that generation will grow 6–7% annually and achieve 120 billion kWh by 2030. Residential consumption will reach 21.9 billion kWh and all other sectors, including industries, will consume 85 billion kWh.

Growing Population:

Uzbekistan has the biggest population in the Central Asia region. With 35 million inhabitants, the country represents almost half of the region's population. Over the last 20 years, the population increased by 10 million people, from 24 to 35 million. It is estimated that by 2030, Uzbekistan will be home to almost 40 million residents. Therefore, an expanding population will be a source of consumption and economic growth and simultaneously require more job opportunities and infrastructure services.

Environmentally Driven Demand:

Acknowledging its relatively high GHG emissions and responding to its commitments under the Paris Agreement, the Government intends to reduce GHG emissions to 35% per unit of GDP by 2030. Among the key instruments for reaching that goal is upgrading the fleet of thermal power plants by installing efficient Combined Cycle Gas Turbine technologies and targeted policies to roll out utility-scale renewable energy (solar and wind) for electricity generation.

¹⁰ <https://orient.tm/ru/post/56430/v-bryussele-predstavlen-potencial-turkmenistana-v-formirovanii-chistoj-energetiki-budushchego>

Weaknesses

- **High Dependence on Fossil Fuels:**

Natural gas accounts for 85% of power generation.

- Energy tariffs not reflecting real costs, hindering renewable energy investments.
- Current low share of renewables in the energy mix.
- Absence of an efficient energy market in the country
- Potential challenges in grid integration of intermittent renewable sources.

Opportunities

- **Significant renewable energy potential:**

Need to increase renewable generation by 8 GW within a three-year program (until 2027) focused on expanding renewable energy capacity.

- **Regional cooperation:** Potential for energy system flexibility and interconnectivity with neighboring countries.

Multi-Faceted Programs: Development of programs for small-scale renewables that will have elements of raising awareness, campaigns, assistance on grants applications, and training.

BESS development:

Government incentivizes the battery energy storage systems (due to country targets on RE). It plans to build 18 energy storage facilities with a combined capacity of 2.2 GW by 2027 within the abovementioned program. All new RE projects are required to have BESS.

Threats

- Competition from traditional fossil fuel industries.
- Lack of flexible generating capacity to balance intermittent renewables.
- To ensure grid stability there could be more regulatory amendments (due to maneuvering capacity issues)

Countries face common challenges, such as the need for grid modernization, the development of flexible capacity, and the creation of transparent and enforceable PPA mechanisms.

5. Resource Availability and Transparency

Kazakhstan

Strengths

– **Abundant Renewable Resources:** Kazakhstan has substantial potential for renewable energy, particularly in wind and solar power. Approximately 50% of the country's territory has wind speeds suitable for energy generation.

– **Data Availability:** Kazakhstan has made efforts to improve data collection and dissemination. The Wind and Solar Atlas of Kazakhstan is an example of reliable data on wind and solar potential.

Renewable energy map:

<https://rfc.kz/en/res-sector/investors/renewable-resources/162700/>

Weaknesses

– **Aging Infrastructure:**

The existing power infrastructure is aging, which can pose challenges for integrating new renewable energy projects.

– **Data Gaps:**

While there are efforts to collect data, there may still be gaps in the availability and accessibility of comprehensive data on renewable energy resources.

Opportunities

– **Policy Support:**

The government has set ambitious renewable energy targets, aiming for 50% renewables by 2050, which can drive demand and investment in the sector.

– **International Collaboration:** Opportunities for international partnerships to further develop and utilize renewable energy resources.

Threats

– **Logistical Challenges:**

The vast and varied geography can pose logistical challenges for transporting and installing renewable energy infrastructure.

– **Economic Volatility:** Fluctuations in global energy prices and economic conditions could impact investment stability.

Kyrgyzstan

Strengths

– **Hydropower Dominance:**

Up to 90% of electricity is generated by large hydroelectric power plants, indicating a strong foundation in renewable energy.

– **Public Maps:**

Official websites of authorized bodies have an interactive map of existing, planned, and future hydropower plants and network infrastructure.

– **Regulatory Framework:**

The government has developed regulations to support renewable energy generation and supply, providing a clear framework for investors.

Weaknesses

- **Limited Diversification:**

The renewable energy sector is heavily reliant on hydropower, with limited development in other renewable sources like solar and wind.

- **Data Accessibility:**

There may be challenges in accessing reliable and comprehensive data on renewable energy resources. Indicators of distributed generation, solar, and wind energy are not integrated into national statistics and an interactive map of existing and future energy capacities.

Opportunities

- **Diversification Potential:**

Significant potential to diversify into other renewable energy sources such as solar, wind, and biogas.

- **International Funding:** Opportunities for international funding and technical assistance to support renewable energy projects.

Threats

- **Climate Impact:**

Rising temperatures and melting glaciers could impact water availability for hydropower generation.

- **Regulatory Risks:**

Inconsistent regulatory environment can affect investor confidence.

Tajikistan

Strengths

- **Hydropower Resources:**

Tajikistan's hydropower capacity is immense, with an estimated potential of 527 terawatt-hours, of which only a small fraction is currently utilized. This vast resource base provides a strong foundation for energy development.

- **Government Commitment:**

The government has set clear and ambitious renewable energy targets, including increasing hydropower generation capacity by 10 gigawatts and raising annual electricity exports by 10 TWh, underlining its dedication to enhancing the renewable sector.

Weaknesses

- **Data Gaps:**

There is a notable lack of detailed and current data on the full scope of renewable resources, which can hinder effective planning and utilization. The last comprehensive survey of energy resources was conducted decades ago, underscoring the need for updated information.

- **Dependence on Imports:**

High dependency on imported fossil fuels, which can affect energy security and investment attractiveness.

Opportunities**- Renewable Energy Potential:**

Potential to further develop hydropower and explore other renewable energy sources like solar and wind.

- Policy Support:

Supportive policies and international cooperation can enhance renewable energy development.

Threats**- Environmental Risks:**

Vulnerability to natural hazards and climate change impacts, which can affect hydropower generation.

- Economic Constraints:

Limited financial resources and reliance on external funding for energy projects.

Turkmenistan**Strengths****- Abundant Resource Potential:**

Substantial potential for renewable energy resources, including solar and wind, is ranked second in the CA region.

- Raw Materials:

The country has reserves of critical raw materials like lithium, iron, and copper, which are essential for renewable energy technologies.

Weaknesses**- Data Transparency:**

Lack of consistent and timely data on economic indicators and market trends.

- Regulatory Framework: Underdeveloped regulatory framework for renewable energy, which can hinder investment.

Opportunities

- Resource Development: Potential to develop and utilize abundant renewable resources and critical raw materials for energy transition.

- International Cooperation: Opportunities for international partnerships and investment in renewable energy projects.

Threats**- Limited Cooperation:**

Limited international and regional exposure to renewables can limit access to technology and financing for renewable energy projects.

- Infrastructure Requirements:

Infrastructure modification requirements can hinder the development and integration of renewable energy projects.

Uzbekistan

Strengths

- **High Resource Potential:**

Good wind resources are available throughout Uzbekistan, making large-scale wind power development possible. In fact, it is theoretically possible to generate 1,078 TWh of electricity annually based solely on wind power. Uzbekistan has significant solar resources with peak solar activity occurring from the beginning of May to the end of September. Overall, there are about 320 sunny days in a year with average annual global horizontal irradiation ranging from 1,461 to 1,826 kWh/sqm.

- **Government Support:**

Strong government support for renewable energy development, with ambitious targets and policies in place.

Weaknesses

Aging Infrastructure:

The existing power infrastructure (especially transmission) is aging, which can pose challenges for integrating new renewable energy projects.

- **Data Accessibility:**

Challenges in accessing reliable and comprehensive data on renewable energy resources and market trends.

- **Energy Dependency:**

High dependency on natural gas and coal for energy production, which can affect the transition to renewables.

Opportunities

- **Market Growth:**

Potential for rapid growth in the renewable energy sector, driven by government initiatives, international partnerships, and availability of resources.

- **Policy Reforms:**

Ongoing policy reforms to improve the investment climate and support renewable energy development.

Threats

- **Regulatory Risks:**

Regulatory and bureaucratic hurdles can delay project implementation and affect investor confidence.

- **Market Competition:**

Competition from traditional fossil fuel industries and other countries with more established renewable energy sectors.

All countries in Central Asia face common challenges such as data accessibility, regulatory hurdles, and infrastructure deficiencies.

6. Grid Infrastructure

Kazakhstan

Strengths

- **Robust Infrastructure:** Kazakhstan has a relatively well-developed electricity grid and energy infrastructure. The Kazakhstan Electricity Grid Operating Company (KEGOC) oversees a robust transmission network.
- **Recent Upgrades:** Ongoing projects, such as the \$123 million financing deal with the Asian Development Bank, are aimed at expanding the high-voltage transmission network and integrating large-scale renewable power generation.

Weaknesses

- **Aging Infrastructure:** Despite recent upgrades, parts of the grid infrastructure are aging and may require further modernization.
- **Transmission Losses:** Existing infrastructure still faces issues with transmission losses, which need to be addressed to improve efficiency.
- **Off-grid Emergencies:** In case of emergency, KEGOC will not be able to assist in providing energy to the community that is not connected to the grid and works autonomously

Opportunities

- **Grid Expansion:** There are plans for further grid upgrades and expansions, including the construction of new transmission lines and substations, which will enhance the capacity to integrate renewable energy.
- **Energy Storage:** Potential for developing energy storage solutions to support the integration of intermittent renewable energy sources.
- Off-grid and on-grid energy communities development

Threats

- **Economic Volatility:** Economic fluctuations could impact the funding and implementation of grid modernization projects.
- **Regulatory Challenges:** Potential regulatory hurdles in coordinating grid expansion and renewable energy integration.
- **Unexpected Scenarios:** In case of emergency in remote areas, energy communities will face energy shortage, while the RE facility will see financial loss.

Tajikistan

Strengths

– **Hydropower Resources:**

Tajikistan's grid benefits significantly from its abundant hydropower resources, which not only provide a stable and renewable source of energy but also support the country's energy independence goals.

– **Recent Upgrades:**

Projects like the EBRD-funded upgrade of the Sugd-500 substation to integrate up to 700 MW of intermittent renewables.

Weaknesses

– **Aging Infrastructure:**

Significant portions of the grid infrastructure are outdated and require modernization.

– **Data Gaps:**

Limited availability of reliable data on grid performance and renewable energy integration

Opportunities

– **Grid Expansion:**

There are ongoing plans to further expand and modernize the grid. This includes enhancing the grid's technical capabilities to handle increased renewable energy generation and to facilitate regional energy trading, especially with the reconnection to the Central Asian Unified Power Grid.

– **International Funding:**

Access to international funding and technical assistance for grid modernization projects

Threats

– **Environmental Risks:**

Vulnerability to natural hazards and climate change impacts, which can affect hydropower generation and grid stability.

– **Economic Constraints:**

Limited financial resources and reliance on external funding for grid projects.

Turkmenistan

Strengths

– **Resource Potential:**

Significant potential for renewable energy resources, including solar and wind.

– **Government Acknowledgment:**

The government recognizes the potential for both oil/gas and renewable energy sectors.

– **Infrastructure Upgrade:**

Extended government commitment and financial investments in countrywide power plant construction and modernization.

Recently launched large-scale projects to strengthen the national power grid will also largely enhance the reliability of the network and renewables integration.

Opportunities**- Data Transparency:**

Lack of comprehensive and accessible data on grid infrastructure and renewable energy resources.

- Grid Requirements:

Despite upgraded grid infrastructure, substantial work is to be done for preparing renewables integration given the underdeveloped RE sector.

Threats**- Grid Modernization:**

Potential to develop and modernize the grid to support renewable energy integration. Recently launched strengthened national power grid will enhance energy reliability and cut transmission losses, facilitating the opportunity for smoother integration of renewable energy.

- Recent Projects:

The technological justification developed by local R&D for connecting a renewable energy station to the 110 kV network opens the way to involve more multilateral cooperation in this area.

- International Cooperation: Opportunities for international partnerships and investment in grid infrastructure projects.

Threats**- Limited Cooperation:**

Limited international and regional exposure to renewables can limit access to technology and financing for grid modernization.

- Regulatory Challenges:

Underdeveloped regulations framework can hinder the development and integration of renewable energy projects.

- Inadequate Financing:

Traditional energy may deter due financings for goals pledged for MEAs and national programs including for renewables and related infrastructure development.

Uzbekistan**Strengths****- Robust Infrastructure:**

Uzbekistan has a relatively well-developed electricity grid and energy infrastructure. The distribution system is owned and operated by JSC Regional Electric Grid of Uzbekistan (REGU). As of 2022, the distribution infrastructure comprises 652 transformer substations (110 kV), 977 transformer substations with 35 kV current, and around 82,500 6-10 kV substations. Distribution lines include 14,250 km of 110 kV lines, 13,800 km of 35 kV lines, 96,000 km of 6-10 kV lines, and 128,200 km of 0.4 kV.

- Recent Investments:

Significant investments in green energy projects and grid infrastructure upgrades.

Opportunities

- **Aging Infrastructure:**

Despite recent upgrades, parts of the grid infrastructure are aging and may require further modernization. Needs to improve power transmission network capacity and reduce transmission losses.

According to REGU, about 55% of the distribution infrastructure has been in operation for more than 30 years, exceeding its useful life. In particular, 43,000 transformer substations (52% of the total) and 130,000 km of 0.4-10 kV lines (58% of the total) should be upgraded.

- **Operational Life Exceeded:**

More than 80% of LV lines have been in operation for over 30 years with approximately 30-40% of distribution substation transformers requiring replacement. Hence, there are serious technical issues such as high system losses, overloads, voltage drops, and blackouts in winter and summer peak times.

- **Energy Dependency:**

High dependency on natural gas and coal for energy production, which can affect the transition to renewables.

- **Transmission Losses:**

High levels of electricity losses due to outdated infrastructure.

Threats

- **Grid Modernization:**

Ambitious plans to upgrade power lines and substations, including the implementation of a Supervisory Control and Data Acquisition (SCADA) system for enhanced monitoring and control. NEGU is investing in the introduction of SCADA, Energy Management System, and Enterprise Resource Planning (ERP) systems.

By 2025, the company intends to finish implementing SCADA at a cost of around \$90 million and ERP systems at a cost of about \$30 million. In 2022, NEGU signed an agreement for the company's digital transformation with an overall cost of \$109.4 million.

- **Renewable Energy Potential:**

Potential for rapid growth in the renewable energy sector, driven by government initiatives and international partnerships

Threats

- **Regulatory Challenges:**

Potential regulatory hurdles in coordinating grid expansion and renewable energy integration.

- **Unexpected Scenarios:**

In case of emergency in remote areas, energy communities will face energy shortage, while the RE facility will see financial loss.

Countries in Central Asia have significant potential for renewable energy development but face common challenges such as aging infrastructure, data transparency, and regulatory hurdles.

7. Market Access

Kazakhstan

Strengths

– **Ease of Establishment:** Foreign companies can establish a presence and operate relatively easily in Kazakhstan. The law treats branches of foreign companies as residents, facilitating smoother operations.

– **Investment Tax Residency Program:**

Foreigners may register as a legal entity at The Astana International Finance Centre, this will allow tax residents under simplified conditions.

– **Energy Auctions:** Kazakhstan has successfully implemented renewable energy auctions, creating competitive conditions and attracting international investors. Ministry of Energy has approved a 5-year schedule for auctions to be held with a total capacity of 6.8 GW.

– **Digitalization:**

Significant strides in digitalizing the energy industry, including digital monitoring of licensing and contract conditions, which increases transparency and efficiency.

Weaknesses

– **Local Content Requirements:**

Local content policies can be a barrier for international investors, potentially limiting financing from major international institutions.

– **Complex Bureaucracy:**

Despite digitalization efforts, navigating local regulations and bureaucratic processes can still be challenging.

Opportunities

– **Further Digitalization:** Continued efforts to digitalize processes can enhance transparency and efficiency, making it easier for foreign investors to participate in the market.

– **Strategic Positioning:**

Opportunities to develop local renewable energy supply chains, which can attract more FDI and create sustainable jobs.

Threats

– **Economic Volatility:**

Economic fluctuations could impact investor confidence and the stability of the investment climate.

– **Regulatory Changes:**

Potential changes in local content policies and other regulations could affect the attractiveness of the market for foreign investors.

Kyrgyzstan

Strengths

- **Regulatory Framework:**

The government has developed regulations to support renewable energy generation and supply, providing incentives for investors.

- **Ease of Entry:**

The Kyrgyz Republic does not mandate local stakeholder equity positions or local partnerships, which simplifies market entry for foreign investors. The Law of the Kyrgyz Republic on Investments does not distinguish between local and foreign investors.

- **Access to Markets:**

The CASA-1000 project opens access to the markets of South Asia.

Weaknesses

- **Market Size:**

The market for renewable energy is relatively small, which may limit opportunities for large-scale investments.

- **Seasonal Swings:**

While RE generation peaks in the summer, there is a shortage of electricity in the winter.

- **Digitalization:**

The tendering process is not fully digitized, which can slow down project approvals and increase bureaucratic hurdles.

Opportunities

- **Diversification Potential:**

Significant potential to diversify into other renewable energy sources such as solar, wind, and biogas.

- **International Support:**

Opportunities for international funding and technical assistance to support renewable energy projects and market access.

Threats

- **Regulatory Risks:**

Inconsistent regulatory environment can pose challenges for foreign investors.

- **Climate Impact:**

Variability in hydropower generation due to changing water inflows can affect market stability.

Tajikistan

Strengths

– **Open Market:**

Tajikistan does not restrict foreign investment and does not mandate local stakeholder equity positions or local partnerships, making it easier for foreign companies to enter the market.

– **Government Commitment:**

The government has set ambitious renewable energy targets and policies to encourage clean energy adoption.

Weaknesses

– **Bureaucratic Hurdles:**

Local licensing and permitting processes can be complex and time-consuming, potentially delaying project development.

– **Data Gaps:**

Limited availability of reliable data on market trends and resource potential.

– **Dependency on International Financial Aid and Sources:**

This dependence could affect the stability and attractiveness of investment if external economic conditions shift.

Opportunities

– **Renewable Energy Potential:**

Tajikistan has substantial undeveloped potential in hydropower and is actively exploring the expansion into other renewables such as solar and wind. Recent support from international projects like CASA-1000 highlights ongoing efforts to enhance regional energy connectivity and market access, which could facilitate greater energy export opportunities.

– **Policy Support:**

Supportive policies and international cooperation can enhance renewable energy development and market access.

Threats

– **Economic Constraints:**

Limited financial resources and reliance on external funding for energy projects.

– **Regulatory Changes:**

Potential changes in local regulations and policies could impact market access and investment attractiveness.

Turkmenistan

Strengths

– **Resource Potential:**

Significant potential for renewable energy resources, including solar and wind.

– **Government Acknowledgment:**

The government recognizes the potential for both oil/gas and renewable energy sectors.

– **Open Market:**

Turkmenistan welcomes foreign investment and does not mandate local partnerships.

Weaknesses

- **Data Transparency:**

Lack of comprehensive and accessible data on market trends and resource potential.

- **Underdeveloped Market:**

The market for renewable energy is underdeveloped compared to other countries in the region.

- **Complex Bureaucracy:** Despite some digitized processes efforts, navigating local regulations and bureaucratic processes can be challenging.

Opportunities

- **Resource Development:**

Potential to develop and utilize abundant renewable resources and critical raw materials for energy transition.

- **International Cooperation:**

Opportunities for international partnerships and investment in renewable energy projects.

Threats

- **Limited Cooperation:**

Limited international and regional exposure to renewables can limit access to technology and financing for renewable energy projects.

- **Regulatory Barriers:**

Potential regulatory barriers and lack of transparency can deter foreign investors.

Uzbekistan

Strengths

Competitive tenders/auctions:

Since 2019, with assistance from international financial institutions (IFIs) such as IFC, ADB, and EBRD, the Government has implemented competitive tenders/auctions to attract foreign direct investment for the development of large-scale solar PV and wind projects. Ten large-scale solar projects totaling 2,050 MW have been put out to tender, mostly in the southern and south-western regions of the country where the Global Horizontal Irradiation is higher than the national average.

- **Ease of Establishment:** Foreign companies can establish a presence and operate relatively easily in Uzbekistan. According to the Doing Business report, Uzbekistan is in the top 10 countries with ease of registering business.

- **Tax incentives:** Wide range of incentives are available for RE developers through direct negotiations with the Government.

Weaknesses**- Regulatory Challenges:**

Regulatory and bureaucratic hurdles can delay project implementation and affect investor confidence.

- Local Content Requirements:

Potential requirements for local partnerships and content can complicate market entry for foreign investors.

Opportunities**- Market Growth:**

Potential for rapid growth in the renewable energy sector, driven by government initiatives and international partnerships.

Uzbekistan has the biggest population in the Central Asia region. With 37 million inhabitants, the country represents almost half of the region's population. It is estimated that by 2030, Uzbekistan will be home to more than 40 million residents. Therefore, an expanding population will be a source of consumption and economic growth and simultaneously require more job opportunities and infrastructure services.

- Policy Reforms:

Ongoing policy reforms to improve the investment climate and support renewable energy development.

- Further Digitalization: Continued efforts to digitalize processes can enhance transparency and efficiency, making it easier for foreign investors to participate in the market.

Threats**- Economic Volatility:**

Economic fluctuations could impact investor confidence and the stability of the investment climate.

- Regulatory Risks:

Potential changes in local regulations and policies could impact market access and investment attractiveness.

8. Investment Protection

Kazakhstan

Strengths

– Strong Legal Framework:

Kazakhstan has a robust legal framework protecting foreign investments, including the Law on Investments, which guarantees the protection of investor rights and interests.

– International Arbitration:

Kazakhstan is a member of the International Centre for Settlement of Investment Disputes (ICSID) and recognizes international arbitration for dispute resolution.

– Capital Movement:

The legal system allows for the free movement of capital, including the transfer of profits and dividends.

– Intellectual Property Rights:

Kazakhstan has a well-established system for protecting intellectual property, including membership in the World Intellectual Property Organization (WIPO) and adherence to international IP treaties.

– Investment Shield:

Special project on investor protection by the Prosecutor's office.

Weaknesses

– Regulatory Complexity:

Despite strong legal frameworks, navigating the regulatory environment can be complex and time-consuming for foreign investors.

– Inconsistent Enforcement:

There can be inconsistencies in the enforcement of laws and regulations, which may affect investor confidence.

Opportunities

– Legal Reforms:

Continued legal reforms and improvements in the investment climate can further enhance investor protection.

– Technology Transfer:

Opportunities to develop mechanisms for technology transfer while safeguarding intellectual property.

Threats

– Economic Volatility:

Economic fluctuations could impact the stability of the investment climate.

– Regulatory Changes:

Potential changes in regulations could affect the predictability and stability of the legal environment for investors.

Kyrgyzstan

Strengths

- **Open Market:**

Kyrgyzstan does not mandate local stakeholder equity positions or local partnerships, making it easier for foreign companies to enter the market.

- **International Arbitration:**

The country recognizes international arbitration for dispute resolution, providing a reliable mechanism for resolving investment disputes.

- **Investment Zones:**

The Kyrgyz Republic may establish a Special Investment Regime that provides for state guarantees for the implementation of projects in a certain territory of the country in priority sectors of the economy (currently the Batken province). Certain financial obligations of the state may be provided for investors within the framework of guarantees for investment projects

- **Remittance Exemption:**

If the legislation of the Kyrgyz Republic that restricts remittances in foreign currency to the Kyrgyz Republic and abroad is introduced, it will not apply to foreign investors.

Weaknesses

- **Legal System:**

The legal system may lack the robustness and transparency needed to fully protect foreign investments.

- **Intellectual Property:**

Limited development in the protection of intellectual property rights can be a concern for foreign investors.

Opportunities

- **Legal Improvements:**

Potential for legal reforms to strengthen investment protection and improve the overall business environment.

- **International Cooperation:**

Opportunities for international cooperation to enhance the legal framework and investment protection mechanisms.

Threats

- **Political Instability:**

Periodic political instability can undermine the legal environment and investor confidence.

- **Regulatory Risks:**

Inconsistent regulatory environment can pose challenges for foreign investors.

Tajikistan

Strengths

- **Government Commitment:**

The government has shown a commitment to improving the investment climate and protecting foreign investments.

- **Arbitration Mechanisms:**

Tajikistan recognizes international arbitration for dispute resolution, providing a reliable mechanism for resolving investment disputes.

Weaknesses

- **Legal Framework:**

The legal framework for investment protection may not be as robust or transparent as in other countries.

- **Intellectual Property:**

Limited development in the protection of intellectual property rights can be a concern for foreign investors.

Opportunities

- **Legal Reforms:**

Potential for legal reforms to strengthen investment protection and improve the overall business environment.

- **International Support:**

There are opportunities for international support and cooperation to improve the legal framework and investment protection mechanisms. Partnerships with global financial institutions and foreign governments can provide both expertise and funding to develop more comprehensive legal protections.

Threats

- **Economic Constraints:**

Limited financial resources and reliance on external funding can affect the stability of the investment climate.

- **Regulatory Changes:**

Potential changes in regulations could affect the predictability and stability of the legal environment for investors.

Turkmenistan

Strengths

– **Resource Potential:**

Significant potential for renewable energy resources, including solar and wind, which can attract foreign investments.

– **Government Acknowledgment:**

The government recognizes the potential for both oil/gas and renewable energy sectors.

– **Legal framework:**

Developing of robust legal framework for investment and investment protection

– **International Arbitration (IA):**

Turkmenistan is a party to the Convention on the Settlement of Investment Disputes (ICSID) and the Recognition and Enforcement of Foreign Arbitral Awards (New York Convention)

– **Intellectual Property Rights:**

The government adopted laws designed to protect intellectual property rights domestically and is a member of international conventions and treaties in the area of Intellectual property that serves as a guarantee for foreign investors.

Weaknesses

– **Legal Framework:**

Despite developing a legal structure, limited information on detailed guides is needed to fully protect foreign investments.

– **International and Domestic Laws:**

Despite membership in IA, there might be a discrepancy in the level of development and modernity between the domestic and foreign arbitration laws.

– **Data Transparency:**

Lack of comprehensive and accessible data on market trends and resource potential.

Opportunities

– **Legal Development:**

Potential to develop and strengthen the legal framework for investment protection.

– **Technology Transfer:**

Opportunities to develop mechanisms for technology transfer while preserving intellectual property.

– **International Cooperation:**

Opportunities for international partnerships and investment in renewable energy projects.

Threats

– **Limited Cooperation:**

Limited international and regional exposure to renewables can limit access to technology and financing for renewable energy projects.

– **Regulatory Barriers:**

Potential regulatory barriers and lack of transparency can deter foreign investors.

Uzbekistan

Strengths

– **Strong Legal Framework:**

Uzbekistan Investment Law provides guarantees to private investors.

These guarantees are aimed at increasing the attractiveness of investments in Uzbekistan by reducing the risks associated with FDI in the RE sector:

- **Free use of funds.**

Under the Investment Law, investors can, subject to the payment of taxes and fees, reinvest or use in any other manner, at their own discretion, the proceeds derived from investment activities in Uzbekistan;

- **Free transfer and currency convertibility.** Investors are guaranteed a free transfer of funds in foreign currency to and from Uzbekistan without any restrictions provided that any due taxes and charges are paid promptly. They are also guaranteed a right to free currency conversion for this purpose.

- **Right to cease investment activity.** Foreign investors are statutorily guaranteed the right to terminate their investment activity in Uzbekistan. Upon such termination, a foreign investor is entitled to free repatriation, in cash or kind, of its assets derived from the termination of the investment activity, without prejudice to the foreign investor's obligations assumed with respect to the Republic of Uzbekistan or other creditors.

- **Protection against change in law.**

The Investment Law establishes norms for investors to defend against new changes in legislation.

- **Expropriation.**

As a general rule, foreign investments and foreign investors' assets located in Uzbekistan are not subject to nationalization. However, in a limited number of cases such as during natural disasters, accidents, and epidemics, nationalization (requisition) of property is permitted, provided adequate compensation is made by the government.

- **International Arbitration:**

Uzbekistan is a member of the International Centre for Settlement of Investment Disputes (ICSID) and recognizes international arbitration for dispute resolution.

- **Intellectual Property Rights:**

Uzbekistan has an established system for protecting intellectual property, including membership in the WIPO and adherence to international intellectual property treaties.

Weaknesses

- **Regulatory Complexity:**

Despite strong legal frameworks, navigating the regulatory environment can be complex and time-consuming for foreign investors.

- **Inconsistent Enforcement:**

There can be inconsistencies in the enforcement of laws and regulations, which may affect investor confidence.

- **Regulatory Challenges:**

Regulatory and bureaucratic hurdles can delay project implementation and affect investor confidence.

Opportunities**- Legal Reforms:**

Continued legal reforms and improvements in the investment climate can further enhance investor protection.

- New Law „On Investments“:

Will be adopted by the end of 2024. This document has been developed in accordance with the regulations and standards of the World Trade Organization in cooperation with IFC and OECD.

The International Commercial Court:

Will be established under the Center for the Development of Digital Technologies.

- Technology Transfer:

Opportunities to develop mechanisms for technology transfer while safeguarding intellectual property.

Threats**- Economic Volatility:**

Economic fluctuations could impact the stability of the investment climate.

- Regulatory Changes:

Potential changes in regulations could affect the predictability and stability of the legal environment for investors.

While all Central Asian countries have made strides to improve investment protection, they face common challenges such as regulatory complexity, inconsistent enforcement, and the need for further legal reforms.

9. Financial Environment**Kazakhstan****Strengths**

- Relatively well-developed financial sector compared to other Central Asian countries.
- Strong government support for renewable energy development.

Access to Multiple Funds:

EBRD, UNDP, and USAID develop programs and projects for small and large-scale RE and provide loans to national companies. This improves investors' confidence in terms of validation of the project, specifically with the involvement of multiple financial institutions.

Weaknesses

- Heavy reliance on fossil fuel exports, which may affect financial priorities.
- Limited experience in large-scale renewable energy project financing.
- Conflicts of interest may arise in cases where multiple international institutions seek participation in the same project.

Opportunities

- Potential for green bonds and other innovative financing mechanisms.
- Growing interest from international investors in Kazakhstan's renewable energy sector.
- Cooperation with international organizations on joint projects or programs, in particular, vetting and validation of the projects

Threats

- Economic volatility due to dependence on oil prices.
- Potential political risks affecting investor confidence.

Terms:

Ambiguities as regards project terms, for example, interest rates in case multiple financial institutions participate.

Kyrgyzstan

Strengths

- Growing interest in renewable energy development.
- International support for energy sector reforms.
- Existence of IFI (World Bank, ADB, EBRD) in the country, which can provide guarantees.
- Bilateral funds (Kyrgyz-Russian Fund, Kyrgyz-Uzbek Fund, Kyrgyz-Hungarian Fund, Kyrgyz-Kuwait Fund) provide loans to the investors, including for RE projects.

Weaknesses

- Limited domestic financial resources.
- Underdeveloped financial sector with little experience in renewable energy financing.
- Lack of auctions, state guarantees within the framework of the PPA, regulated tariff benefits, and tender procedures for the development of renewable energy infrastructure.

Opportunities

- Potential for microfinance and community-based renewable energy projects.
- Access to international climate finance mechanisms.
- Growing interest from major players (Masdar, ACWA Power, etc.).

Threats

- Political instability affecting the investment climate.
- Economic challenges that may limit government support for renewable energy.

Tajikistan

Strengths

- Strong government commitment to renewable energy development, with a target of 700MW of solar and wind energy generating stations by 2030.
- Significant potential for renewable energy, especially solar and hydropower.
- International support and financing available from organizations like the World Bank, USAID, and ADB.

Weaknesses

- Limited domestic financial resources and reliance on external funding for energy projects.
- Underdeveloped financial sector with limited experience in renewable energy project financing.
- High poverty rates and low GDP per capita, which may affect the overall financial environment.
- While exports have fueled economic growth, this dependency can pose risks if global demand fluctuates, impacting the financial stability needed to support renewable investments.

Opportunities

- Increasing interest from international investors and developers, such as Masdar and MW Energy.
- Potential for public-private partnerships in renewable energy projects.
- Access to international financing and technical assistance for renewable energy projects

Threats

- Economic volatility and dependency on remittances.
- Political and regulatory risks that could affect investor confidence.
- Climate change impacts and natural disasters that could affect project viability and returns.
- The reliance on a few economic sectors for growth and potential macroeconomic instabilities, such as inflation or external shocks, could adversely affect investment in renewable energy by increasing the risks associated with such investments.

Turkmenistan

Strengths

- Significant natural gas resources that could potentially support renewable energy transition.
- Strong central government control that could facilitate large-scale projects if prioritized.
- Fitch Ratings Agency positive outlook with a B+ rating.
- Opportunity to attract more financing from international development or financial institutions (e.g. WB's ECARES, Abu Dhabi Development Fund), focused on clean energy in Central Asia.
- Solid income from natural gas exports gives the government ample reserves to cushion any economic shocks or to invest in its economic growth.

Weaknesses

- Centralized economy with limited private sector involvement.
- Limited experience in renewable energy project financing.
- The State Bank of Foreign Economic Affairs (TFEB) conducts almost all financial services for international companies and may be at risk of being overloaded if the number of foreign businesses increases.

Opportunities

- Potential for sovereign wealth fund investments in renewable energy.
- ADB's studies suggest the opportunity to deploy combined cycle systems (gas and solar) given the large-scale gas plants and high solar radiation offer the potential to produce electricity at an incredibly low cost (5 to 6 cents per KWh).¹¹
- Growing international interest in Central Asian energy markets.
- Strategic agreement with Masdar for exploring renewable energy opportunities and PPP scheme for RE projects.
- Prospective projects of combined solar and gas power plants, installations of small-scale off-grid plants planned by SC TurkmenEnergy, pilot projects of the state R&D center, as well as CJSC "Turkmen Invest" and Ashgabat Stock Exchange, have the potential to open up renewables sector and hence more funding inflows and mechanisms

Threats

- Limited international exposure affecting access to global financial markets.
- Heavy reliance on fossil fuel exports, potentially limiting renewable energy investments.

Uzbekistan

Strengths

Access to Multiple Funds:

EBRD, ADB, WB, and UNDP develop programs and projects for large-scale RE and provide loans. This improves investors' confidence in terms of validation of the project, specifically with the involvement of multiple financial institutions.

Financial support within PPP law:

PPP law provides the following types of financial support to a private investor:

- **Subsidies**, including those aimed at ensuring a guaranteed minimum income to the private investor from project implementation;
- **Contributions in the form of assets and property** required for project implementation;
- **Funds from the budgets of the budgetary system** allocated to pay for the consumption or use of a certain amount or part of goods (works, services) produced or supplied;
- **Provision of budget loans, loans, grants, credit lines**, and other types of financing; and
- **State guarantees, tax and other benefits**, and other guarantees or compensation.

¹¹ <https://daryo.uz/en/2023/07/31/turkmenistan-eyes-investment-to-harness-export-potential-of-alternative-energy>

Weaknesses

- Heavy reliance on fossil fuel exports, which may affect financial priorities.
- Limited experience in large-scale renewable energy project financing.
- Historically centralized economy transitioning to a more market-based system.

Opportunities

- Increasing interest from international investors and financial institutions.
- Potential for innovative financing mechanisms as part of broader economic reforms.
- Potential for green bonds and other innovative financing mechanisms.

International market:

In 2023, Uzbekistan issued two tranches of Eurobonds worth \$660 million and, **for the first time**, “green” Eurobonds worth 4.25 trillion UZS with maturities in 2028 and 2026, respectively.

Domestic market:

The National Agency for Perspective Projects has registered the first official issuance of green bonds in Uzbekistan by the Mortgage Refinancing Company.

This issuance, totaling UZS 50bn (nearly \$4mn), marks a significant step forward in the country's push toward sustainable finance following recent amendments to the rules of securities issuance and registration made in June 2024.

- Growing interest from international investors in Uzbekistan's renewable energy sector.
- Cooperation with international organizations on joint projects or programs, in particular vetting and validation of the projects.

Threats

- Regulatory risks as the country undergoes economic transition.
- Regional geopolitical tensions affecting investor confidence.

All Central Asian countries show potential for renewable energy development, but they face common challenges, such as limited domestic financial resources, reliance on external funding, and the need for further development of their financial sectors to support renewable energy projects.

10. In-country Skilled Workforce

Kazakhstan

Strengths

- **Technical Expertise:** Kazakhstan has a relatively well-developed technical workforce with expertise in various energy sectors, including renewables.
- **Educational Initiatives:** The country has several universities and technical institutes offering programs in renewable energy technologies. (e.g., USAID PCA has developed a Master's program on Strategic Management of RE and energy efficiency at DKU).
- **Government Support:** The government invests in local skills development and industry capacity to maximize workforce participation and technology transfer.

Weaknesses

- **Skills Gap:** Despite educational initiatives, there may still be a gap in specialized skills required for advanced renewable energy technologies.
- **Limited Experience:** The workforce has more experience in traditional energy sectors like oil and gas compared to renewables.

Opportunities

- **Training Programs:** Opportunities to expand domestic training programs and initiatives to address skills gaps in the renewable energy workforce.
- **International Collaboration:** Potential for partnerships with international institutions to bring in expertise and enhance local training programs.

Threats

- **Brain Drain:** Skilled workers may seek opportunities abroad, leading to a shortage of qualified personnel.
- **Economic Volatility:** Economic fluctuations could impact funding for training and educational programs.

Kyrgyzstan

Strengths

– **Education Heritage:**

The scientific schools and the system of training personnel in the field of renewable energy have been preserved since the post-soviet period and are developing. Research is being carried out with funding from the Ministry of Education and Science (mainly on the equipment of mini and small hydropower plants, distributed solar generation, and biogas).

– **Growing Interest:**

Increasing interest in renewable energy development is driving demand for skilled workers in this sector.

– **International Support:**

Access to international funding and technical assistance for workforce development.

Weaknesses

– **Limited Skilled Workforce:**

A relatively small pool of skilled local workers with expertise in renewable energy technologies is caused by the drain of personnel due to their lack of demand.

– **Underdeveloped Training Programs:**

Limited domestic training programs specifically focused on renewable energy with practical learning on site.

Opportunities

– **Capacity Building:**

Potential to develop comprehensive training programs and initiatives to build a skilled workforce in renewable energy.

– **Government Initiatives:**

Government investment in local skills and knowledge to support renewable energy projects.

– **International Cooperation:**

Training, retraining, and advanced training of specialists in neighboring countries and other countries with the support of development partners (for example, in 2022, specialists from the Kyrgyz Republic attended training on renewable energy in Uzbekistan with the support of the World Bank).

Threats

– **Political Instability:**

Political instability could affect the implementation of training programs and workforce development initiatives.

– **Economic Constraints:**

Limited financial resources may hinder the development of comprehensive training programs.

Tajikistan

Strengths

– **Government Commitment:**

Strong government commitment to renewable energy development, which includes workforce development initiatives.

– **International Support:**

Significant international support and funding for renewable energy projects, which can include capacity-building components.

Significant investments, such as the \$15 million allocated by the World Bank to the Higher Education Project, are enhancing the relevance and quality of higher education in Tajikistan.

Weaknesses

– **Skills Gap:**

A significant gap in the availability of skilled workers with expertise in renewable energy technologies.

– **Educational System:**

Limited incorporation of renewable energy topics into the national educational curriculum.

Inadequate Skills:

Despite efforts to improve education, local firms often identify an inadequately skilled workforce as a significant constraint. There is a notable gap, especially in "new economy" skills like analytical skills, communication, and conflict resolution, which are crucial for the renewable energy sector.

Opportunities

– **Training Programs:**

Potential to develop and expand domestic training programs to address skills gaps in the renewable energy workforce.

– **International Partnerships:**

Opportunities for partnerships with international institutions to bring in expertise and enhance local training programs

Threats

– **Economic Volatility:**

Economic challenges could impact funding for training and educational programs.

– **Regulatory Risks:**

Inconsistent regulatory environment could affect the implementation of workforce development initiatives.

– **Emigration of Skilled Workers:**

The tendency of skilled workers to seek opportunities abroad could lead to a brain drain, depriving the local renewable energy sector of essential talent.

Turkmenistan

Strengths

– **Government Control:**

Strong central government control can facilitate the implementation of large-scale training and workforce development programs.

– **Resource Potential:**

Significant potential for renewable energy resources, which can drive demand for a skilled workforce.

– **Recent RES Integration in Higher Education:**

Compared to previous decades, Turkmenistan has started integrating new RES-related specialties, developed capacity-building opportunities at the R&D center of the state power energy university, and created a hydrogen center at the oil and gas university.

Weaknesses

– **Limited Skilled Workforce:**

A relatively small pool of skilled local workers with expertise in renewable energy technologies.

– **Insufficient Training Programs:**

Limited domestic training programs specifically focused on renewable energy.

– **Employment Guarantee:**

Need for more industrial facilities and employment security for applying gained skills in renewables by current students or those wishing to study RE.

– **Regulatory Barriers:**

Registration permits to work in the capital may deter potential key experts from working in central offices, usually located in Ashgabat.

Opportunities

– **Capacity Building:**

Potential to develop sufficient training programs to build a skilled workforce in renewable energy given the provided clean energy commitments.

– **Job Creation:**

By 2025, green jobs could increase to almost 1000 if current targets (aligned with MEAs) are adhered to and to 4000 if the ambitious scenario is implemented. By 2050 the scenarios lead to 2000 – 9000 jobs.¹²

– **International Collaboration:**

Opportunities for partnerships with international institutions to bring in expertise and enhance local training programs.

Threats

– **Limited Cooperation:**

Limited international and regional exposure to clean energy can limit access to technology and funding for workforce development.

– **Regulatory Barriers:**

Potential regulatory barriers and lack of transparency can deter international collaboration.

¹² OSCE. (2024, January 23). <https://www.osce.org/files/f/documents/f/f/561811.pdf>

Uzbekistan

Strengths

- **Technical Expertise:**

Uzbekistan has a relatively well developed technical workforce with expertise in various energy sectors, including renewables. Several VET schools are dedicated to preparing RE professionals (Shirin Energy College and others).

- **Technical Expertise:**

Nine universities and technical institutes offer programs in energy and renewable energy technologies in the country (e.g., Tashkent State Technical University, Namangan, Namangan Institute of Engineering and Technology).

- **Government Support:**

The government invests in local skills development and industry capacity to maximize workforce participation and technology transfer.

Weaknesses

- **Skills Gap:**

A significant gap in the availability of skilled workers with expertise in renewable energy technologies.

- **Educational System:**

Limited incorporation of renewable energy topics into the national educational curriculum.

Opportunities

- **Training Programs:**

Potential to develop and expand domestic training programs to address skills gaps in the renewable energy workforce.

- **International Partnerships:**

Opportunities for partnerships with international institutions to bring in expertise and enhance local training programs.

Threats

- **Regulatory Risks:** Regulatory and bureaucratic hurdles could affect the implementation of workforce development initiatives.

- **Market Competition:**

Competition from other countries with more established renewable energy sectors could attract skilled workers away from Uzbekistan.

While all Central Asian countries show the potential to develop a skilled workforce in renewable energy, they face common challenges such as skill gaps, limited domestic training programs, and economic constraints.

11. Project Developers and Engineering, Procurement, and Construction (EPC) Companies

Kazakhstan

Strengths

- Relatively well-developed renewable energy sector with operating facilities.
- Experience in implementing various types of renewable energy projects, including wind, solar, and biogas.

Weaknesses

- Financial barriers related to the lack of sufficient domestic and foreign investment capital.
- Potential skills gap in specialized renewable energy technologies.

Opportunities

- Growing investor interest in renewable energy construction projects.
- Potential for collaboration between domestic and foreign companies to navigate the market and regulatory landscape.

Threats

- Economic volatility that could impact project financing and development.
- Competition from traditional energy sources, particularly coal.

Kyrgyzstan

Strengths

- Growing interest in renewable energy development.

Weaknesses

- Limited experience with large-scale renewable energy projects.
- Potential lack of domestic EPC companies with renewable energy expertise.

Opportunities

- Potential for partnerships with foreign EPC companies to build local capacity.
- Opportunities for knowledge transfer and skill development.

Threats

- Economic constraints that may limit project development.
- Potential political instability affecting long-term project planning.

Kazakhstan

Strengths

- Growing interest in renewable energy development, particularly solar energy.
- Some international collaborations, such as the USAID-funded solar power plant in Murghab district.

Weaknesses

- Limited experience with large-scale renewable energy projects.
- Lack of clear and precise rules, presence of excessive bureaucracy.
- Lack of local experience and expertise in renewable energy projects.

Opportunities

- Potential for partnerships with international firms, such as the consortium of JURU Energy Limited (UK) and Rina Consulting (Italy) for project feasibility studies.
- Significant untapped potential for solar energy development.

Threats

- Monopoly on the energy market and low tariffs, which may discourage project developers.
- Outdated infrastructure that may hinder project development.

Turkmenistan

Strengths

- Strong government control that could facilitate large-scale project implementation if prioritized.

Weaknesses

- Limited experience with renewable energy projects.
- Potential lack of domestic EPC companies with renewable energy expertise.

Opportunities

- Potential for partnerships with foreign EPC companies to develop the local market.
- Opportunities for knowledge transfer and skill development.

Threats

- Limited international exposure that may limit foreign company participation.
- Heavy reliance on fossil fuels potentially limits renewable energy development.

Uzbekistan

Strengths

- Most of the EPC and O&M contractors for utility-scale renewable energy projects are active in Uzbekistan. Although there are limited technical and financial capabilities for end-to-end project construction, local entities have nonetheless started participating as subcontractors to the larger and well-established EPC players. While the current involvement of local entities has been on the civil and/or balance of plant subcontracts, greater involvement of such entities is expected due to increased competition in the RE sector as well as the government's push to maximize the involvement of local manpower, at least for negotiated projects.
- Developing renewable energy sector with operating facilities.

Weaknesses

- Limited experience with large-scale renewable energy projects.
- Potential skills gap in specialized renewable energy technologies.
- Potential lack of domestic EPC companies with specialized renewable energy expertise.

Opportunities

- Increasing interest from international investors and EPC companies such as JURU Energy Limited (UK) and others.
- Potential for partnerships between domestic and foreign companies to navigate the market and regulatory landscape.

Threats

- Economic volatility that could impact project financing and development.
- Competition from traditional energy sources, particularly coal.

The maturities of project developers and EPC companies vary across Central Asia. Most countries face challenges related to their limited experience with large-scale renewable energy projects and a potential lack of domestic expertise. However, there are significant opportunities for partnerships between domestic and foreign companies, which could help build local capacities and navigate complex regulatory landscapes. The success of these partnerships and the overall maturity of the sector depend on addressing challenges such as regulatory barriers, economic constraints, and competition from traditional energy sources.

12. Public-Private Partnerships (PPPs)

Kazakhstan

Strengths

- Established frameworks for renewable energy development, including auctions that have helped bring down tariffs for renewable energy sources (RES).
- Track record of meeting renewable energy targets, such as achieving 3% of electricity production from renewables by 2020.
- Presence of rules providing priority dispatching and guaranteed offtake of all RES electricity production at guaranteed prices.

Weaknesses

- Low energy prices due to regulation and administrative means, making it difficult for renewables to compete with conventional power producers.
- Lack of flexible generating capacity to balance intermittent renewables.
- Tariffs for conventional power producers do not fully account for maintenance, replacement costs, and environmental externalities.

Opportunities

- Ambitious government commitments to increase the role of renewables in electricity supply.
- Potential for developing more gas-fired and/or hydroelectric plants to provide flexibility in the power system.
- Opportunity to revise tariff structures to level the playing field for RES and developers of flexible capacity.

Threats

- Dependence on large reserves of inexpensive coal, making it challenging for renewables to compete.
- Potential resistance from traditional fossil fuel industries.
- Economic volatility that could impact investment in renewable energy projects

Kyrgyzstan

Strengths

- Growing interest in renewable energy development.
- Existence of an authorized agency in the field of PPP.
- Legislation and clear rules for PPP projects.
- The PPP Centre offers investors a list of projects in the field of RE, mainly hydroelectric power plants.

Weaknesses

- Limited experience with PPPs in the renewable energy sector.
- The procurement regime for renewable energy projects is not clearly defined between the RE Regulation and PPP frameworks.

Opportunities

- Potential for developing PPP frameworks specifically for renewable energy projects.
- Opportunities for knowledge transfer and capacity building through international partnerships.

Threats

- Economic constraints that may limit the government's ability to provide incentives or share risks in PPPs.
- Potential political instability affecting long-term project planning and investor confidence.
- **Inconsistencies Between Statutes:**
 1. PPP projects with an investment volume exceeding KGS 1 billion, are awarded through direct negotiations while the Regulation on Renewable Energy requires conducting tender procedures;
 2. The PPP Law does not require the development of a feasibility study or pre-feasibility studies in all cases, giving the public partner the right to make decisions at its own discretion. The PPP Law does not require the development of a feasibility study or pre-feasibility study in all cases, giving the public partner the right to make decisions independently at its own discretion. In addition, the PPP Law allows private initiative in PPP projects, requiring that the private partner initiating the project, developed a preliminary feasibility study. It contradicts the requirements provided for by the Law on Renewable Energy Sources and the Regulation on Renewable Energy Sources, which requires the Ministry of Energy to develop the necessary studies.

Tajikistan

Strengths

- Government commitment to renewable energy development, with plans for 10% of energy production to come from wind and solar by 2040.
- Launch of public-private partnership programs for renewable energy projects.
- Significant potential for solar energy development.

Weaknesses

- Limited experience with large-scale renewable energy projects.
- Lack of clear and precise rules, presence of excessive bureaucracy.
- Aging electricity infrastructure that may hinder project development.
- There may be a shortage of local expertise in managing and scaling PPP projects, which can limit the effectiveness of these partnerships and the speed at which they can be executed.

Opportunities

- Growing interest from international investors and institutions, including the European Union and EBRD.
- Potential for partnerships between domestic and foreign companies to navigate the market and regulatory landscape.
- Access to international funding and technical assistance for renewable energy projects.

Threats

- Monopoly on the energy market and low tariffs, which may discourage private sector participation.
- Geopolitical competition that could influence investment decisions.
- Changes in government policies or political instability can affect the terms and viability of PPP agreements, posing a risk to both existing and future projects.
- Economic constraints and reliance on external funding can impact the government's ability to sustain investment in PPPs, potentially leading to delays or reductions in funding for critical infrastructure projects

Turkmenistan

Strengths

- Strong government control that could facilitate the implementation of PPP frameworks if prioritized.
- Increasing share of the non-state sector in GDP (excluding fuel and energy), reaching over 70%.
- The strategic importance of developing PPPs as a tool to increase private sector share in GDP.
- The legal framework and mechanism for PPPs are developing given the recently adopted state law on PPP and the emerging few projects in industry (transport, manufacturing, and water-related projects).

Weaknesses

- Despite developments in the regulatory framework, there is a low level of PPP-based companies.
- Limited experience with PPPs in the renewable energy sector.
- Potential lack of transparency in procurement processes.

Opportunities

- Existing small private business practice of solar panels installations.
- Potential for developing PPP frameworks to attract foreign investment in renewable energy, enabled by the state law on PPP, and the model agreement signed with Masdar with further studies for PPP work.
- Opportunity for more private projects emerging provided there is a policy for large-scale solar roof-top installations for new houses (the government has experienced a joint project with UNDP on sustainable cities focused on energy efficiency in buildings).
- Opportunity to leverage international support (e.g. UNECE) to establish a dedicated PPP Unit within the Ministry of Finance and Economy.

Threats

- Limited international exposure that may limit foreign company participation in PPPs.
- Lack of transparency that could deter potential private partners

Uzbekistan

Strengths

PPP Law:

The PPP Law came into force on June 12, 2019, to encourage the use of PPPs in Uzbekistan by officially permitting and regulating their use. The PPP Law standardized and simplified the procedure for long-term cooperation with the state to attract investment in Uzbekistan and, in particular, accelerate the implementation of RE projects.

The adoption of a PPP Law is a significant step in the promotion of PPP projects and attraction of foreign investors for major infrastructure projects.

The key stages of a PPP project in Uzbekistan are:

- **Initiation and preparation of a PPP project:** Generally, when a PPP project is conceptualized and initiated by a public partner (which is the usual case), it carries out a preliminary evaluation of the proposed PPP project to examine its feasibility.

- **Selection of the private partner:**

A private partner for the PPP project can be selected by either tender or through direct negotiations.

- **PPP agreement:**

A PPP agreement sets out the rights and obligations of both the public and private partners in relation to the implementation of the PPP project. The PPP agreement for renewable energy projects is usually executed in the form of a PPA.

- **Project execution.**

Weaknesses

- Limited experience with PPPs in the renewable energy sector.
- Lack of flexible generating capacity to balance intermittent renewables.
- Tariffs for conventional power producers do not fully account for maintenance, replacement costs, and environmental externalities.

Opportunities

- The country's increased RE capacity targets are quite ambitious and large in scale, which in turn necessitate equally large investments to realize these objectives.
- Potential for developing more gas-fired and/or hydroelectric plants to provide flexibility in the power system.
- Opportunity to revise tariff structures to level the playing field for RES and developers of flexible capacity. Energy tariff reform is among the government's highest priorities for ensuring the sector's reliable and financially sustainable operation and the active participation of foreign investors. The Government has also approved "Main Directions of the Tariff Policy in the Electric Power Industry of the Republic of Uzbekistan for the Period Up to 2030."

Threats

- Economic volatility that could impact investment in renewable energy projects.
- Competition from traditional energy sources that may affect the attractiveness of renewable energy PPPs.
- There are also associated needs for maintaining power system stability considering the integration of large-scale RE into the grid

The PPP environments in the renewable energy sector across Central Asia vary by country. Most countries face challenges related to their limited experience with PPPs in renewable energy, a potential lack of clear frameworks, and competition from traditional energy sources. However, there are significant opportunities to develop PPP frameworks, attract international investment, and build capacity through partnerships. The success of PPPs in promoting FDI in renewable energy depends on addressing challenges such as regulatory barriers, risk-sharing mechanisms, and creating transparent and competitive procurement processes.

13. Environmental and Social Factors, Stakeholder Engagement

Kazakhstan

Strengths

- Relatively well-developed renewable energy sector with operating facilities.
- Experience in implementing various types of renewable energy projects.

Weaknesses

- Potential resistance from traditional fossil fuel industries.
- Possible lack of strong standards to mitigate negative impacts of large-scale renewable projects.

Opportunities

- Potential to leverage experience in renewable energy to improve stakeholder engagement processes.
- Opportunity to develop more comprehensive environmental impact assessment processes.

Threats

- Environmental challenges related to the country's vast and varied geography.
- Potential social resistance in regions heavily dependent on fossil fuel industries.
- Lack of waste management and requirements on recycling (e.g., solar panels or wind turbines after the end of the project cycle [25–30 years for example]) may bring significant harm to the environment if by then there will be no amendments to policy on how to recycle or handle RE technology,

Kyrgyzstan

Strengths

- Growing interest in renewable energy development.
- Potential for strong community engagement due to the country's smaller size and population.
- Legally approved EIA procedures.

Weaknesses

- Limited experience with large-scale renewable energy projects and associated environmental assessments.
- Potential lack of public awareness about renewable energy benefits.

Opportunities

- Potential to develop comprehensive stakeholder engagement processes from the ground up.
- Opportunity to integrate environmental and social considerations into renewable energy planning early in the sector's development.

Threats

- Environmental challenges related to the country's mountainous terrain.
- Potential social and cultural barriers in transitioning from traditional energy sources.
- Failure to conduct an environmental and social assessment in accordance with all international rules can have a detrimental effect on flora and fauna, the natural environment (for example, birds and bats monitoring is not conducted properly, as well as monitoring of fish species, etc.).

Tajikistan**Strengths**

- Strong government commitment to renewable energy development, with plans to transition into a "green country" by 2037.
- The country is actively integrating climate action into its energy policies. This includes efforts to improve the environmental liability of energy production, ensuring that energy developments comply with high environmental and safety standards.
- High public awareness due to the mandatory installation of solar panels in new and renovated buildings starting April 2024.
- Significant potential for solar energy development, with the ability to generate up to 220,000 GWh of electricity from solar power.

Weaknesses

- Lack of clear and precise rules, presence of excessive bureaucracy.
- Limited local experience and expertise in renewable energy projects.
- Outdated infrastructure that may hinder project development.
- Despite progress, the regulatory framework remains a challenge with potential fluctuations that can impact investor confidence and stakeholder relationships.

Opportunities

- Increasing international support and funding for green energy projects.
- Potential for collaboration with neighboring countries, particularly Kazakhstan, to leverage their experience in renewable energy projects.
- Growing interest from international investors and institutions, including the European Union and EBRD.

Threats

- Environmental challenges, including the country's mountainous topography and loss of glaciers threatening hydropower generation.
- Potential social and cultural barriers due to the transition from traditional energy sources.
- Monopoly on the energy market that may hinder stakeholder engagement and community participation.
- Reliance on external funding for energy projects can be precarious, especially if global financial conditions shift, potentially disrupting ongoing and planned renewable energy projects.

Turkmenistan

Strengths

- Strong government control that could facilitate the implementation of environmental and social standards if prioritized.
- **Government Initiatives:**
Government has adopted several national policies (National Strategy on Climate Change, RES Strategy), announced commitments for MEAs (NDC, PA to UNFCCC), and joined organizations (IRENA, GGGI, GMP) to adapt to and mitigate climate threats (e.g., introduce resource-efficient solutions and reduce emissions) involving state bodies, local NGOs, and communities
- **State Programs on Climate-Friendly Projects:**
Planned projects on the construction of new (and conversion of existing) gas-fired plants to a combined cycle of steam and gas by 2028 promise a reduction of harmful emissions.
- **Prospective State Concern for Remote Communities:**
- State's plans to deploy small-scale off-grid renewables plants (total 6 MW) for distant settlements.

Weaknesses

- Limited experience with renewable energy projects and associated environmental assessments.
- Limited information on known stakeholder engagement processes or meetings of government and investor entities projects.
- Most of the known stakeholder meetings of climate-related projects are mostly co-organized by development organizations.

Opportunities

- Potential to develop comprehensive environmental and social standards for renewable energy projects.
- Opportunity to leverage international best practices in stakeholder engagement.
- Opportunity to decrease the FDI-related CO₂ emissions growth,¹³ and turn the pledged conditional targets on emissions reductions to unconditional through deploying more renewables projects, mobilizing more funds and technologies.

Threats

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Uzbekistan

Strengths

The national environmental impact assessment (EIA) is regulated by the:

- Law of the Republic of Uzbekistan “On Ecological Expertise” (2000); and
- Resolution “On the State Environmental Expertise,” approved by the Resolution of Cabinet of Ministers No. 541 “On Further Improvement of the Environmental Impact Assessment Mechanism” (2020).

– **Resolution 541** specifies the legal requirements for EIA in Uzbekistan.

– State Environmental Expertise is a type of environmental examination carried out by specialized expert divisions to ensure compliance of the planned activities with the environmental requirements and determination of the permissibility of the environmental examination object implementation.

– **The 2022–2026 Development Strategy** of New Uzbekistan (PF-60) envisions the introduction of green economy technologies in all sectors to achieve a 20% increase in the energy efficiency of the economy while reducing the emission of air pollutants by 20%.

Weaknesses

– Limited experience in stakeholder engagement for large-scale renewable energy projects.

– Possible lack of strong standards to mitigate negative impacts of large-scale renewable projects.

Opportunities

– Increasing interest from international investors, which could bring best practices in environmental and social standards.

– Potential to leverage experience in renewable energy to improve stakeholder engagement processes.

– Opportunity to develop more comprehensive environmental impact assessment processes.

Threats

– Lack of waste management and requirements on recycling (e.g., solar panels or wind turbines after the end of the project cycle [25–30 years for example]) may bring significant harm to the environment if by then there will be no amendments to policy on how to recycle or handle RE technology,

– Environmental challenges related to the country's diverse geography.

The maturity of the environmental and social factors and stakeholder engagement processes varies across Central Asia. Most countries face challenges related to their limited experience with large-scale renewable energy projects, the potential lack of strong environmental impact assessment processes, and the need to balance

economic development with environmental and social considerations. However, there are significant opportunities to develop comprehensive stakeholder engagement processes, leverage international best practices, and integrate environmental and social considerations into renewable energy planning. The success of these efforts depends on addressing challenges, such as environmental constraints, potential social resistance, and the need to build local capacity and expertise in environmental and social impact assessments.

14. Technology and Innovation

Kazakhstan

Strengths

– **Research and Development:**

Kazakhstan has several universities and research institutions with strong programs in renewable energy, such as Nazarbayev University, DKU (Kazakh–German University), and Almaty University of Power Engineering and Telecommunications.

– **Government Support:**

The government provides funding and support for R&D in renewable energy technologies.

– **Innovation Culture:**

There is a growing culture of innovation and entrepreneurship, supported by initiatives like the Astana International Financial Centre (AIFC).

Weaknesses

– **Limited Domestic Expertise:**

While there are strong institutions, the overall pool of domestic expertise in cutting-edge renewable technologies is still developing.

– **Bureaucratic Hurdles:**

Regulatory and bureaucratic challenges can slow down innovation and the adoption of new technologies.

– **Lack of Manufacturers:**

Although a 50% incentive is provided by the Law of supporting RE, with a requirement on local technology installation, there are no local manufacturers in the renewable energy technologies sector.

Opportunities**- International Collaboration:**

Opportunities for joint programs with international development institutions to enhance technology transfer and innovation.

- Government Initiatives:

Potential for new government initiatives to further support R&D and technology transfer in the renewable energy sector.

Technological Aspects:

Due to the wear and tear of energy facilities costly upgrades and modernization are required, which could provide alternative opportunities to attract investors to participate in renewable energy projects.

Threats**- Economic Volatility:**

Economic fluctuations could impact funding for R&D and innovation.

- Regulatory Risks:

Potential changes in regulations could affect the stability of the innovation environment.

- Hidden Operational Costs:

Kazakhstan has recycling fees for BESS as per the Environmental Code, but most SMEs are unaware of this requirement. In the case of policy amendments regarding other RE technologies in the form of a requirement to recycle the technology once the life cycle ends, this may impose additional costs on the RE operator.

Kyrgyzstan**Strengths****- Growing Interest:**

Increasing interest in renewable energy development is driving demand for innovation and technology in this sector.

Incentives:

Currently, a Green Taxonomy is being developed (includes solar and wind energy equipment, hydroelectric power plants, equipment for the transmission and storage of electricity, as well as the conversion of electricity into hydrogen), various benefits and preferences will be provided for this equipment.

- International Support:

Access to international funding and technical assistance for renewable energy projects.

Weaknesses

- **Limited R&D Infrastructure:**

Limited domestic research and technology development capabilities in renewable energy.

- **Educational Gaps:**

Few universities with strong programs in renewable energy (Kyrgyz National Technical University, Kyrgyz-Russian Slavic University).

- **Centralization of RE Resources in Large Cities:**

In the regions of the country, renewable energy technologies and equipment, education, and research, as well as RE specialists are very limited.

Opportunities

- **Capacity Building:**

Potential to develop domestic training programs and initiatives to build a skilled workforce in renewable energy.

- **International Partnerships:**

Opportunities for partnerships with international institutions to bring in expertise and enhance local R&D capabilities.

Threats

- **Economic Constraints:**

Limited financial resources may hinder the development of comprehensive R&D programs.

- **Political Instability:**

Political instability could affect the implementation of technology and innovation initiatives.

- **Skilled Professionals and Researchers Leave:** Renewable energy professionals leave the country in search of work or change careers after receiving their education.

Tajikistan

Strengths

- **Government Commitment:**

Strong government commitment to renewable energy development, with plans to transition into a "green country" by 2037.

- **International Collaboration:**

Plans to leverage Kazakhstan's experience and expertise in renewable energy projects.

Weaknesses

- **Limited Domestic Expertise:**

Limited local experience and expertise in renewable energy technologies.

- **Educational Gaps:**

Few universities or research institutions with strong programs in renewable energy.

Opportunities**- International Support:**

Significant international support and funding for renewable energy projects, including from the European Union and EBRD.

- Capacity Building:

Potential for developing local R&D capabilities through international partnerships and collaborations.

Threats**- Economic Volatility:**

Economic challenges could impact funding for R&D and innovation.

- Environmental Challenges:

The country's mountainous topography and aging infrastructure may pose challenges to the development of renewable energy projects.

Turkmenistan**Strengths****- Government Control:**

Strong central government control can facilitate the implementation of large-scale R&D and innovation programs if prioritized.

- Government Initiatives:

National Strategies aimed at the development of RES and Hydrogen fields through international cooperation, and also the recently established hydrogen center at the state oil and gas university and expanding studies at state power university in renewables could stimulate enhanced support for R&D and technology transfer in the RE sector.

Weaknesses**- Limited R&D Infrastructure:**

Limited domestic research and technology development capabilities in renewable energy.

- Educational Gaps:

Few universities or research institutions with programs in renewable energy.

Opportunities**- International Collaboration:**

Potential for developing R&D capabilities through partnerships with international institutions given the national strategies: Renewables development until 2030, upcoming Hydrogen development, and RES Cooperation in 2025–2030.

Technology Transfer:

Potential for a high decarbonization impact of new and transferred technology given the absence of renewable energy generation in the country.¹⁴

- R&D Development:

The high potential of renewable energy and raw materials stimulated the national R&D to some pilot projects or studies since Soviet times, and with increased support, R&D experience is well positioned for development.

14 CAREC. (2030). Energy Outlook 2030. <https://www.adb.org/sites/default/files/publication/850111/carec-energy-outlook-2030.pdf>

Threats

– **Limited Cooperation:**

Limited international and regional exposure to renewables can limit access to technology and funding for R&D.

– **Regulatory Barriers:**

Potential regulatory barriers and lack of transparency can deter international collaboration.

Uzbekistan

Strengths

– **Government Commitment:**

The Government passed the Law “**On Measures to Develop Renewable and Hydrogen Energy** in The Republic of Uzbekistan,” which includes the following objectives:

- **Establish the National Research Institute of Renewable Energy Sources** under the Ministry of Energy, a Hydrogen Energy Research Center, and a testing and certification laboratory for hydrogen energy technologies.
- Form an **Interdepartmental Commission** on the development of renewable and hydrogen energy.
- Approve the roadmap for the organization of activities by the **National Research Institute of Renewable Energy Sources** and the development of renewable and hydrogen energy.
- Signed an open agreement between Air Products (US company) and ACWA Power (Saudi Arabia) for the **development of renewable and hydrogen energy**.
- Develop proposals for the implementation of pilot projects for introducing “**green**” **hydrogen** technologies.

Weaknesses

– **Limited Domestic Expertise:**

While there are strong institutions, the overall pool of domestic expertise in cutting-edge renewable technologies is still developing.

– **Bureaucratic Hurdles:**

Regulatory and bureaucratic challenges can slow down innovation and the adoption of new technologies.

Opportunities

– **International Partnerships:**

Increasing interest from international investors and institutions, which could bring best practices in R&D and innovation.

– **Capacity Building:**

Potential for developing local R&D capabilities through international partnerships and collaborations.

– **Potential in education:**

According to the WIPO 2023 Global Innovation Index, Uzbekistan ranks 82nd out of 132 countries and is below average for its level of economic activity.

- **Uzbekistan ranks 12th in the indicator of Graduates in Science and Technology**

Threats– **Economic Volatility:**

Economic fluctuations could impact funding for R&D and innovation.

– **Regulatory Risks:**

Potential changes in regulations could affect the stability of the innovation environment.

The maturity of technological and innovation environments in Central Asia varies. Most countries face challenges related to limited domestic R&D capabilities, educational gaps, and the need to develop innovation ecosystems further. However, there are significant opportunities for international collaboration, government initiatives, and capacity building to enhance technology transfer and innovation in the renewable energy sector. The success of these efforts will depend on addressing challenges such as economic constraints and regulatory barriers, and building local expertise and infrastructure for R&D.

15. Regional Cooperation

Kazakhstan

Strengths

- Significant experience in renewable energy projects, making it a valuable partner for regional cooperation.
- Substantial investment (\$38bn) planned across 60 projects in the energy sector.

Weaknesses

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Opportunities

- Potential to export expertise and technology in renewable energy to neighboring countries like Tajikistan.
- Opportunities for cross-border energy trade and joint projects.

Threats

- Potential competition from other regional powers for influence in Central Asia's energy sector.

Kyrgyzstan

Strengths

- Potential for renewable energy development, particularly in solar and wind resources.
- Growing interest in regional cooperation for energy security.
- Positive examples of the development of regional cooperation in the implementation of power plant construction projects (the conclusion of a Memorandum between the Kyrgyz Republic, Kazakhstan, and Uzbekistan for the construction of the Kambarata HPP-1; the joint construction of a 50 MW solar power plant with the Republic of Kazakhstan, the construction of a small hydroelectric power plant with the participation of the Kyrgyz-Uzbek Fund and the approval of 19 projects worth 36 million US dollars, including in the energy sector);
- Implementation of the CASA-1000 regional project with the Republic of Tajikistan.

Weaknesses

- Possible lack of experience in large-scale renewable energy projects compared to Kazakhstan.
- Potential differences in energy policies and regulations among countries.

Opportunities

- Potential for providing frequency regulation services.
- Potential for participation in regional renewable energy initiatives.
- Opportunities for cross-border energy trade and knowledge sharing.
- Access to expertise and investment from more advanced regional partners like Kazakhstan and Uzbekistan.

Threats

- Geopolitical competition between global powers (EU, China, Russia) affecting regional cooperation.
- Threats related to water supply mechanism to downstream countries.
- Potential for political tensions or conflicting national interests to hinder cooperation efforts.

Tajikistan

Strengths

- Strong intention to leverage regional expertise, particularly Kazakhstan's experience in renewable energy projects.
- Government commitment to transition into a "green country" by 2037.
- More than 98% of Tajikistan's electricity is derived from hydropower resources, providing a strong base for renewable energy.
- Tajikistan is engaged in several strategic regional initiatives such as the CASA-1000 project and partnerships with regional bodies and neighboring countries. These partnerships enhance its role in regional energy markets and leverage its hydropower resources to increase electricity exports.
- The country benefits from international support for regional projects, such as the USAID Power Central Asia Activity, which promotes energy cooperation among Central Asian countries and supports Tajikistan in enhancing its regional energy security.

Weaknesses

- Limited domestic experience in solar and wind power plant construction.
- Dependence on regional countries for energy resources, such as liquefied gas from Kazakhstan.
- There may be regulatory inconsistencies or barriers that complicate regional cooperation. Aligning energy policies and regulations with neighboring countries remains a challenge that can impede seamless regional integration.

Opportunities

- Potential for cross-border renewable energy trade, particularly with Kazakhstan.
- Access to regional expertise and technology transfer in renewable energy.
- Participation in regional initiatives, as evidenced by cooperation with Kazakhstan's parliament.
- By increasing the capacity and efficiency of its hydropower generation, Tajikistan can provide a reliable source of renewable energy to the region, supporting regional energy stability and sustainability.

Threats

- Geopolitical competition affecting investment decisions, as seen with EU and Chinese investments in the region.
- Potential for regional political tensions to impact cooperation efforts.

Turkmenistan**Strengths****- Experience:**

Existing experience of bilateral energy and regional cooperation on various large-scale joint projects (e.g. hydroelectric power plants, water management), and other programs such as the upcoming Road Map for Regional Cooperation until 2027, the Central Asia 2040 strategy, can be leveraged for taking advantage of the opportunity to effectively cooperate in the renewables field.

Power Supplies during the Transition Period:

In the case of a country's integration into the Central Asia Unified Energy System, the opportunity to ensure adequate energy supplies and facilitate a smooth integration of renewables across the region may increase.

International Cooperation:

The government initiates programs for international cooperation and support for the development of renewables and hydrogen in which directions for regional cooperation could be developed where appropriate.

Weaknesses

- *Regional Position:*

Abundant traditional energy resources and subsidies may induce less active participation of the Turkmen government and businesses in RE regional cooperation compared to other active counterparts interested in energy availability and security.

Development of New Institutional and Policies Framework:

New policies may need to be developed in line with regional renewable energy cooperation concepts, which will take more time and hamper rapid integration into the regional agenda.

Participation in Regional RE Projects:

No participation in joint renewable energy projects, strategies, or plans involving bilateral or multilateral cooperation with intra-regional partners.

Opportunities

- *Regional Cooperation in Climate and Energy:*

Opportunity to introduce renewable technologies into the Turkmenistan energy sector owing to the MoU signed by the Ministry of Environmental Protection of Turkmenistan and UNEP to develop regional programs aimed at transferring climate technologies to CA states.

- Potential to increase the renewables regional cooperation through Astana Communiqué on Accelerating the Uptake of Renewables for collaboration with IRENA.
- Potential for regional experience sharing in PPPs in collaboration with UNECE.

Threats

- Potential competition from other regional powers for influence in Central Asia's energy sector.
- Presence of vast energy resources, the revenues they generate, and the need to develop a new sector with greater financial and time resources may deter the government from dynamic cycles of regional cooperation and commitment.
- Due to the neutral position, there might be limited participation in regional economic blocks.

Uzbekistan

Strengths

- Potential for renewable energy development, particularly in solar and wind resources.
- Growing interest in regional cooperation for energy security.
- Positive examples of the development of regional cooperation in the implementation of power plant construction projects (the conclusion of a Memorandum between Kyrgyzstan, Kazakhstan, and Uzbekistan for the construction of the Kambarata HPP-1; the joint construction of a 50 MW solar power plant with Kazakhstan, the construction of a small hydroelectric power plant with the participation of the Kyrgyz-Uzbek Fund and шёы approval of 19 projects worth 36 million US dollars, including in the energy sector);
- Joint cooperation in power plant construction projects with Tajikistan, HPPs.

Weaknesses

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Opportunities

- Opportunities for cross-border energy trade and joint projects.
Uzbekistan’s electricity grid is interconnected with the systems of other countries in the region which together form the Central Asian Power System, established during the Soviet era.
In recent years, however, due to growing demand, Uzbekistan imported more electricity and became a net importer. Even with capacity additions, Uzbekistan still needs more electricity, which can be covered by flexible generation from hydropower sources from upstream countries.

Threats

- Potential competition from other regional powers for influence in Central Asia's energy sector.

Appendix 3 Categories and Elements in Joint Pseudo-Ecosystem

The Research Project identified 15 main categories that constitute the renewable energy investment ecosystem in Central Asian economies. The elements that constitute the content and context of each main category are outlined below.

Aggregate

Wind

Solar

Bio

S-S Hydro

10%

Government Commitment and Institutional Support

Country perceived to be politically stable (WB WGI and EIU DI)					
Government commitment to international climate and RE agreements					

Long-term, holistic energy strategy exists, integrating renewable energy policies into the overall energy mix					
Energy strategy integrating broader economic, environmental, and societal goals					
Established renewable energy sector					
Prioritized sub-sectors (wind, solar, bio, small-scale HP)					
Specific renewable energy targets, aggregate and per sub-sector					
Documented track record on achieving targets					
Cabinet minister with specific responsibility for RE portfolio					
Inter-ministerial coordination mechanisms for renewable energy policy					
Government bodies dedicated to the renewable energy sector					
No ambiguities regarding state bodies' competencies and mandates for RE					
Stable institutional structure for renewable energy					
Documented track record on honoring energy agreements with foreign investors					

Long-term climate and green economy strategy, in symbiosis with energy strategy					
Specific climate targets, linked with renewable energy targets					
Regular reviews by authorities of statutes, regulations, policies, and RE targets and strategies					
Government apparatus able to adapt renewable sector to changing externalities					

Aggregate

Wind

Solar

Bio

S-S Hydro

10%

Regulatory Framework and Policy Environment

Consistent, robust, and complete regulatory framework, in aggregate and per sub-sector					
Regulatory environment easy to navigate by foreign investors					
Bureaucracy structure facilitates swift renewable energy investments					
Bureaucratic processes are streamlined and coordinated					
Tendering for RE projects is digitalized					
Digitalized licensing and permitting processes for RE projects					

Good coordination between Government bodies involved in the renewable energy sector					
Relevant regulations always implemented before RE project execution					

Aggregate

Wind

Solar

Bio

S-S Hydro

10%

Market Conditions and Potential

Nation needs foreign investments to reach renewable energy targets					
Market size attractive to foreign investors in wind, solar, bioenergy, and small-scale hydro					
Double-digit annual growth in demand for renewable energy over the next decade					
Competitive electricity market					
Electricity subsidies prevalent					
Guaranteed electricity off-take throughout the year and over the lifecycle					
Traditional off-takers (TSOs, DSOs, large corporations) are robust in terms of creditworthiness and payment history					
Dispatching of RE electricity production is the priority					

Renewable energy can be exported at negotiated terms					
Electricity prices conducive to RE generation and distribution investments					
Electricity price range is predictable and guaranteed over the lifecycle					
PPAs are freely negotiated and legally protected					
Utilities have targets or mandates as regards renewable energy					
Incentives tailored to renewable energy (e.g., tax breaks, subsidies, favorable tariffs, land rights, and climate-related). Be concrete					
Incentives time-bound					
Incentives event-triggered					
Incentives made generally applicable to RE projects by the Government					
Incentives granted on an ad-hoc, project-by-project basis					
Green taxonomy linked to incentives exist					
Authorities systematically and publicly marketing RE project opportunities					
Clear rules for award of renewable energy projects to investors					

Traditional energy industry not creating impediments for renewable energy investments					
Traditional energy industry offering synergies with renewable energy investments					

Aggregate

Wind

Solar

Bio

S-S Hydro

7%

Investment Promotion Agencies

IPA with renewable energy expertise and experience exist					
IPA well-resourced					
IPA serving foreign investors through business registration, pre-investment, investment, and operational life-cycle matters, reducing 'red tape'					
IPA with the mandate to enact RE projects nationwide throughout the full lifecycle					
IPA with enforcement mechanisms to protect investors' granted rights					
No scope for ambiguity between IPA for renewable energy and other public bodies					
IPA actively and systematically promoting renewable energy opportunities					

IPA creating synergies between
RE investments and investments
in other sectors

Aggregate

Wind

Solar

Bio

S-S Hydro

8%

Resource Availability and Transparency

Renewable energy resources and potential exist in amounts that can be commercialized					
Quality data on available wind, solar, bioenergy, and small-scale hydro-energy resources exist					
Quality data on the potential for wind, solar, bioenergy, and small-scale hydro-energy exist					
Quality data on renewable energy resources and potential regularly updated					
Quality RE data maintained by a central, reliable, and authorized body					
Open and online access to data on renewable resources and potential					
Access to data granted to foreign investors					
Potential for the raw material industry essential for renewable technologies exists					

Potential for a green hydrogen industry based on renewable energies exists

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Aggregate

Wind

Solar

Bio

S-S Hydro

6%

Investment Promotion Agencies

Documented topology and nominal capacities of the electricity grid exist					
All regions covered by transmission and distribution networks					
Necessary regional autonomy and redundancy in place					
Assessment of national and regional grid quality and losses exists					
All data on the electricity grid available to foreign investors					
Entire domestic electricity grid fully inter-connected					
Grid capable of integrating intermittent renewable energy projects on a 100 MW scale					
One-stop shop to connect new renewable energy practiced					
Network Code developed					
Network Code in use					

Advanced monitoring and control of the entire domestic electricity network implemented					
Connected to the Central Asian Unified Power Grid					
Connected to CASA-1000					
Energy storage supporting intermittent renewable energy sources on a 100 MW scale exists or is being developed					
Plans for grid upgrades, expansion, or modernization to accommodate renewable energy exist					

Aggregate

Wind

Solar

Bio

S-S Hydro

7%

Market Access

Law on foreign investment and investors exists					
No discrimination of foreign investors vs. domestic investors					
Foreign investors can participate in renewable energy auctions					
Foreign investors can be invited to direct negotiations for renewable energy projects					
Local stakeholders are not required as partners for renewable energy projects					

State participation is not required for renewable energy projects					
SEZs for renewable energy projects exist					
SEZs for RE projects open to foreign investors					
No restrictions on specific RE projects that can be opened to foreign investors					
No limitations for RE projects in certain geographies and on societal grounds					
No monopoly barriers					

Aggregate

Wind

Solar

Bio

S-S Hydro

7%

Investment Protection

Law on protecting foreign investments and investors exists					
Bilateral investment treaties adopted					
Double-taxation treaties adopted					
Free remittance and movement of capital, including profits and dividends					
Measures protecting against the expropriation of assets or mitigation thereof exist					

Mechanisms to mitigate operational matters outside the foreign investors' control exist (e.g., consequences of the market being unable to absorb electricity production)					
International arbitration recognized					
Ability to freely negotiate and agree on international arbitration					
Membership in ICSID					
WIPO membership					
Protection of intellectual property rights as per WIPO standards					
Technology transfer protection, sufficiently safeguarding intellectual property					
Legal system independence and impartiality					

Aggregate

Wind

Solar

Bio

S-S Hydro

6%

Financial Environment

Financial institutions can operate on market-based principles					
Stable financial market					
Presence of all major MDBs operating in Asia					

MDBs already partaking in real, renewable energy investments					
Established access to international development organizations and funds					
Domestic financial institutions familiar with renewable energy projects					
Domestic financial institutions capable of \$50 million RE project funding					
Domestic funds capable of \$10 million RE project funding					
Presence of reputable international financial institutions, domestic or remote					
Competition between funding sources possible					
No limitations on foreign investors to acquire financing in the country for RE projects					
No risk factors (e.g. market, political, foreign relations) that adversely impact the financial environment for RE projects					
State programs or initiatives specifically designed to attract foreign RE investment					
State guarantees for investment in renewable projects with foreign investors					
Other risk mitigation instruments for foreign investors					

State participation in renewable energy projects with foreign investors					
Domestic currency is freely convertible					
Domestic currency non-volatile					
Domestic currency investment bindings that could affect returns on investment					

Aggregate

Wind

Solar

Bio

S-S Hydro

5%

In-country Skilled Workforce

Sufficient availability of skilled in-country workers for wind, solar, bioenergy, and small-scale hydro projects					
Sufficient availability of in-country RE specialists					
Workforce in-country retention is adequate					
Domestic R&D capabilities in renewable energy are adequate					
Domestic educational system for a renewable workforce is fit for purpose					
Sufficient domestic training programs closing skills gaps in renewable energy					

Structured and systematic support from international development partners exist					
Mechanisms formalized to bring expertise from abroad to compensate for the lack of qualified local resources					
Government investing in local skills, knowledge, and industry capacity building					

Aggregate

Wind

Solar

Bio

S-S Hydro

5%

Project Developers and Engineering, Procurement, and Construction (EPC) Companies

Domestic experience in renewable energy project execution (wind, solar, bioenergy, and small-scale hydro)					
Existing, mature domestic industry of project developers and EPC companies for renewable energy projects					
Existing domestic industry to manufacture RE technology components					
National strategy to develop domestic renewable energy industry					
National clusters and networks of renewable energy development companies					

Real business activity of foreign project developers and operators in the country's renewable energy sector					
Real business activity of foreign EPC companies in the country's RE sector					
No local content required for renewable energy projects					
Public procurement requirements for RE projects exist					
Public construction standards for RE projects exist					
No domestic construction company monopolies exist					
No mandatory collaboration between domestic and foreign EPC companies in the RE sector					
Collaboration between domestic and foreign EPC companies allowed in the RE sector					
Logistics infrastructure sufficiently developed for renewable energy projects					
Climatic conditions do not threaten renewable energy projects and operations					

Aggregate

Wind

Solar

Bio

S-S Hydro

5%

Public-Private Partnerships (PPPs)

Law on PPPs exists					
Competitive PPP processes established					
Competition in PPP procurement processes is transparent					
Negotiated PPP allowed					
Roles and responsibilities of public and private partners are clearly defined					
Incentives offered to private investors participating in PPPs					
Law on PPPs is applicable to the renewable sector					
No barriers or challenges to forming PPPs in the renewable energy sector exist					
Existence of a dedicated PPP agency					
PPP agency has renewable energy competence					
Compilation of approved PPP opportunities exist					
PPP opportunities in renewable energy are systematically promoted online					
Risk-sharing mechanisms between public and private partners are clearly defined for renewable energy projects					

PPP agency has the authority to complete transactions nationwide					
Track record of PPPs in the country is documented					
Track record of PPPs in the country available online					

Aggregate

Wind

Solar

Bio

S-S Hydro

5%

Environmental and Social Factors, Stakeholder Engagement

Law on ESIA exists					
ESIA law includes provisions that can stop or suspend RE projects					
Institutionalized collaboration between government, RE industry, and communities					
Strong enforcement of ESIA law and bylaws					
Mandatory environmental and social impact assessment for RE projects					
Mandatory stakeholder dialogue at the community level for RE projects					
Communities can stop or suspend RE projects					
Mandatory and formalized environmental performance review on RE projects					

Strong standards to mitigate the negative impacts of large-scale renewable projects					
All-encompassing fines and penalties for foreign investors are described in ESIA law					
Climate and nature preservation policy integrated with energy policy					
Mandatory consultation with neighboring countries on cross- or near-border projects					
No danger of renewable projects, perse, leading to serious environmental degradation					
Waste management system from RE projects and operations exists					
Opportunity to significantly reduce GHG emissions by hybrid fossil/renewable projects					

Aggregate

Wind

Solar

Bio

S-S Hydro

5%

Technology and Innovation

Domestic R&D institutions and networks dedicated to renewable energy exist					
Universities and educational institutions with strong programs in renewable energy					

Government funding R&D for RE technologies and capacity building					
Domestic companies developing renewable technologies					
Domestic RE professionals are sufficiently incentivized to stay and work in-country					
Culture of innovation and entrepreneurship in the renewable energy sector					
Formal collaboration with international institutions and corporations in RE technologies					
No requirements for foreign investors to collaborate with domestic universities and research institutions					
No mandatory transfer by foreign investors of proprietary technology in RE projects					
Transfer of proprietary technology in renewable energy projects allowed					
No requirements for foreign investors to use domestic technology in RE projects					
The domestic RE ecosystem can absorb technologies and solutions already studied and accepted in-country					

Aggregate

Wind

Solar

Bio

S-S Hydro

4%

Regional Cooperation

Law on regional energy trade exists					
Electricity systems interconnected with neighboring countries with 220kV-500 kV transmission lines					
Participation in material and regional energy trade established					
Participation in regional renewable energy projects above \$10 million					
Regulations on regional harmonization of renewable energy policies exist					
Bi-lateral or multi-lateral cooperation with neighboring countries on renewable energy institutionalized					
Regional issues do not adversely affect electricity trade					
Regional issues do not adversely affect RE initiatives					
Geopolitics does not affect regional RE projects					
Geopolitics does not affect regional electricity trade					

Table Appendix 3.01 Categories and Elements of Joint Ecosystem

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Below are references of relevance to the context and content in Chapter 5.1.

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