

Powering the Future: Building a skilled and diverse renewable energy workforce in Central Asia



Preamble

This study was commissioned by the Organization for Security and Co-operation in Europe (OSCE) in the context of the initiative to establish a Regional Task Force on Education for a Just and Inclusive Energy Transition (RTEET) to build the capacities of Central Asian countries to develop a skilled and diverse workforce to support the energy transition in the region. The initiative brings together representatives of educational institutions, ministries of energy and education, and energy companies in Central Asia to develop and strengthen educational programs in the field of renewable energy sources (RES) at technical universities, aligned with government and industry needs. The implementation of the initiative at the regional level in Central Asia is supported by the Regional Environmental Center for Central Asia (CAREC).

The initiative is funded through the OSCE project “Promoting women’s economic empowerment in the energy sector in Central Asia for energy security and sustainability” running through 2028.

Acknowledgements

The publication has been prepared by the Office of the Co-ordinator of OSCE Economic and Environmental Activities (OCEEA) under the lead of Giulia Manconi, Senior Energy Security Adviser, Emomali Mirzoev, Assistant Project Officer, Energy Security and Ludmila Kiktenko, CAREC Program Manager.

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The authors would like to thank the interviewees, RTEET members, especially line agencies, energy enterprises, technical universities, and research institutions across Central Asia, who contributed their invaluable insights in the preparation of this report.

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ABBREVIATIONS

ADB	- <i>Asian Development Bank</i>
AUPET	- <i>Almaty University of Power Engineering and Telecommunications</i>
RE(S)	- <i>Renewable Energy (Sources)</i>
HEI	- <i>Higher Education Institutions</i>
KSTU	- <i>Kyrgyz State Technical University</i>
DKU	- <i>Kazakh-German University</i>
OSCE	- <i>Organization for Security and Co-operation in Europe</i>
UNDP	- <i>United Nations Development Programme</i>
UNFCCC	- <i>United Nations Framework Convention on Climate Change</i>
CAREC	- <i>Regional Environmental Center for Central Asia</i>
SES	- <i>Solar power plant</i>
TSTU	- <i>Tashkent State Technical University</i>
TVET	- <i>Vocational Education and Training Institution</i>
GIZ	- <i>German Agency for International Cooperation</i>



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BRIEF SUMMARY

A sustainable and just energy transition depends on the availability of qualified and diverse specialists capable of designing, implementing, operating, and maintaining modern technologies in the field of renewable energy (RE). To identify the skills needed in the emerging RE labor market and assess the readiness of educational institutions to provide them, an assessment of the current human resources and educational infrastructure in Central Asia was conducted. The goal was to identify key gaps and outline steps for the OSCE to support the update or development of new RE training courses in partnership with the governments of the five Central Asian OSCE participating States and relevant national and regional universities. The assessment methodology included desk analysis, semi-structured interviews, questionnaires, review of open sources and expert assessments, data analysis, focus group brainstorming, and stakeholder feedback. The assessment was conducted in Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan.

The assessment confirmed that: **1)** Despite the development of the renewable energy sector and targets in this field, countries experience a shortage of skilled personnel at all levels. **2)** Educational programs in Higher Education Institutions (HEIs) and Technical and Vocational Education and Training Institutions (TVETs) do not fully meet the needs of the RE sector. Current curricula often lack modern technologies and practical aspects of specific types of renewable energy sources (RES), including solar, wind energy, bioenergy, etc., as well as courses on RES integration into the energy system, digitalization, and related disciplines such as energy management and energy efficiency. **3)** Countries are not fully utilizing the transformative potential of women and youth. This applies to training in renewable energy professions and the staffing of energy companies.



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To strengthen human resources and educational infrastructure in the renewable energy sector of the OSCE Central Asian participating States, a comprehensive approach is recommended: **1)** developing new and updating existing curricula, strengthening practice-oriented training, and developing interdisciplinary programs. **2)** Developing short-term and modular courses (including online) for existing professionals, enabling them to master new technologies and skills in a short period of time and in remote areas. **3)** Equipping laboratories and creating practical training grounds at universities or production facilities. **4)** Increasing funding for research and development in the field of renewable energy, including grants for scientists and researchers, partnerships between universities and enterprises for joint research and innovation. **5)** Expanding academic mobility programs with leading foreign universities specializing in renewable energy. **6)** Attracting practitioners and experts from the RES sector (local and international) to teach, conduct master classes, and participate in the development of educational programs. **7)** Involving universities and research centers in international projects for the development of RES. **8)** Identifying and addressing barriers to women’s equal participation in the sector, and identifying potential motivational factors. To increase overall interest, including among Central Asian youth, it is recommended to introduce introductory courses and electives on RES into the school curriculum.



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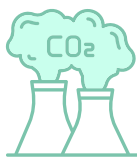







REGIONAL OVERVIEW

2.1. Key Priorities in the field of Renewable Energy

Central Asia, a region naturally rich in hydrocarbon resources, is increasingly recognizing the strategic need to develop renewable energy. This is driven by a number of factors, including global climate commitments such as the Paris Agreement (2015) and the United Nations Framework Convention on Climate Change (UNFCCC), national energy security objectives through diversification of sources and reduction of electricity deficits, as well as economic advantages associated with the cost-effectiveness of decentralized energy solutions for remote areas and the potential for electricity exports. All five countries in the region — Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan — have formulated ambitious national strategies and adopted supportive legislation in the field of renewable energy development. For example, Kazakhstan has enshrined its goals in the "Concept for the Transition towards a Green Economy" and "Kazakhstan Strategy 2050," aiming to achieve a 50% share of total energy consumption from renewable energy and alternative sources by 2050 [1]. Uzbekistan has adopted the "Strategy for the Transition to Green Economy by 2030" and the "Uzbekistan Strategy 2030," planning to increase the share of renewable energy to 54% by 2030 [2]. Kyrgyzstan's National Development Strategy 2018-2040 aims for renewables (excluding large-hydro) to constitute at least 10% of the country's total energy supply [3]. Tajikistan has set a target for non-hydro to provide 10% of generating capacity by 2030 [4]. Turkmenistan has also approved the National Strategy for the Development of Renewable Energy Sources until 2030.

Table 1.

Targets for renewable energy and greenhouse gas (GHG) emissions reduction

	 Mitigation (GHG emission reduction targets)	 Current share of RES in electricity generation (year)	 Renewable Energy Targets
 Kazakhstan	NDC 3.0 Unconditional: 17% reduction by 2035 (relative to 1990) Conditional: 25% reduction by 2035 (relative to 1990) Carbon neutrality by 2060 [5]	7.2% (2025) [5]	15% share of renewable energy in electricity production by 2030 50% share of renewable energy in electricity production by 2050 [6]
 Kyrgyzstan	NDC 3.0 Unconditional: 16% reduction by 2035 (vs. BAU) Conditional: 39% reduction by 2035 (vs. BAU) [7]	>90% (2024), mainly large hydropower [8]	Increase the share of renewable energy sources (excluding large hydropower) to 10% by 2040 [9,3]
 Tajikistan	Unconditional: 30–40% reduction vs. 1990) Conditional: 40–50% reduction vs. 1990) [10]	98% (2025), mainly large hydropower [11]	Production of at least 1,000 MW of renewable energy (solar/wind) by 2033. Diversify electricity mix by ≥10% with non-hydro RES [11]
 Turkmenistan	Unconditional: 20% reduction by 2030 (from 2010 levels) [12]	>1% [13]	Development of renewable energy with international support. Quantified targets have not yet been set.[14]
 Uzbekistan	NDC 3.0 Reduction of specific GHG emissions per unit of GDP by 50% by 2035 (from 2010) Carbon neutrality by 2050 [15]	16% (2024) [2]	Increase the share to 54% RES by 2030 [16]

Despite the unanimous political will for a green transition and the stated goals, the actual share of renewable energy in the energy balance of Central Asian countries varies significantly.

2.2. Renewable Energy Technologies in Use and in Demand in Central Asia

Central Asia has significant but unevenly utilized renewable energy potential. Each country in the region has its own unique characteristics that determine the dominant technologies and directions for RES development.

Renewable energy technologies used and dominant in Central Asian countries:

Kazakhstan demonstrates a strong commitment to the transition to green energy. In 2025, the share of electricity generated from renewable energy sources reached 7% of total production, more than double the 2020 figure of 3%. There are 162 renewable energy facilities in the country with a total installed capacity of over 3,5 GW. The dominant types of renewable energy are wind (1,909 MW) and solar (1,313 MW), with hydropower (314 MW) also making a significant contribution [17].

Kyrgyzstan is positioned as a "green energy" country, as almost 90% of its electricity generation comes from large hydropower plants [18]. The country's hydropower potential is estimated at 142 billion kWh, of which only about 10% is utilized [18]. The total installed capacity of operating power plants exceeds 3.2 GW, including the Toktogul HPP (1,380 MW). The country also has significant solar energy potential (267 GW) and wind energy potential (44.6 million kWh per year). In July 2025, the country reached an investment agreement to develop a 1.9 GW solar PV plant in Issyk-kul region, poised to be one of the largest in the region.

Tajikistan is a world leader in terms of the share of renewable energy in its total energy balance, due to its enormous hydropower potential. In 2024, more than 98% of all electricity in the country was produced by hydropower plants [19]. The total installed capacity of power plants is about 5,738 MW, the vast majority of which are hydropower plants, including the Nurek Hydropower Plant (3,000 MW) and the Rogun Hydropower Plant (planned capacity 3,600 MW), currently under construction. Solar and wind energy development in Tajikistan is limited, with only a few small-scale solar stations and no large-scale solar or wind projects commissioned yet.

Uzbekistan has set a strategic goal of increasing the share of renewable energy in total electricity generation to 54% by 2030. In 2025, there were plans to commission additional green capacity of 19 GW, including 18 solar and wind power plants with a capacity of 3.4 GW, as well as energy storage systems with a capacity of 1.8 GW [2]. Solar energy is the most widespread type of renewable energy in the country, alongside wind and small and large hydropower plants, such as Norin HPP Cascade.

With the world's fourth largest natural gas reserves, **Turkmenistan** has traditionally relied on hydrocarbons. However, the country has significant untapped renewable

energy potential: exceptional potential for solar energy (655 GW) and wind energy (around 10 GW). However, the current contribution of renewable energy to total electricity production is minimal, estimated at less than 1%. The country aims to reduce greenhouse gas emissions by 20% by 2030 (from 2010 levels) [20].

There are significant differences in the dominant technologies and plans for the development of renewable energy in the countries of the region. Tajikistan and Kyrgyzstan are strongly reliant on hydropower. Kazakhstan and Uzbekistan, having hydropower and large territories, are more actively diversifying into solar and wind energy. Turkmenistan, having huge potential for solar and wind energy, remains heavily dependent on hydrocarbons, although it is now initiating more active efforts to explore solar energy solutions.

New technologies with the most promising prospects for development in Central Asia.

Hybrid power plants. The development of hybrid systems is key to improving the stability of energy supply, especially with high penetration of renewable sources such as solar and wind. Integration with traditional sources (e.g., gas turbines) or energy storage devices helps smooth fluctuations in renewable energy production. In Kazakhstan, for example, Samruk-Energy JSC (Kazakhstan's largest electric power holding company) is actively considering and implementing projects to build hybrid power plants. One of the key projects is the construction of a hybrid power plant in the Zhambyl region, which will combine gas turbines, solar panels, and wind turbines. The aim of such projects is to ensure the stability of the power system, reduce emissions, and make maximum use of available natural resources. These stations may also include energy storage systems (batteries) for additional stabilization.

Production of "green" hydrogen. Green hydrogen is produced by the electrolysis of water using electricity obtained exclusively from renewable sources (hydro, solar, wind). It is considered a key element for the decarbonization of heavy sectors of the economy, such as industry, transport, and energy. Kazakhstan and Uzbekistan already have significant potential for green hydrogen production. This is due not only to their solar and wind energy resources, but also to their national plans to achieve carbon neutrality by 2060. In Kazakhstan, on the Caspian coast, an ambitious project is underway to build a large-scale complex for the production of green hydrogen. The project involves the use of giant wind and solar power plants with a capacity of up to 40 GW to generate energy that will be used for water electrolysis. The complex is expected to produce up to 2 million tons of green hydrogen or 10 million tons of green ammonia per year, most of which will be exported to Europe and Asia. If successful, this will make Kazakhstan one of the world's largest suppliers of green hydrogen.



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Autonomous RES systems for remote areas. Many remote and rural areas in Central Asia do not have access to centralized power grids or depend on expensive and environmentally harmful diesel fuel or coal for electricity generation.

Off-grid and small-scale RES-based systems (solar power systems and wind turbines with battery storage, and small hydropower plants) offer a sustainable and cost-effective solution. In Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan, projects supported by international organizations (e.g., UNDP, GIZ, OSCE, World Bank) are being implemented to electrify remote settlements using autonomous solar and wind power systems. In the mountainous regions of Kyrgyzstan and Tajikistan, where water resources are abundant, small and micro-hydroelectric power plants are widely used to provide local communities with energy. In regions with high solar insolation (e.g., in the southern regions of Kazakhstan and Uzbekistan), individual solar panels are being installed for lighting and powering household appliances.

Energy efficiency technologies and the creation and development of smart grids. Outdated infrastructure, high network losses, and inefficient energy consumption are serious barriers. In Central Asia, there is a growing understanding of the need for "smart" networks that can manage electricity flows more flexibly, integrate decentralized sources (including RES), optimize consumption, and minimize losses. This includes the installation of modern transformers, automated control systems, and "smart" meters. In addition, the modernization of power lines and substations is a priority for the electricity sector. Thermal modernization of buildings (insulation, replacement of windows), installation of energy-efficient lighting, and regulation of heating systems have great potential for development. Demand-side management technologies are developing. These are programs aimed at changing electricity consumption patterns to reduce peak loads and increase grid stability.

As part of an assessment of the skills needs for RES specialists and education gaps, conducted with the support of the OSCE and CAREC in Central Asian countries in 2025, a total of 38 stakeholders were interviewed. When asked about significant enabling factors for a rapid and successful development of the renewable energy sector, interviewees selected the following factors.



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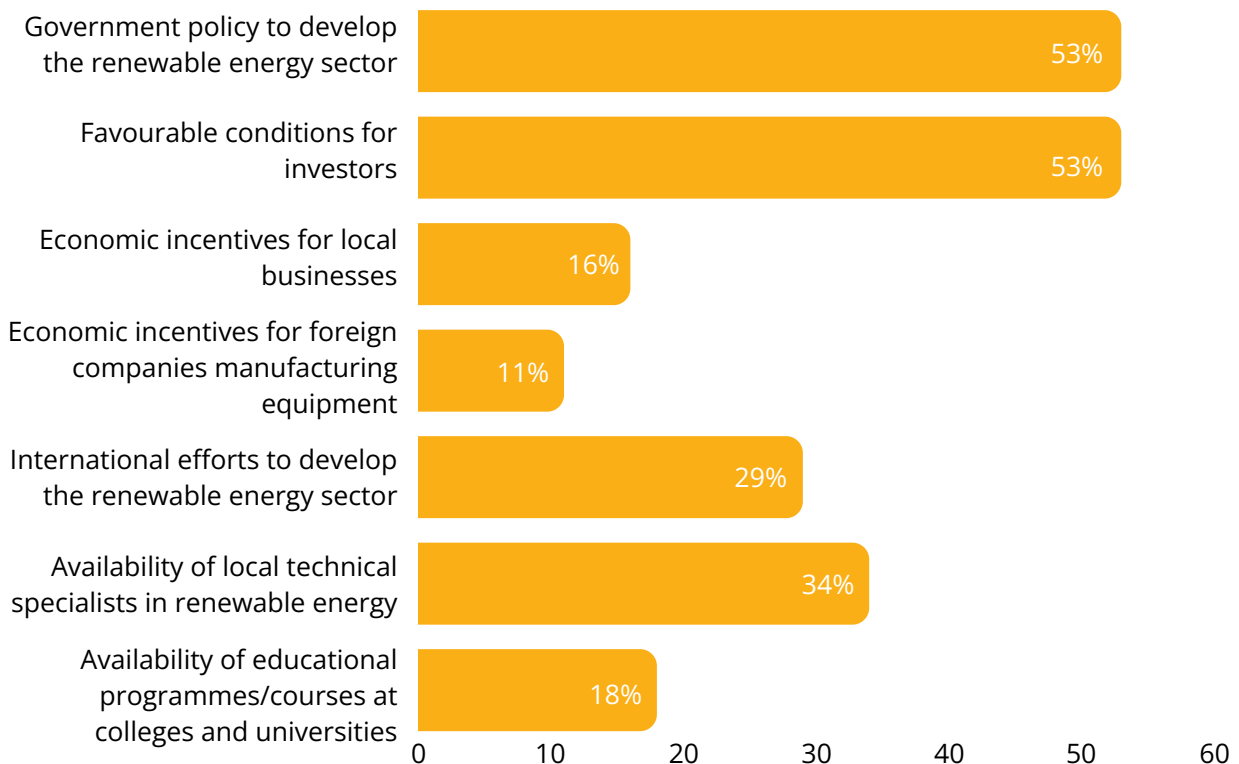


Diagram 1.

Important factors for the development of renewable energy in Central Asia (Percentage of respondent selections - results of focus interviews conducted as part of a needs assessment carried out in Central Asia in 2025 with the support of the OSCE and CAREC, aggregated to a regional estimate).



2.3. Key Workforce and Skills Challenges in Renewable Energy Development in Central Asia

The growth of the renewable energy sector in Central Asia is directly linked to the development of education and training programs in the field. All countries in the region recognize the shortage of skilled personnel, gaps in educational programs, limited research and laboratory facilities, which prevent graduates from acquiring sufficient practical skills, and insufficient administrative coordination to ensure interaction between ministries, universities, and energy companies (suppliers and consumers of RES specialists).

Hydropower specialists are a priority for Kazakhstan, Kyrgyzstan, and Tajikistan. However, technology and specialists are needed not only to operate hydropower plants, but also to manage the risks associated with climate change, glacier melt, low rainfall in dry years, and seasonal power shortages. Specialists are needed to forecast and model related processes.

All countries are experiencing a shortage of specialists in solar and wind energy. Hydrogen energy production is a new and promising area that requires skilled personnel in all fields.

A common challenge is training in the design of renewable energy stations and systems, the integration of renewable energy into the energy system, the development of electricity storage facilities and network modernization, and the preparation of feasibility studies and investment projects, including for international funds. Lawyers who understand the specifics of renewable energy systems, the renewable energy market, participants, and technologies are needed to improve the legislative framework and prepare and conduct collective and individual agreements between electricity suppliers.

A shortage of green energy skilled and gender-diverse workforce can significantly affect the ability of the Central Asian countries to achieve their energy security and renewable energy targets. It may also limit the socioeconomic benefits of the energy transition, as reliance on external expertise reduces local capacity and participation.



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03

RENEWABLE ENERGY LABOR MARKET NEEDS

3.1. Qualifications in Demand

In Central Asia, the shortage of RES specialists is both quantitative and qualitative. There are too few specialists, and many lack the necessary depth of skills and training.

An assessment comparing the demand for renewable energy specialists with the educational and training offers in Central Asian countries, conducted in 2025 with the support of the OSCE and CAREC, revealed that the practical knowledge and technical skills of young graduates do not fully meet the needs of energy companies.

This means that simply increasing the number of graduates is not enough; a fundamental overhaul of what and how specialists are taught is needed to prepare them for work in the renewable energy sector. The problem is not only filling vacancies, but filling them with competent specialists.



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The needs assessment also identified the percentage of skills gaps in the Central Asian countries (broken down by value chain), as assessed by interviewed stakeholders in *Diagram 2*.

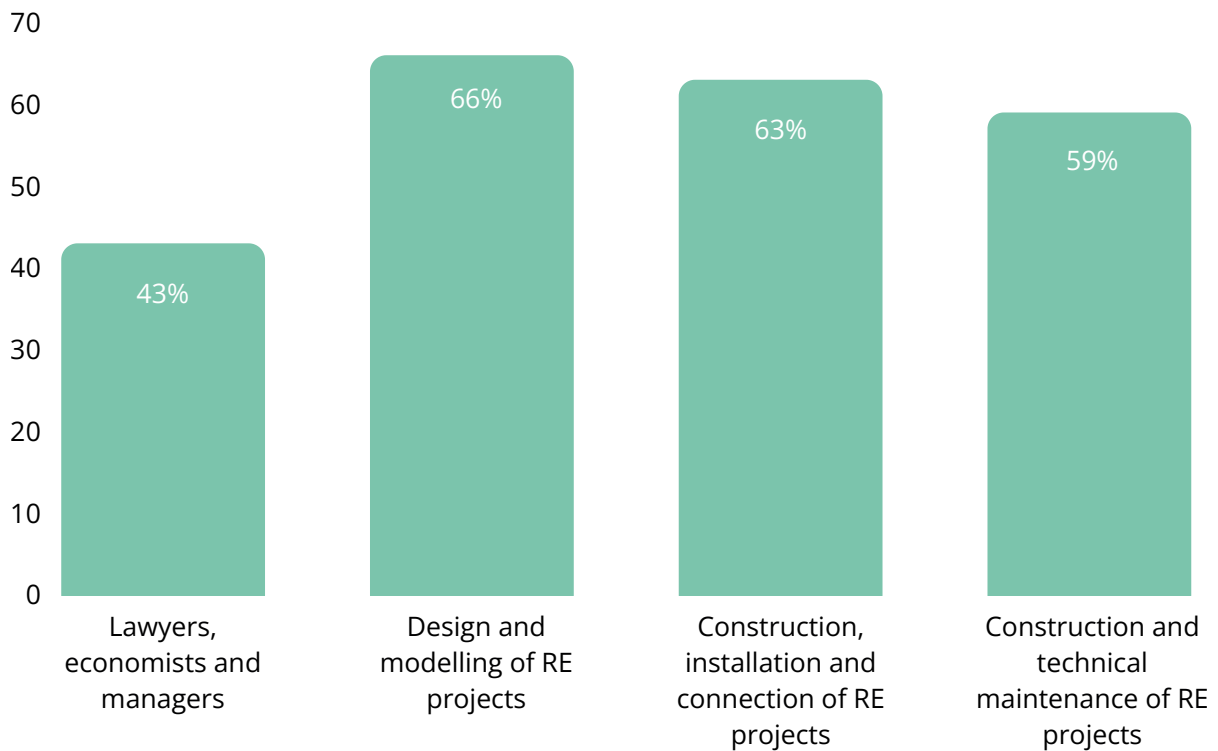


Diagram 2.

Percentage of shortage of specialists in the RES sector in Central Asia by value chain (average of percentages reported by surveyed stakeholders as part of the needs assessment carried out in Central Asia in 2025 with the support of the OSCE and the CAREC, aggregated to a regional estimate)

3.2. Shortage of Skilled Labor

As part of the needs assessment conducted in 2025 with the support of the OSCE and CAREC, the following responses were received from respondents regarding the shortage of skilled personnel in the renewable energy sector.

Kazakhstan. There is a shortage of skilled personnel at all levels. The growth of the RES sector creates a critical need for accelerated human capital development and the formation of new, specialized competencies. This is confirmed by strategic documents on the development of the fuel and energy complex [21]. There is a demand for engineers (at all levels), specialists in various types of renewable energy, energy managers, energy efficiency specialists, forecasting and modeling specialists, power engineers, electrical engineers, heat engineers, and specialists for dispatch services.

Kyrgyzstan. There is an acute shortage of qualified personnel with practical experience, technical knowledge, and an understanding of the legal and economic specifics of renewable energy projects. Employers note that the skills of graduates does not meet their requirements. There is a demand for engineers in the design and integration of renewable energy sources, installation, commissioning, and operation of systems, specialists in storage systems, energy managers and auditors, specialists with knowledge of digital tools (SCADA, generation modeling), knowledge of international standards and regulations, and project management.

Tajikistan. The shortage of specialists is attributed to training at universities that does not fully meet industry needs. The shortage of industry specialists is confirmed by an analytical review by the ADB [9]. Assuming an average annual increase of around 200 MW in renewable energy capacity through 2030, the sector is expected to generate annual demand for approximately 30–50 electrical engineers, 25–35 design engineers, 10–15 project managers, 25–35 operations and maintenance engineers, and 40–60 mid-level technical specialists [22].

Uzbekistan. There is a growing gap between the needs of the renewable energy sector and the availability of qualified specialists. There is a shortage of engineering and production personnel, as well as qualified teachers at universities and training centers. Due to the implementation of large infrastructure projects in Uzbekistan, there is a growing need for engineers to design, operate, and maintain renewable energy installations, specialists in energy storage and hybrid systems, specialists in the safe integration of renewable energy into the grid, experts in hydrogen energy, specialists in digital solutions (SCADA, IoT, AI), specialists in standardization, certification, and energy auditing, as well as teachers with practical experience in the industry. This is evidenced by labor market reviews and investment plans in the energy sector.

Turkmenistan. The need for a skilled workforce has been identified as a challenge for the country's transition to renewable energy [9]. Ambitious targets for the development of renewable energy in Turkmenistan imply significant future demand, and existing specialists do not have the necessary knowledge and skills [23]. The following specializations are identified as necessary: Design engineers, specialists in technical design of renewable energy facilities, network integration, operation, and maintenance (O&M), specialists with practical skills in adapting to new renewable energy technologies and overcoming the dominance of the hydrocarbon sector.

The forecast of rapid growth in demand for RES specialists in all countries indicates that the current output of educational institutions, along with training methodologies is insufficient or outdated to meet future needs. This means that the gap between supply and demand will widen, which, if not addressed, will become a serious obstacle to achieving national RES targets and ensuring energy security.

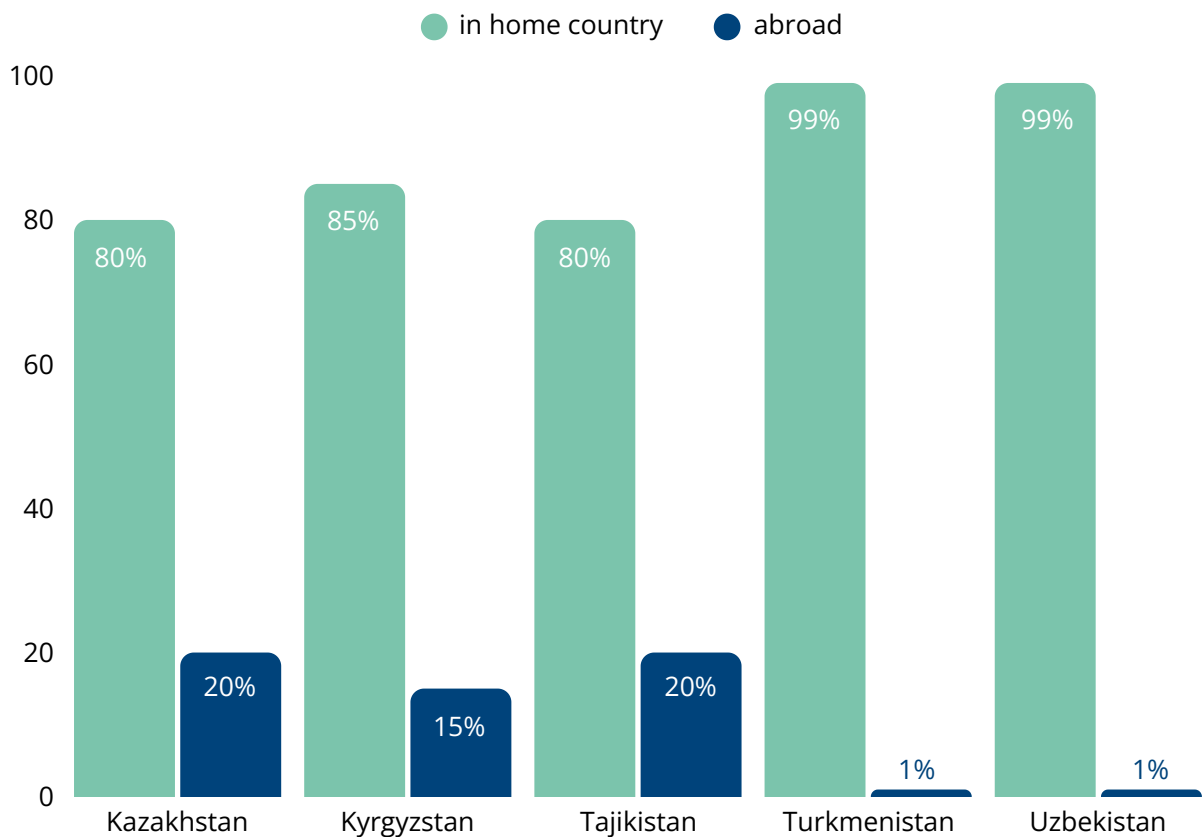


Diagram 3.

Where are RES sector specialists trained in Central Asian countries? (average of percentages reported by surveyed stakeholders as part of the needs assessment carried out in Central Asia in 2025 with the support of the OSCE and the CAREC, aggregated to a regional estimate)

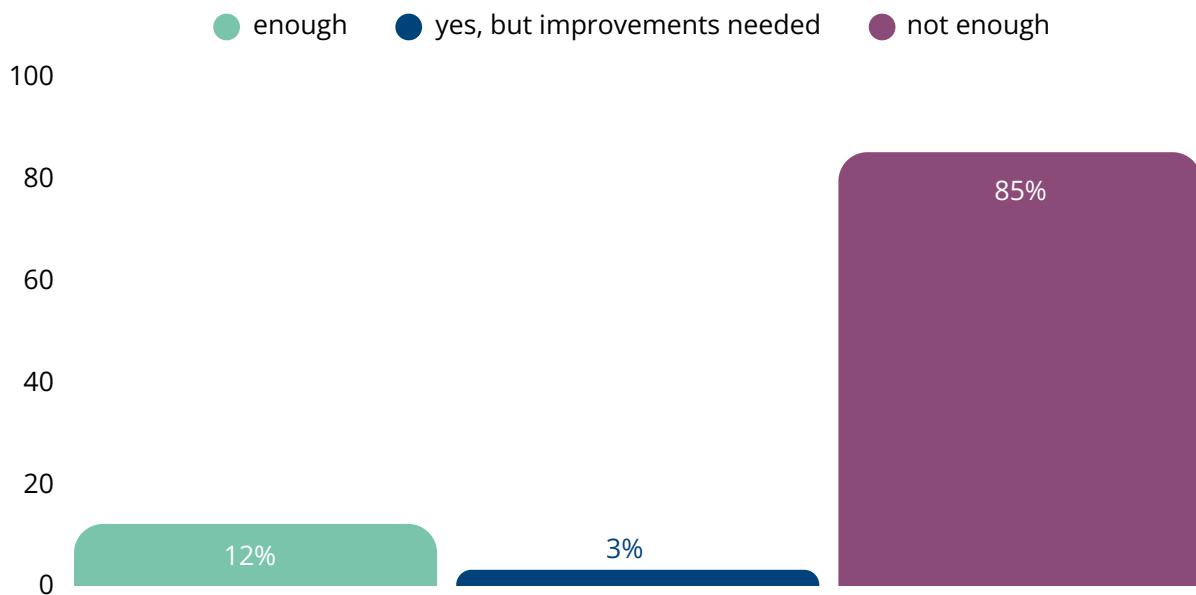


Diagram 4.

Are there enough specialists for the renewable energy sector produced by educational institutions in Central Asia? (average of percentages reported by surveyed stakeholders as part of the needs assessment carried out in Central Asia in 2025 with the support of the OSCE and the CAREC, aggregated to a regional estimate)

The projected demand is not just for more specialists, but also for specialists with the right skills to perform highly specialized roles in emerging areas such as hydrogen energy, advanced energy storage systems, and digital network management. Additionally, there is a critical need to increase the participation of women in the renewable energy workforce to ensure a diverse and inclusive talent pool capable of driving innovation in these rapidly evolving sectors.

This means that educational institutions cannot afford to be reactive; they must proactively develop curricula that anticipate future industry needs by integrating cutting-edge technologies and interdisciplinary skills (e.g., climate modeling, ESG, project management). This requires significant foresight and flexibility in education planning. And this is the goal of the OSCE's initiative 'Regional Task Force on Education for a Just and Inclusive Energy Transition in Central Asia' (RTEET).

Table 2.

Summary of skills shortages in key RE professions in Central Asia (OSCE-CAREC survey)








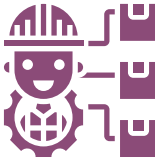

	 Assessment of workforce shortage and level of practical knowledge (%)	 Key specialties in shortage	 Specific skill gaps
 Kazakhstan	80% of experts confirm an acute shortage of personnel; 100% believe that the level of practical knowledge among young professionals is insufficient	Engineers (all levels), specialists in specific types of renewable energy (solar, wind, bio), energy managers, energy efficiency specialists	Practice-oriented training, modern technologies, interdisciplinary skills (energy management, energy efficiency), digital skills, project management
 Kyrgyzstan	88% of experts confirm an acute shortage, 100% mismatch between graduates' skills and market requirements	Engineers (design, operation, integration), energy storage specialists, technicians/installers, energy managers/auditors, sustainable development specialists	International standards, project economics, project management, digital tools (SCADA, modeling), practical installation/operation experience, legislation
 Tajikistan	86% of experts confirm a shortage and insufficient level of practical knowledge among young professionals	Design engineers (PV, wind), electrical engineers (SCADA, instrumentation and control), project managers, operations and maintenance (O&M) specialists, mid-level technical staff	In-depth knowledge of new RES technologies (except hydro), practical application, working with modern equipment, integration of research into training
 Turkmenistan	67% of experts confirm an acute shortage of personnel 100% acknowledge the insufficient level of knowledge among young specialists	Design engineers, technical design specialists, network integration, operation, and maintenance (O&M) specialists	Practical skills, adaptation to new technologies, overcoming the dominance of the hydrocarbon sector
 Uzbekistan	All stakeholders confirm a shortage of personnel and insufficient practical knowledge among young specialists	Engineers (operation, design), specialists in storage systems/hybrids, network integration, hydrogen energy, digital solutions (SCADA, IoT, AI), standardization/certification, teachers	Access to modern equipment, internships, interdisciplinary skills, digital tools, climate modeling, ESG, industrial safety

Table 2 shows the quantitative and qualitative aspects of the skills shortage, allowing regional patterns to be identified.

Summarizing the above information, Central Asian countries share a shortage of specialists in the following types of tasks and specialties (**Table 3**):

Table 3.
Shortage of Specialists by Task and Specialty in Central Asia

Specialists	Tasks and specialties
 <p>Lawyers, economists, managers</p>	<ul style="list-style-type: none"> • Energy policy and legislation lawyers • Contract lawyers in the renewable energy sector • Economists specializing in green energy and renewable energy technologies with energy efficiency calculation skills • Project managers in the renewable energy sector • Energy managers
 <p>Design and modeling of renewable energy projects</p>	<ul style="list-style-type: none"> • Station design engineers (solar, wind, small and micro hydro, hydrogen) • Energy system planners (smart grids) • Battery Energy storage system (BESS) engineers • Renewable energy modeling specialists (PVsyst, WindPro) • Digitalization and SCADA system specialists • Architects with knowledge of green building principles and renewable energy
 <p>Manufacturing and assembly of renewable energy technologies</p>	<ul style="list-style-type: none"> • Renewable energy equipment manufacturing engineers • Equipment assembly and installation specialists • Equipment commissioning specialists
 <p>Construction, installation, and grid connection</p>	<ul style="list-style-type: none"> • Installation, grid connection, and commissioning engineers • Electrical engineers, mechanical engineers • Electrical installers



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Specialists

Tasks and specialties



Operation and technical maintenance (O&M)

- Renewable energy plant operation and maintenance engineers
- Maintenance technicians and electricians
- Operators, fitters, and repairers of renewable energy systems and networks



Related professions

- Meteorologists, environmentalists
- Data analysts and researchers (biotechnology)
- ESG analysts (environmental, social, and governance)
- Specialists in standardization, certification, and energy auditing
- Circular economy specialists (component recycling)
- Specialists in cartography and geoinformatics (GIS)



© OSCE-CAREC visit to the Satpayev University laboratory for the production of electric vehicle charging stations, Kazakhstan

04

EDUCATION AND TRAINING IN THE RENEWABLE ENERGY SECTOR

4.1. Structure and Scope of Educational Programs

The education system in Central Asian countries is actively adapting to the needs of the renewable energy sector, but this is happening at different speeds and with varying degrees of change in different countries.

In Kazakhstan, the Gumarbek Daukeev Almaty University of Power Engineering and Telecommunications (AUPET) is a leading university actively developing RES programs, including bachelor's, master's, and doctoral degrees within the Institute of Energy and Green Technologies [24]. The Kazakh National Research Technical University named after K.I. Satpayev (Satbayev University), the Kazakh-German University (DKU), the Kazakh-British Technical University (KBTU), and the Eurasian National University named after L.N. Gumilyov also offer energy specializations that include modules on renewable energy sources. At the secondary vocational education level, colleges such as the Almaty State College of Energy and Electronic Technologies offer qualifications in electrical engineering and related specializations.

In Tajikistan, the key higher education institutions are the Tajik Technical University (TTU) named after Academician M.S. Osimi, which has an energy faculty and

a specialization in "Non-traditional and Renewable Energy Sources" [25]. The branch of the Moscow Power Engineering Institute (MPEI) in Dushanbe, the Tajik National University, the Tajik Agrarian University named after Shirin Shokh Shokhmurodov, and the Tajik Energy Institute in Bokhtar also contribute to the training of personnel. Secondary specialized and technical colleges, such as the Technical College of TTU, train specialists in power supply.

In Uzbekistan, more than 20 universities offer bachelor's and master's degree programs in fields related to RES, including "Alternative Energy Sources," "Renewable Energy Sources and Physics of a Sustainable Environment," "Hydrogen Energy and Hydrogen Technologies," and "Hydroelectric Power Plants, Hydropower Engineering." More than 17 universities offer postgraduate programs (PhD, DSc) in "Energy Plants Based on Various Types of Renewable Energy Sources." Some colleges, such as the Tahiatash Professional College of Energy, are beginning to introduce elements of RES training. Among the leading public universities are Tashkent State Technical University (TSTU), Fergana Polytechnic Institute (FerPI), and Urgench State University (UrDU), among others.

In Turkmenistan, the State Energy Institute of Turkmenistan in Mary is recognized as a key institution in the field of RES education, with a specialized RES Research and Production Center [26]. The Yagshigeldy Kakayev International University of Oil and Gas is showing growing interest in green energy and is developing its "Hydrogen Energy Center." The Turkmen State Architectural and Construction Institute participates in energy-efficient construction projects, and the Oguz Khan University of Engineering and Technology offers specializations related to ecology and renewable energy. The Green School program integrates sustainable development principles into curricula from preschool to higher education.

In Kyrgyzstan, specialists in renewable energy are trained at the Kyrgyz State Technical University named after I. Razzakov (KSTU), the Osh Technological University named after M.M. Adyshev (OshTU), the Kyrgyz-Russian Slavic University named after B.N. Yeltsin (KRSU), and the Kyrgyz National Agrarian University named after K.I. Skryabin (KNAU). The Bishkek Technical College of the Razzakov Kyrgyz Technical University also contributes to secondary vocational education.

Although most countries have well-established energy faculties in their technical universities, there is a trend towards the creation of more specialized programs on RES or dedicated centers (e.g., the Institute of AUPET in Kazakhstan, the TTU Center in Tajikistan, and the Research Center at State Energy Institute in Turkmenistan). Countries recognize the need to develop specific educational programs for the RES sector that go beyond general electrical and energy education. However, the depth and breadth of these specializations vary, and some still offer only fragmented modules on RES.

4.2. Key Gaps in Training

An analysis of the content of curricula in Central Asian countries reveals both certain strengths in the institutionalization of RES topics and significant limitations related to the relevance and practical orientation of training.

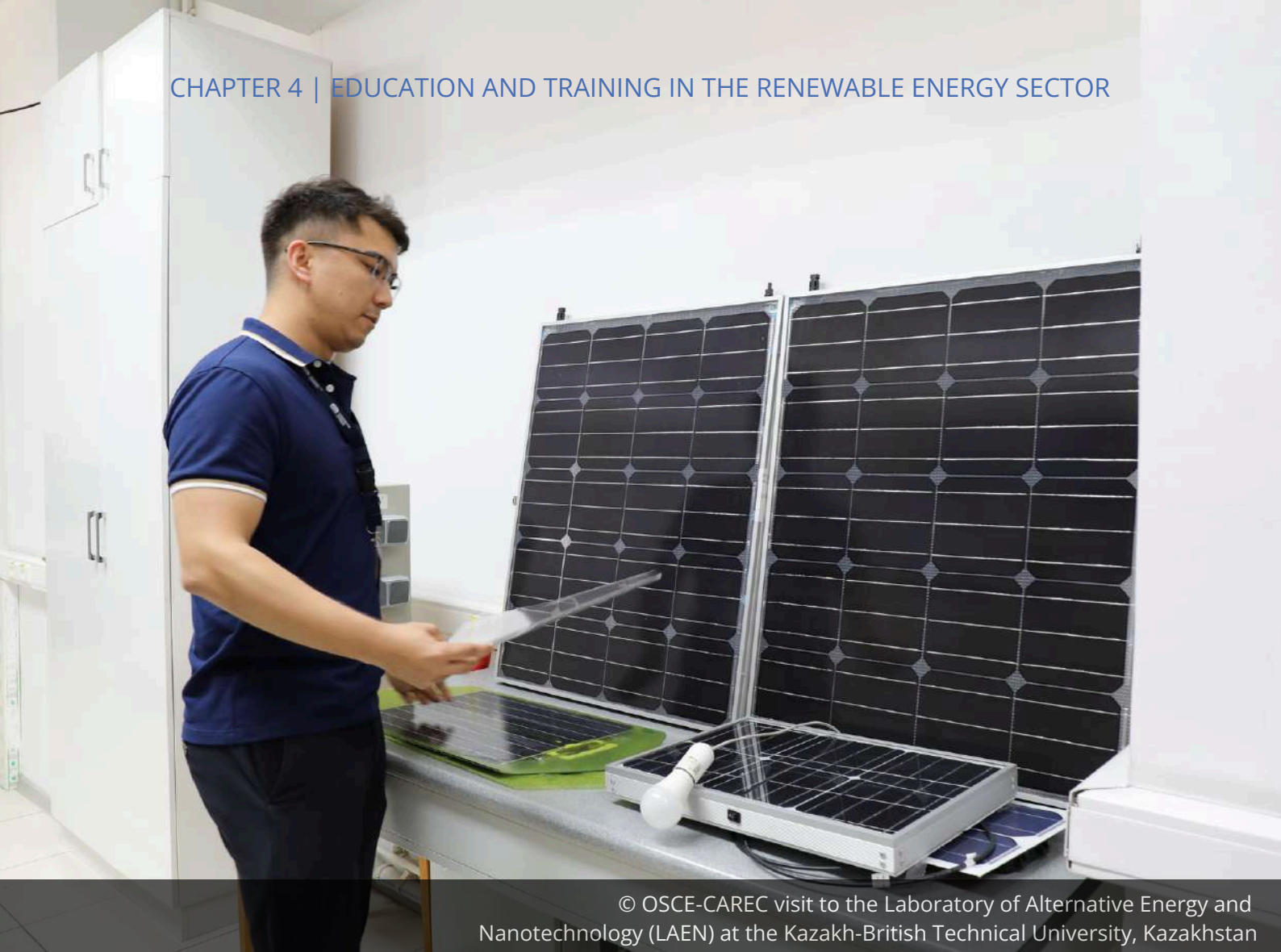
In Kazakhstan, it is noted that many educational programs are outdated and do not include modern technologies and practical aspects. There is a lack of specialized programs on specific types of RES (solar, wind, bioenergy), as well as on related disciplines such as energy management and energy efficiency. It is recommended to update and modernize curricula, include practice-oriented training, develop interdisciplinary programs, and involve practitioners from the industry.

In Tajikistan, the Tajik Technical University (TTU) offers a specialization in "Non-traditional and Renewable Energy Sources" and has extensive digital teaching materials on various types of RES [25]. However, the lack of detailed information on the structure of specific practical programs or the list of equipment for practical training raises questions about the depth of training beyond hydropower. Curricula are likely to be heavily oriented toward traditional energy sources, with insufficient focus on emerging RES technologies.

In Uzbekistan, in related bachelor's programs, courses related to renewable energy make up 40% of total academic load and at master's level - up to 60%, with a strong focus on solar, wind, hydro, and biomass energy, as well as energy storage and sustainable design [22]. Master's programs include hydrogen technologies and digital management. However, limitations include: limited modern laboratory and experimental facilities, especially for hydrogen energy and energy storage systems; limited participation of industry professionals in the teaching process; and the lack of systematic mechanisms for industrial practice and internships. The irrelevance of course content is also mentioned as a problem.

In Turkmenistan, the Scientific and Production Center for Renewable Energy Sources at the State Energy Institute of Turkmenistan covers photovoltaic conversion technologies, concentrated solar energy, wind energy, and biomass processing [26]. The International University of Oil and Gas has a Hydrogen Energy Center. There is an emphasis on developing practical skills and applied training. However, the continued prevalence of traditional energy-focused programs within existing institutions limits the development and depth of specialized RE programs.

In Kyrgyzstan, RES topics are represented in a limited and fragmented manner in curricula. There is a lack of specialized courses on solar, wind, and bioenergy. Practical training is insufficient, especially in terms of working with modern equipment and digital control systems.



© OSCE-CAREC visit to the Laboratory of Alternative Energy and Nanotechnology (LAEN) at the Kazakh-British Technical University, Kazakhstan

A widespread and critical limitation in all countries is the gap between theoretical academic training and the practical requirements of the renewable energy sector. This manifests itself in "insufficient practical training," "limited modern laboratory and experimental facilities," and "outdated curricula."

This means that even when renewable energy topics are included, the pedagogical approach and infrastructure are not sufficiently geared towards preparing specialists who are ready to work in the renewable energy industry. Rapid technological evolution in renewable energy means that static curricula quickly become outdated, creating a constant skills mismatch.

The problem of outdated curricula and lack of practical training is often rooted in a "shortage of teaching staff with relevant industry experience." Although continuing education programs exist, they may not be sufficiently adapted to the rapidly changing knowledge base in the renewable energy sector. This is exacerbated by "limited cooperation between industry and academia," meaning that universities do not receive regular and sufficient information about changing employer needs and are not integrated with them.

4.3. Main Challenges in Education

The renewable energy sector in Central Asia has enormous growth potential, but its development is slowed by a number of obstacles, particularly gaps in education and the skill sets provided by universities in the region. These challenges directly affect the training of specialists needed for the sustainable development of this industry.

1. Mismatch between curricula and labor market needs:

- **Outdated curricula:** In several cases, university programs in Central Asia have been slower to adapt to recent technological developments in the renewable energy sector. Curricula often focus on traditional energy sources or provide only basic, introductory knowledge of renewable technologies.
- **Limited specialization:** There are few highly specialized programs in renewable energy (e.g., solar power engineering, wind energy, geothermal energy, energy storage systems), which limits opportunities for graduates to acquire the in-depth knowledge and skills required for more specialized roles in the sector.
- **Theoretical focus:** Education often remains largely theoretical, with limited practical training, laboratory work using modern equipment, or internships at renewable energy facilities. As a result, graduates may enter the labor market with limited hands-on experience and practical application skills.

2. Limited material and technical resources at universities:

- **Gaps in access to modern equipment:** Most universities have limited access to modern laboratory equipment, simulators and test facilities required for practical training in renewable energy. This can reduce opportunities for students to gain hands-on experience with technologies currently used in the industry.
- **Limited availability of advanced technologies:** Constraints in funding, access to advanced technologies, and relatively weak links with industry can affect the relevance of the material taught.

3. Qualifications of teaching staff:

- **Limited availability of RES experts:** The relatively small number of teachers with practical experience in the field of renewable energy sources is a serious challenge. While many teachers have strong academic education, exposure to the latest trends and requirements of the renewable energy industry is limited.
- **Gaps in professional development programs:** Regular professional development programs, training, and internships that would allow teachers to update their knowledge and skills in line with the rapidly evolving RES sector are not always available.
- **Weak links with industry:** Insufficient involvement of industry practitioners in the educational process (guest lecturers, thesis supervisors, members of examination boards) reduces students' exposure to practical experience and up-to-date insights into labor market requirements.



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4. Gaps in practice-oriented training and interaction with industry:

- **Limited internships and work placements:** Opportunities for students to undertake internships and work placements at RES companies are extremely limited. This reduces opportunities to apply knowledge in practice, gain real work experience, and become familiar with operational and production processes.
- **Weak integration of research and development:** Universities are not actively involved in RES research and development, which leads to limited innovation in the educational process and weak links with the needs of the real economy. The insufficient development or absence of specialized centers and incubators, technology parks focused on renewable energy sources hinders the development of entrepreneurial skills among students and the commercialization of their ideas.

5. Limited flexibility and adaptability of the education system:

- **Slow response to market changes:** Education systems in Central Asia are slow to respond to rapidly changing labor market requirements. The process of approving new curricula and disciplines can be lengthy.
- **Insufficient development of "soft" skills:** In addition to technical skills, the modern labor market in the RES sector requires developed "soft" skills, such as critical thinking, problem solving, teamwork, communication, adaptability, and project management. University programs often do not give these skills the attention they deserve.



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05

GENDER COMPOSITION IN THE RENEWABLE ENERGY SECTOR AND EDUCATION

5.1. Women in the Renewable Energy Sector

The representation of women in the energy sector in Central Asia, especially in technical and managerial roles, remains extremely low, although there are some encouraging trends in the renewable energy sector.

In Kazakhstan, women account for about 25% of the workers in oil and gas and energy sectors. However, in traditional industries such as coal mining and oil and gas, women's participation is 22% and 18%, respectively [27]. The renewable energy sector shows more positive dynamics, with women accounting for 30% of the electricity sector workforce (including RES). Within that share, women mainly occupy lower-skilled positions (53%), and their representation in managerial (16%) and technical (19%) positions is significantly lower [27].

In Tajikistan, general data on the energy sector shows a low level of women's representation (10% of the total number of employees) [28, 29]. In hydropower, women most often occupy administrative and support roles, while technical positions are almost entirely held by men. Women's participation in the renewable

energy sector is minimal. Reports by the OSCE, ADB, the World Bank, and other organizations on gender equality* also confirm the low level of women in technical professions and the energy sector [30].

In Uzbekistan, all organizations report a significant predominance of men among technical and engineering personnel (up to 90%), while share of women in energy sector is reported at around 12% [31, 29]. The ratio is more balanced in managerial and academic roles, but still skewed towards men.

In Turkmenistan, available information suggests that women’s participation in the energy sector is primarily concentrated in non-managerial roles, with limited representation in technical and operational functions [32, 29].

In Kyrgyzstan, an analysis of the distribution of men and women among specialists employed in various segments of the RES sector reveals a gender imbalance. In almost all professional categories of a technical and production as well as managerial profiles, the share of women is lower than that of men [33, 29].

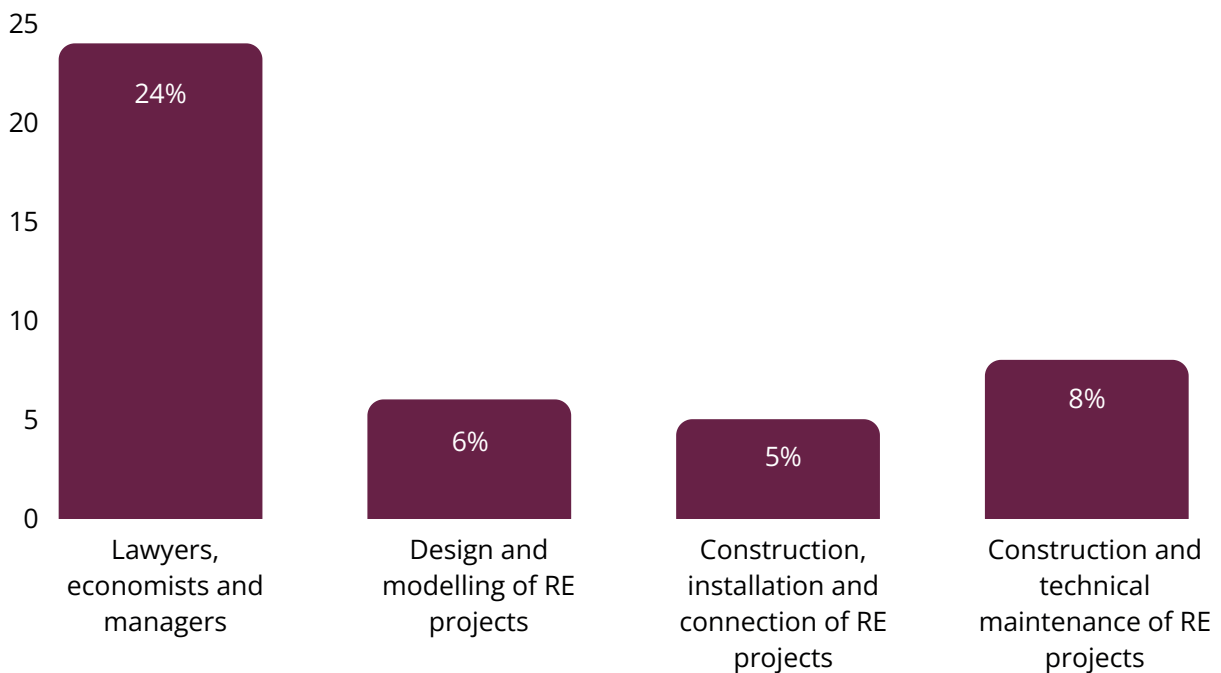


Diagram 5. Percentage of women working in RES specialties in Central Asia (percentages reflect only perceptions of respondents in focus interviews, aggregated to a regional estimate)

***Disclaimer**

In line with the consensual 2004 OSCE Action Plan for the Promotion of Gender Equality, the OSCE works to promote equality between men and women, boys and girls.



© OSCE, Field visit for Empowering Women in Energy, Kyrgyzstan

5.2. Women in Renewable Energy Education Programs

The gender imbalance characteristic of the energy sector is also evident in educational programs that train RES specialists, which is a serious obstacle to the development of an inclusive human resource base.

In Kazakhstan in 2022, less than 10% of students studying energy were women [34, 22]. The survey showed a significantly lower percentage of women compared to men in all RES specialties. The highest number of women (33%) are studying specialties related to the commercial implementation of RES, and the lowest number are studying specialties related to the technical maintenance of RES stations.

In Tajikistan, women account for 38.5% of higher education graduates [35], but the gender gap is even more pronounced in STEM fields (for example, in computer science, the share of female students may be as low as 10%) [22]. The percentage of men and women in RES specialties in educational institutions also shows a predominance of men.

In Uzbekistan, an assessment of gender balance in training programs for specialists in the field of RES revealed a persistent and significant imbalance: women account for only about 11–13% of students in technical RES fields at all forms and levels. The most critical indicator is recorded at the master's level, with only 3.8% of women, indicating a sharp decline in women's participation at the advanced level of training. At the PhD and D.Sc. levels, women's participation is virtually non-existent [22].

In Turkmenistan, the student environment shows a more balanced gender structure, especially in the areas of RES development and maintenance, where women account for up to 30% of students [22]. However, women are largely absent from fields related to the commercial implementation of energy projects.

In Kyrgyzstan, an analysis of the gender distribution of students enrolled in RES-related specialties shows that only about 10% of students pursuing technical and applied specializations in RES, especially in engineering, installation, and production roles, are women [22, 36].

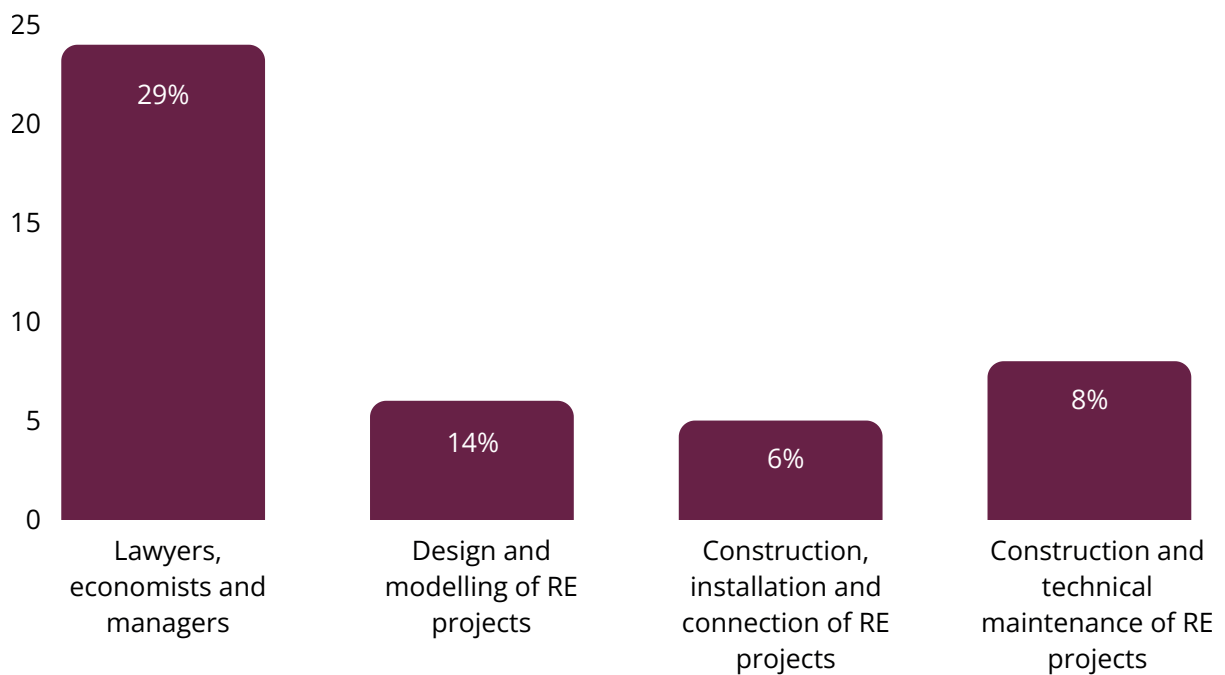


Diagram 6. Percentage of girls studying renewable energy specialties in educational institutions in Central Asia (percentages reflect only perceptions of respondents in focus interviews, aggregated to a regional estimate)



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06

CONCLUSIONS AND RECOMMENDATIONS

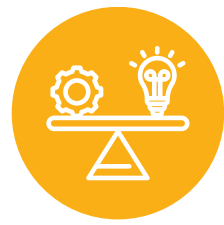
6.1 Summary of Key Challenges

The analysis identified a number of structural factors that would need to be addressed in order to support Central Asia in successfully advancing the development of its renewable energy sector. These issues are interlinked and would benefit from a comprehensive and coordinated approach.



Availability of skilled and diverse personnel: All five countries face significant challenges related to the availability of specialists, from architects with knowledge of RES systems, planning, design and operation engineers to lawyers, economists, technical specialists and teachers with practical knowledge. This gap is both quantitative, due to insufficient numbers of graduates, and qualitative, reflecting a mismatch between graduates' skills and evolving market needs.

Gap between theory and practice in education: Curricula are often not fully aligned with recent technological developments and provide limited opportunities for practical training. In addition, the laboratory, material and technical base of educational institutions is in many cases insufficient, limiting the development of applied skills.



Limited systematic training in emerging areas: While interest in hydrogen technologies, energy storage systems, smart grids, digitalization and ESG competencies is increasing, dedicated disciplines in these areas remain underdeveloped or fragmented.

Limited cooperation between education and industry: Mechanisms for coordination with industry, systematic internship programs, and the involvement of industry experts in teaching are limited, contributing to a mismatch between the skills of graduates and the real demands of the market.



Gender imbalance: Participation of women in technical and applied renewable energy fields remains limited, particularly in engineering and manufacturing roles. This limits the inclusiveness of the system and the potential of the sector as a whole.

Impact of resource dependence and economic factors: Countries with a dominant hydrocarbon economy or extremely low electricity tariffs have seen slow development of diversified RES. This has also affected demand for specialized skills, contributing to continued outward migration of qualified professionals.



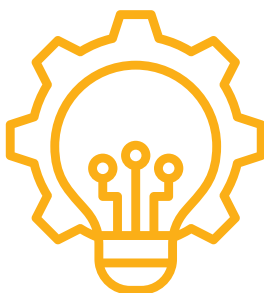
6.2. Recommendations to Improve Training systems

To ensure the sustainable development of the RES sector and overcome human resource challenges, the following recommendations are addressed to government agencies, educational institutions, and international partners:



Institutional consolidation and foresight of needs:

- Ensure institutional consolidation of the human resources component in strategic documents on RES development, including mechanisms for regular assessment and forecasting of medium- and long-term needs.
- Initiate the development of a national qualifications framework for the renewable energy sector, covering the entire spectrum of competencies from secondary vocational education to research and management positions.



Modernization and updating of educational programs:

- Review and update curricula in universities and colleges to reflect the latest technologies in the field of renewable energy, including smart grids, digitalization, hydrogen technologies, and energy storage systems.
- Develop specialized courses and modules on specific technologies (solar, wind, hydro, bioenergy) at all levels of education, with a focus on safety, standardization, and integration into existing networks.

Strengthen practical training and laboratory facilities:



- Significantly increase the share of practice-oriented components of training, including laboratory modules, industrial internships, project activities, and modules developed jointly with industrial partners.
- Ensure targeted and substantial funding for the creation and equipping of modern laboratories and workshops specifically designed for various RES technologies, including trainers and simulators.
- Develop dual education by systematically involving students in practical work at enterprises and in real projects.

Teacher development (ToT):



- Develop specialized, continuously updated professional development programs for teachers focused on the latest technologies and methodologies in the field of renewable energy. These programs should include practical workshops, on-the-job training, and opportunities to participate in research projects.
- Engage practitioners and industry representatives in teaching, master classes, and joint curriculum development.

Attracting and retaining talent:



- Develop and implement government and industry incentive programs to enhance the attractiveness of professions in the energy sector, including competitive salaries and social packages.
- Strengthen career guidance among young people and women, and promote careers in the renewable energy sector through information campaigns and educational events.
- Create clear career paths and opportunities for professional growth in the renewable energy sector, as well as conditions for retaining talent, including addressing brain drain.

Promoting gender equality:



- Develop targeted programs to attract women to STEM education and professions in the renewable energy sector, including scholarships, grants, and mentoring programs.
- Conduct information campaigns aimed at overcoming stereotypes and ensure equal opportunities for career growth and development for women in the energy sector.



Utilizing international experience and cooperation:

- Actively participate in international educational programs and projects to exchange experience in training RES specialists.
- Attract foreign experts and technologies to improve the quality of training and introduce best practices.
- Promote knowledge and technology transfer through international partnerships, technical assistance, and academic exchanges, particularly in the areas of sustainable urban planning, digital modeling, and climate risk assessment.

6.3. Development of Educational Programs and Courses

To provide the RES sector with qualified specialists, it is necessary to focus on creating and improving educational programs that cover both theoretical knowledge and practical skills.



I. Higher education programs (bachelor's, master's, doctoral)

1. Programs on the integration of renewable energy sources and smart grids:

- **Bachelor's/Master's:** "Integration of RES into the energy system." Contents: characteristics of renewable energy generation, technical features of solar and wind energy integration (intermittency, forecasting, frequency and voltage control), impact of renewable energy on the stability and reliability of the power system, modeling and simulation of renewable energy integration.
- **Bachelor's/Master's degree:** "Digital Energy and Smart Power Systems." Contents: demand-side management, energy storage systems, microgrids, cybersecurity in the energy sector, the Internet of Things (IoT) in the energy sector, big data and artificial intelligence for predicting renewable energy generation.

2. Specialized engineering programs in renewable energy:

- **Bachelor's degree:** Creation of specialized fields such as "Solar Energy Systems Engineer" (with in-depth study of photovoltaics, concentrated solar energy, storage systems), "Wind Energy Engineer" (design, construction, aerodynamics, grid integration), "Bioenergy Systems Engineer" (biogas plants, biofuels, waste utilization).

- **Master's/Doctoral programs:** Focus on research and innovation: "Advanced Materials and Technologies for Renewable Energy," "Modeling and Optimization of Renewable Energy Systems," "Environmental Sustainability and Life Cycle of Renewable Energy Projects."

3. Programs in renewable energy management, economics, and law:

- **Master's/MBA:** "Renewable Energy Project Management and Green Finance." Content: economic assessment of renewable energy projects, risk management, investment attraction (including ESG factors), project financing, business plan development, legal support for renewable energy projects, international energy law.

4. Hydrogen technology programs:

- **Bachelor's/Master's degree:** "Hydrogen Energy and Hydrogen Technologies," including safety, storage, transportation, and application issues.



II. Vocational education programs (colleges)

1. Specialized programs for technicians and installers:

- "Solar Power Plant Installer and Maintenance Technician": In-depth training in the installation of all types of solar panels, connection of inverters, configuration of monitoring systems, maintenance, and troubleshooting.
- "Wind Power Plant Operation and Repair Technician": Practical training in mechanics, electrical engineering, wind turbine hydraulics, control systems, and working at heights.
- "Bioenergy Plant Technician": Maintenance of biogas reactors, biomass collection and utilization systems.
- "Small Hydropower Plant Installation and Maintenance Technician" (for Tajikistan and Kyrgyzstan).

2. Energy audit and energy efficiency specialist (practical level):

- Conducting thermal imaging surveys, calculating heat losses, selecting energy-efficient materials and equipment, and learning the basics of integrating solar collectors or heat pumps.



III. Short-term courses and advanced training programs (for working professionals and graduates)

- Certification courses: Development of programs for obtaining international certificates in specific technologies (e.g., Trina Solar installer, Siemens Gamesa operator).



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- **Software and modeling:** In-depth courses on software for designing and modeling renewable energy sources (PVSyst, WindSim, Homer Pro, EnergyPlus, MATLAB/Simulink, PowerFactory, DigSILENT, Python) and for long-term planning of the energy system as a whole (LEAP, TIMES, MESSAGE, PyPSA).
- **Operation and Maintenance (O&M):** Practical training for engineers and technicians on the efficient operation and preventive maintenance of solar and wind power plants.
- **Occupational Safety:** Specialized courses on occupational health and safety at renewable energy facilities, including working at heights, electrical safety, and working with chemicals (for batteries).
- **Energy management:** Courses for business leaders and managers on the implementation of energy management systems using renewable energy sources.
- **Green building standards:** Courses for architects and civil engineers on integrating renewable energy and energy-efficient solutions into buildings (e.g., LEED, BREEAM).
- **Economics in energy:** Study of the basics of economic analysis, including energy cost calculation (LCOE) and full system cost of electricity (FCOE), investment appraisal, tariff regulation, economics of renewable energy projects, and green financing.



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6.4. RTEET: Next Steps

The Needs Assessment confirms that the energy transition in Central Asia is moving at a fast pace. Rapid renewable deployment across the region outpaces grid readiness and the availability of specialized technical training. This signals a strategic need for human capital investment and educational cooperation at the regional level.

To address this, the upcoming phase of the OSCE Regional Task Force on Education for a Just and Inclusive Energy Transition (RTEET) will advance academic collaboration with industry and policymakers through the development of a new regional university course on “Integration of variable renewable energy (vRE) into power systems in Central Asia”. A select group of pilot universities will be in the lead of course development and its integration in their wider educational programs in 2026.

This OSCE initiative will also continue engaging leading academicians from across Central Asia to embed diverse perspectives, inclusive learning pathways, and gender-responsive curricula into the renewable energy workforce agenda. CAREC and the OSCE will provide strategic policy alignment and methodological coherence, ensuring that education systems align with industry demand and government priorities. In parallel, the OSCE will further strengthen the capacities of Central Asian youth, women, and energy-sector stakeholders to advance the energy transition and reinforce regional energy security, thereby supporting Central Asia in building a sustainable, secure, and resilient energy future.

SOURCES

[1] Ministry of Energy of the Republic of Kazakhstan. "[Concept for the Transition of the Republic of Kazakhstan to a Green Economy](#)" and "[Kazakhstan Strategy – 2050](#)."

[2] Ministry of Energy of the Republic of Uzbekistan. "Strategy for the Transition to Green Energy by 2030," and "Strategy for Uzbekistan – 2030."
<https://www.gazeta.uz/ru/2024/12/17/green-energy/>.

[3] IEA. Kyrgyzstan Country Overview.

<https://www.iea.org/reports/kyrgyzstan-2022/executive-summary>.

[4] UNECE. Energy Policy Brief. Tajikistan. <https://unece.org/sites/default/files/2025-06/3-Tajikistan%20Policy%20Brief.pdf>

[5] UNFCC Kazakhstan's NDC Pledge https://unfccc.int/sites/default/files/2025-11/NDC_Kazakhstan%203.0%20eng.pdf

[6] Kazakhstan's Renewable Energy Resource Guide by the US Trade Administration <https://www.trade.gov/energy-resource-guide-kazakhstan-renewable-energy#:~:text=In%20a%202010%20submission%20to,of%20renewables%20capacity%20by%202020>.

[7] UNFCC Kyrgyzstan's NDC Pledge 3.0 https://unfccc.int/sites/default/files/2025-10/NDC3.0_Kyrgyzstan_English_30-09-2025%20%282%29.pdf

[8] U.S. Trade Administration. Kyrgyz Republic's Renewable Energy Guide <https://www.trade.gov/country-commercial-guides/kyrgyz-republic-energy# ftntref1>

[9] CAREC. Energy Outlook 2030
<https://www.adb.org/sites/default/files/publication/850111/carec-energy-outlook-2030.pdf>

[10] UNFCC Tajikistan's NDC Pledge.

https://unfccc.int/sites/default/files/NDC/2022-06/NDC_TAJIKISTAN_ENG.pdf

[11] Tajikistan's Renewable Energy Resource Guide by the US Trade Administration <https://www.trade.gov/country-commercial-guides/tajikistan-electrical-power-systems>

[12] UNFCC Turkmenistan's NDC Pledge.

https://unfccc.int/sites/default/files/NDC/2023-01/NDC_Turkmenistan_12-05-2022_approv.%20by%20Decree_Eng.pdf

[13] IEA. What is the role of renewables in electricity generation in Turkmenistan?
<https://www.iea.org/countries/turkmenistan/renewables#what-is-the-role-of-renewables-in-electricity-generation-in-turkmenistan>

[14] International Bar Association. The energy transition in Central Asia: drivers, policy and opportunities

<https://www.ibanet.org/energy-transition-central-asia>

[15] UNFCC Uzbekistan's NDC Pledge 3.0. <https://unfccc.int/sites/default/files/2025-11/Uzbekistan%20Third%20NDC.pdf>

[16] QazaqGreen. By 2030, Uzbekistan plans to increase the share of renewable energy to 54%

<https://qazaqgreen.com/en/news/central-asia/2507/>

- [17] QazaqGreen. Renewable energy generation in Kazakhstan exceeded 8.6 billion kWh in 2025. <https://qazaqgreen.com/en/news/kazakhstan/3311/>
- [18] IEA. Kyrgyzstan energy profile. <https://www.iea.org/reports/kyrgyzstan-energy-profile>.
- [19] CIS. Tajikistan produces 98 percent of electricity from hydroelectric power plants <https://e-cis.info/news/567/113905/>.
- [20] Ministry of Foreign Affairs of Turkmenistan. Climate change and Turkmenistan's National Position at COP28 <https://docs.un.org/en/A/78/676>.
- [21] Ministry of Energy of the Republic of Kazakhstan. Concept for the Development of the Fuel and Energy Complex for 2023-2029. Astana <https://adilet.zan.kz/rus/docs/P1400000724>
- [22] OSCE Consultants' National Reports (unpublished, survey results aggregated to a regional level and provided in this consolidated regional report)
- [23] IEA. World Energy Outlook. Turkmenistan. <https://www.iea.org/reports/world-energy-outlook-2024>
- [24] Almaty University of Energy and Communications. Institute of Energy and Green Technologies. <https://energo.university/ru/institute/1/>
- [25] Tajik Technical University named after Academician M.S. Osimi. Faculty of Energy. <https://web.ttu.tj/ru/faculties/3>
- [26] State Energy Institute of Turkmenistan. Scientific and Production Center for Renewable Energy Sources. <https://secca.eu/wp-content/uploads/2024/05/2-Turkmenistan-H2-RUS.pdf> & <https://www.tdei.edu.tm/kafwebolfront/5>
- [27] UNDP Kazakhstan. Gender balance in the renewable energy sector in Kazakhstan. <https://www.undp.org/ru/kazakhstan/publications/gendernyy-balans-v-sektore-vozobnovlyaemoy-energetiki-v-kazakhstane-status-problemy-i-resheniya>
- [28] ADB. Tajikistan: Country Gender Assessment. <https://www.adb.org/ru/documents/tajikistan-country-gender-assessment-2016>
- [29] OSCE. Advancing a Just Energy Transition in Central Asia: Women's Key Role in the Energy Sector. <https://ocea.osce.org/ocea/561811>
- [30] World Bank. Tajikistan. Country Gender Assessment <https://documents1.worldbank.org/curated/en/921321638250371738/pdf/Tajikistan-Country-Gender-Assessment.pdf>
- [31] ADB. Updated Gender Assessment for Uzbekistan <https://www.adb.org/sites/default/files/institutional-document/495911/uzbekistan-country-gender-assessment-update-ru.pdf>
- [32] UN Women. The Government of Turkmenistan and UN Women held sub-regional consultations on gender equality in the context of climate change. <https://eca.unwomen.org/ru/stories/press-reliz/2022/02/pravitelstvo-turkmenistana-i-struktura-oon-zhenschiny-proveli-subregionalnye-konsultacii-po-voprosam-gendernogo-ravenstva-v-kontekste-izmeneniya-klimata-0>
- [33] UN Women. Facts and figures about us. Women and men in Kyrgyzstan. https://kyrgyzstan.un.org/sites/default/files/2022-03/UNW%20press%20release%20RU_FV.pdf

[34] Ministry of Science and Higher Education of the Republic of Kazakhstan. Statistical data on the gender composition of students in technical specialties. <https://stat.gov.kz/ru/industries/social-statistics/stat-edu-science-inno/publications/6389/>

[35] World Bank. Tajikistan. Country Gender Assessment <https://documents1.worldbank.org/curated/en/921321638250371738/pdf/Tajikistan-Country-Gender-Assessment.pdf>

[36] UCA. Communication platform of universities in the Kyrgyz Republic for engaging prospective students in technical specialties (STEM specialties) and its assessment for gender sensitivity. <https://roza.kg/press-center/news/6173>

APPENDIX

Appendix 1.

List of key stakeholders and respondents in Central Asia

 <p>Kazakhstan</p>	<ul style="list-style-type: none"> • Qazaq Green Association • Ministry of Energy of the Republic of Kazakhstan • Almaty University of Energy and Communications (AUES) • Satbayev University • Sh. Ualikhanov Kokshetau University • Kazakh-German University
 <p>Kyrgyzstan</p>	<ul style="list-style-type: none"> • Ministry of Energy of the Kyrgyz Republic • Energy Supervision Service under the Ministry of Energy of the Kyrgyz Republic • Department for Regulation of the Fuel and Energy Complex under the Ministry of Energy of the Kyrgyz Republic • Chakan Hydropower Plants JSC • Directorate of Constructed Power Plants JSC • National Electric Grid of Kyrgyzstan JSC • Kyrgyz State Technical University named after I. Razzakov (KSTU) • Osh Technical University, Institute of Energy and Transport • Kyrgyz National Agrarian University named after K. Skryabin • Bishkek Technical College of the Kyrgyz State Technical University
 <p>Tajikistan</p>	<ul style="list-style-type: none"> • Energy Institute of Tajikistan • Renewable Energy Association of Tajikistan • Tajik Technical University named after M.S. Osimi • Green Technology LLC / GIZ / Tajik Technical University • Institute of Energy of Tajikistan • Pamir Energy • Barki Tojik
 <p>Turkmenistan</p>	<ul style="list-style-type: none"> • Tebigy Kuwwat Public Association Enterprise • National Institute of Deserts, Flora and Fauna of the Ministry of Environmental Protection of Turkmenistan • State Energy Institute of Turkmenistan • EU SECCA Project • Tebigy Kuwwat • Turkmen State Energy Institute
 <p>Uzbekistan</p>	<ul style="list-style-type: none"> • Ministry of Energy of the Republic of Uzbekistan • Ministry of Investments, Industry and Trade of the Republic of Uzbekistan • Ministry of Higher Education, Science and Innovation of the Republic of Uzbekistan • National Electric Grids of Uzbekistan JSC • Tashkent State Technical University named after I. Karimov (TSTU) • Scientific Research Institute of Renewable Energy under the Ministry of Energy of Uzbekistan • Institute of Energy Problems of the Academy of Sciences of the Republic of Uzbekistan

