Advancing a Just Energy Transition in Central Asia

Women's Key Role in the Energy Sector

OSCE Organization for Security and Co-operation in Europe

The Organization for Security and Co-operation in Europe – OSCE Secretariat is proud to present the study "Advancing a Just Energy Transition in Central Asia: Women's Key Role in the Energy Sector". This study analyzes – through a gender lens – the socio-economic benefits of the energy transition in Central Asia and provides considerations for the strategic development of an appropriately skilled labour force.

The study was commissioned in the context of the OSCE project "Promoting women's economic empowerment in the energy sector in Central Asia for energy security and sustainability". It is based on findings from a range of sources, collected through an official Survey on the Participation of Women in the Sustainable Energy Sector in Central Asia, developed jointly by the OSCE, Global Women's Network for the Energy Transition – GWNET, and International Renewable Energy Agency – IRENA, as well as through desk research, interviews with regional government and non-governemnt experts, workshops, and IRENA's employment-factor methodology.

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Figures

Tables

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Bartogai dam on a mountain river Chilik, Kazakhstan.

INTRODUCTION

The urgent need to combat climate change and to strengthen energy security has prompted all five Central Asian countries – Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan – to prioritize the transition from fossil fuels to renewable energy. All five countries have abundant renewable energy potential, ranging from wind and solar to hydro and geothermal, and urgently need to develop the renewable energy workforce necessary for the transition and beyond.

A recent report finds that just 22 per cent of the global workforce in the oil and gas sector, and 32 per cent in the renewable energy sector, are women.[1] The International Renewable Energy Agency (IRENA) and the International Energy Agency (IEA) identify the potential for major job creation as countries transition to low-carbon systems to meet their commitments under the Paris Agreement. By bringing more women into the workforce, countries can simultaneously work towards gender equality, take necessary climate action, and advance progress towards all 17 Sustainable Development Goals, while honouring the 2030 Agenda principle to leave no one behind.

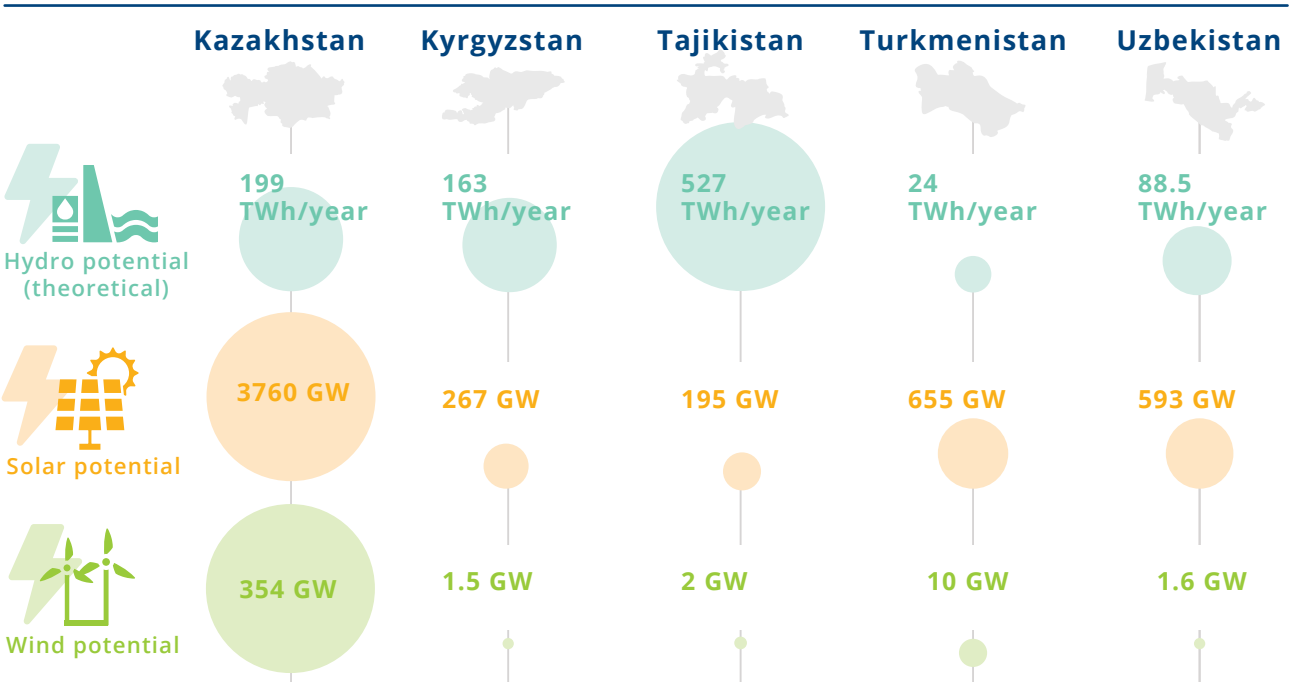
The Central Asian countries can address renewable energy skills shortages and begin closing gender gaps by integrating more women into the sector. And by including women in the design, development, operation, and management of new energy systems, they can close these gaps further and ensure that these systems incorporate wider perspectives and serve the needs of the entire population. These benefits are surely sufficient to justify encouraging more women to join the renewable energy workforce, but there are others, too – a wide range of sources find that increasing women's participation and leadership in the labour force generates benefits ranging from higher profits for companies to society-wide impacts such as higher GDP and increased household spending on education and health.

The participating States of the OSCE – including the five countries of Central Asia – have acknowledged that women's economic participation contributes significantly to economic recovery following crises, sustainable growth, and the creation of cohesive societies, and is essential to the security and stability of the OSCE region.[2] The participating States have also agreed on the importance of mainstreaming a gender perspective into the development and implementation of projects and policies related to energy sustainability, and of ensuring that men and women have equal opportunities to access resources and benefits, and to participate in decision-making at all levels.[3] In addition, the Energy Ministers of the countries in the Central Asia Regional Economic Cooperation Program (CAREC) have recognized the need for, and benefits of, a diverse, inclusive and balanced talent pool in the energy sector, and have committed to achieving gender equality by 2030.[4]

Despite these commitments and the growing awareness of women's centrality in advancing the energy transition, however, significant barriers and challenges to gender equality in the energy sector remain.

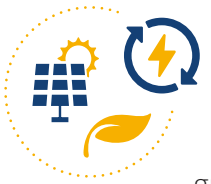
This study analyzes - through a gender lens - the socio-economic benefits of the energy transition in Central Asia and provides considerations for the strategic development of an appropriately skilled labour force. It presents projections of renewable energy job creation potential in the five countries of Central Asia and assesses the expected benefits resulting from women's greater participation in the energy sector. Finally, it investigates the current employment of women in energy, identifies barriers to gender equality in the sector, and provides recommendations for addressing these barriers.

Figure 1.
Renewable energy potential in Central Asia



Source: OSCE, 2022

Key findings



Though their economies and energy systems remain heavily dependent on fossil fuels, the countries of Central Asia have great potential for the development of renewable energy.

Kyrgyzstan and Tajikistan already operate significant hydropower installations and have the potential to develop further hydro capacity, while Kazakhstan and Uzbekistan have high potential for solar and wind energy generation. In recent years, the governments of these countries have set targets for emission reductions and renewable energy capacity as part of their commitments under the Paris Agreement. They have also begun the development of plans, laws and other instruments to accelerate their energy transitions.

All Central Asian countries can pursue multiple objectives through accelerated energy transitions, beyond the reduction of greenhouse gas emissions. Systems based on renewable energy are faster to deploy than traditional energy systems, are more resilient to climate change and other shocks, and more affordable over the long term, particularly in remote areas. The countries also have an opportunity to carve out a space in a rapidly changing global environment characterized by major technological competitions. And the energy transition opens up avenues for societal transformation with the potential for greater social justice and gender equality, including through the creation of tens of thousands of new, high-quality jobs, as the modelling exercise undertaken for this study demonstrates.

The model analysis ran for this study shows that if renewable energy capacity additions continue at the current pace, 17,345 jobs are likely to be created by 2050. But meeting the current renewable energy commitments under the Paris Agreement will result in the creation of more than 51,090 jobs by 2050.

Finally, an increase in country ambition to achieve 75 per cent renewable generation capacity by 2050 will result in the creation of more than 91,000 jobs.

An energy sector based on renewables requires a greater variety of skills than the traditional energy sector.

To meet the Central Asian countries' renewable energy targets, significant numbers of skilled personnel will be needed within the next three to five years, and the countries therefore need to encourage young women and men to start building those skills now.

Women have traditionally been, and still are underrepresented in the energy industry, accounting for an estimated 20 per cent of the energy workforce in Central Asia. To prevent skills shortages, ensure that the renewed energy systems meet the needs of both women and men, and guarantee that the energy transition benefits from the widest possible talent pool, stakeholders must increase their efforts to bring more women into the energy sector.

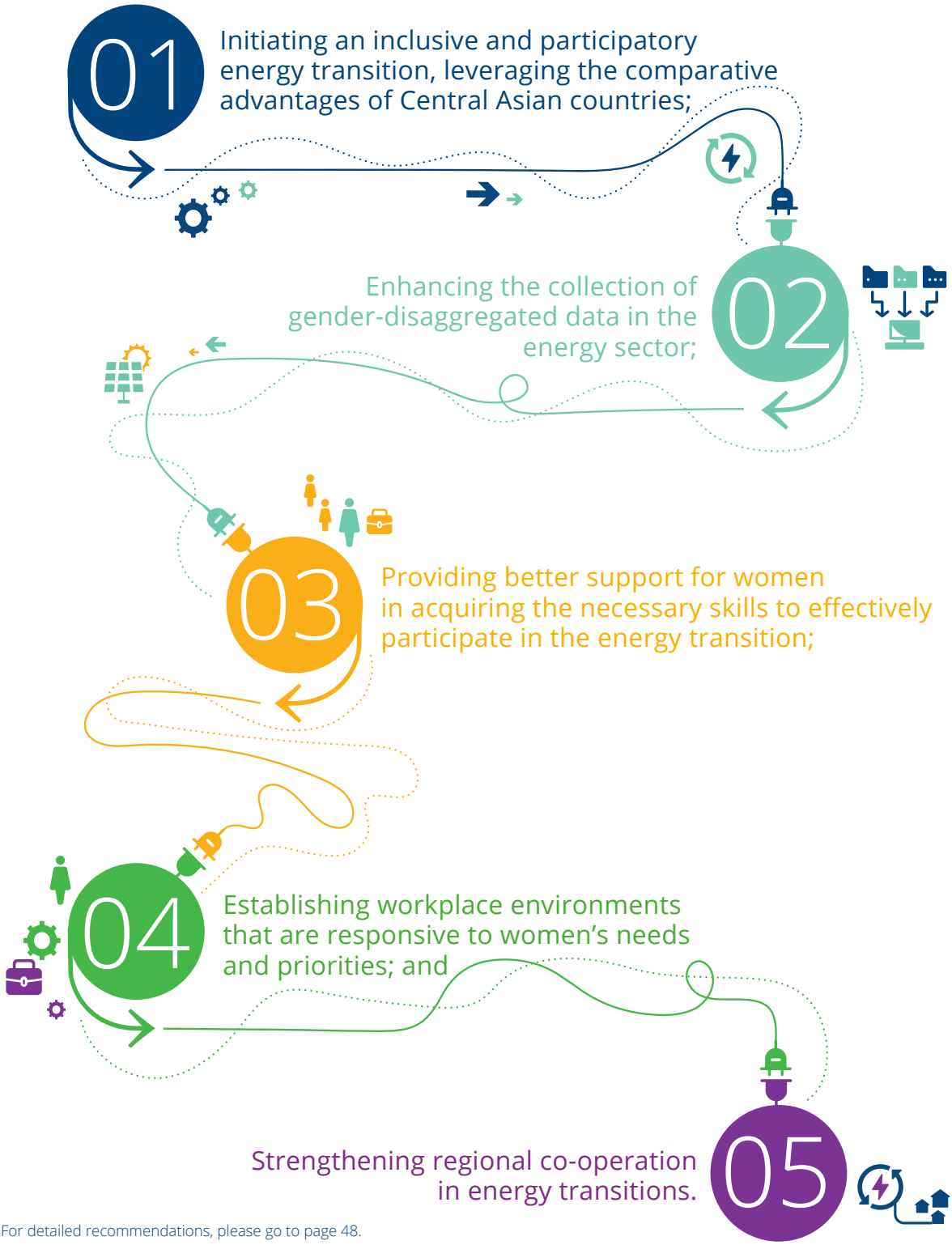
In a survey conducted for this study, respondents were asked to score the most significant barriers to women's entry into, and advancement in, the Central Asian energy sector. The findings were similar to those of surveys undertaken in other regions of the world, demonstrating that women in energy in Central Asia face similar hurdles to women elsewhere. Many of the barriers stem from culturally entrenched biases about women pursuing careers in technical, male-dominated sectors, and from traditional norms that require women to spend much more time than men on unpaid care and household work.

The barriers to gender equality are significant, but so are the opportunities.

Summary of recommendations

This report closes with recommendations intended to help Central Asian governments, companies, academic institutions, civil society, and other relevant stakeholders ensure that the transition to renewable energy harnesses the full potential of women's participation and leadership and leaves no one behind.

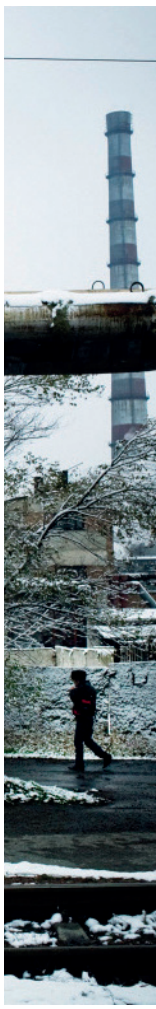
Specifically, the report proposes:



For detailed recommendations, please go to page 48.

THE ENERGY SECTOR IN THE REGION

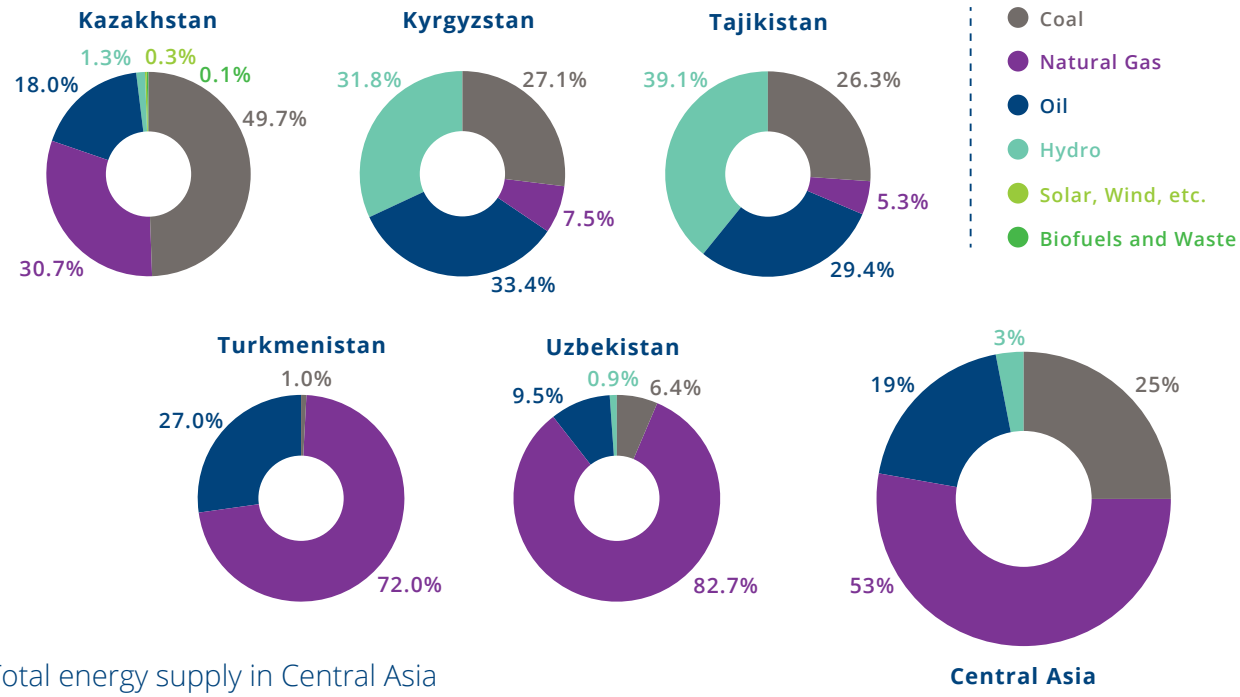
01



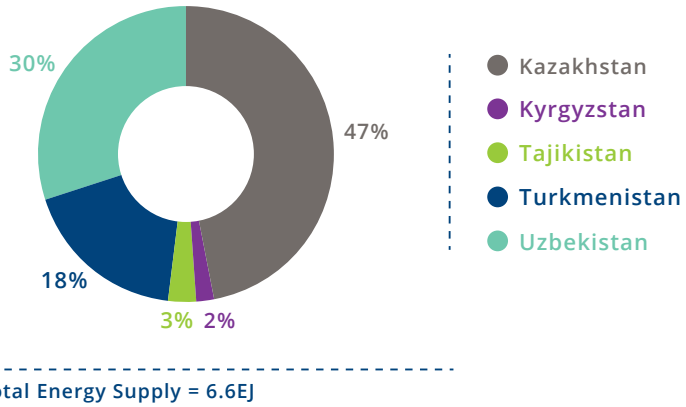
© William Daniels
A Soviet-era power plant in Bishkek.

Throughout Central Asia, energy systems dating from the Soviet era and designed to serve the Soviet strategy of centralized distribution of resources are no longer adequate. Many transmission and distribution lines are in need of replacement, while hydropower and thermal power plants that have come to the end of their lifespans require renovation.[5] Modernization is underway, and while this transformation poses financial and organizational challenges for the countries in the region, it also offers opportunities for efficiency improvements and innovation. It allows the countries to pursue improved services for their populations, and to create a new and more diverse energy workforce while making progress towards climate change mitigation commitments set out in their national development strategies.

Figure 2.
Energy mix by source and country, 2020



Total energy supply in Central Asia



Total Energy Supply = 6.6EJ

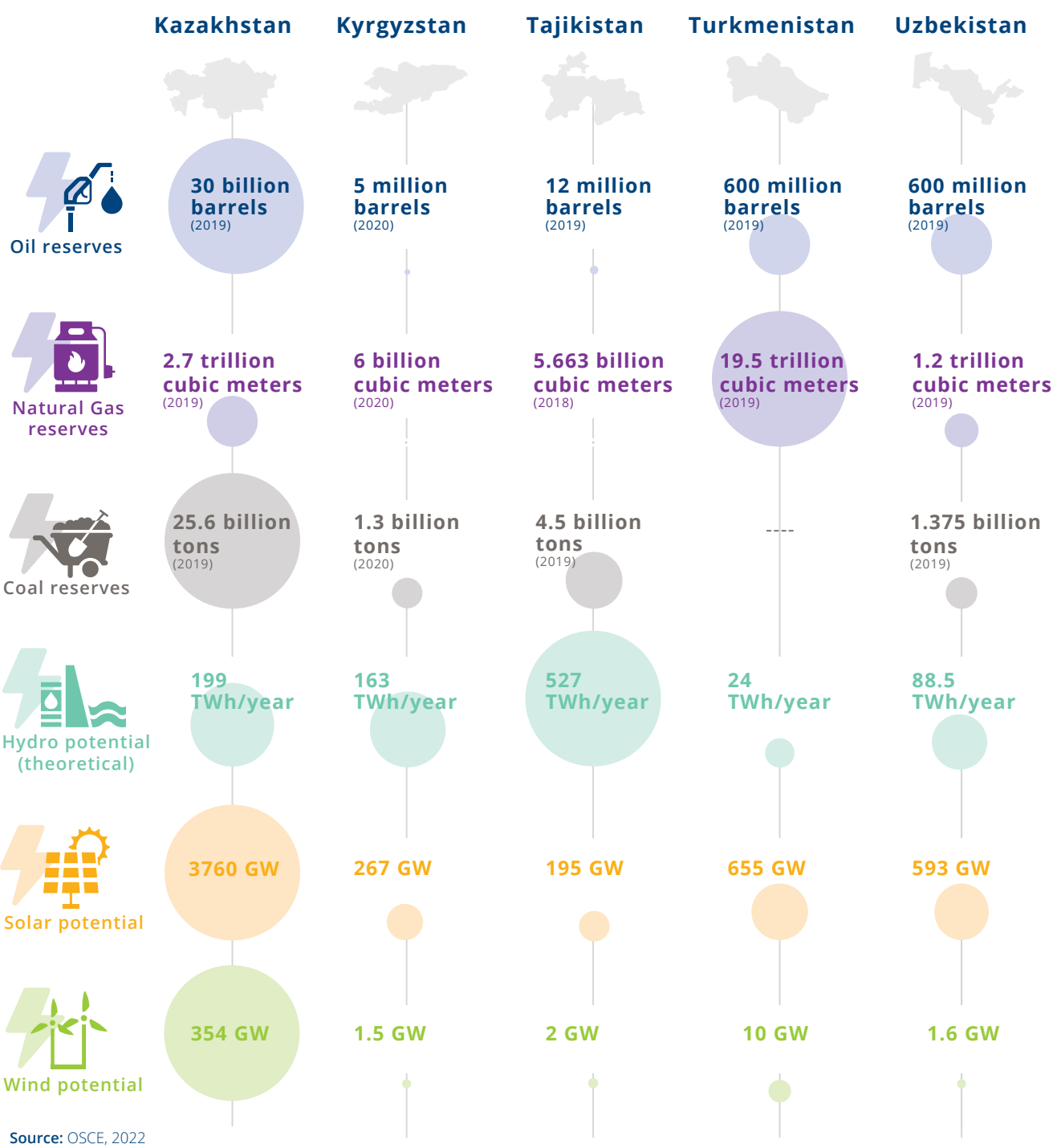
Note: Percentages may not add up to 100% due to rounding.
Source: IEA Country Energy Policy Reviews 2022[6], IRENA

Natural gas has the largest share in the energy supply mix in Central Asia at 53 per cent, followed by coal at 25 per cent, and oil at 19 per cent. Hydropower contributes 2.7 per cent, and wind, solar and other renewables comprise approximately 0.3 per cent, making up a total of about 3 per cent renewable energy. The total energy supply varies significantly by country (Figure 2).

Central Asia's energy sector is increasingly affected by extreme weather events, melting glaciers, and rising temperatures, and in response to climate change and to projected growth in energy demand, Central Asian policymakers have embraced decarbonization and renewable energy as top priorities. As Central Asian governments pursue enhanced energy security and sustainability for the future, their untapped modern energy resource potential is a great asset.

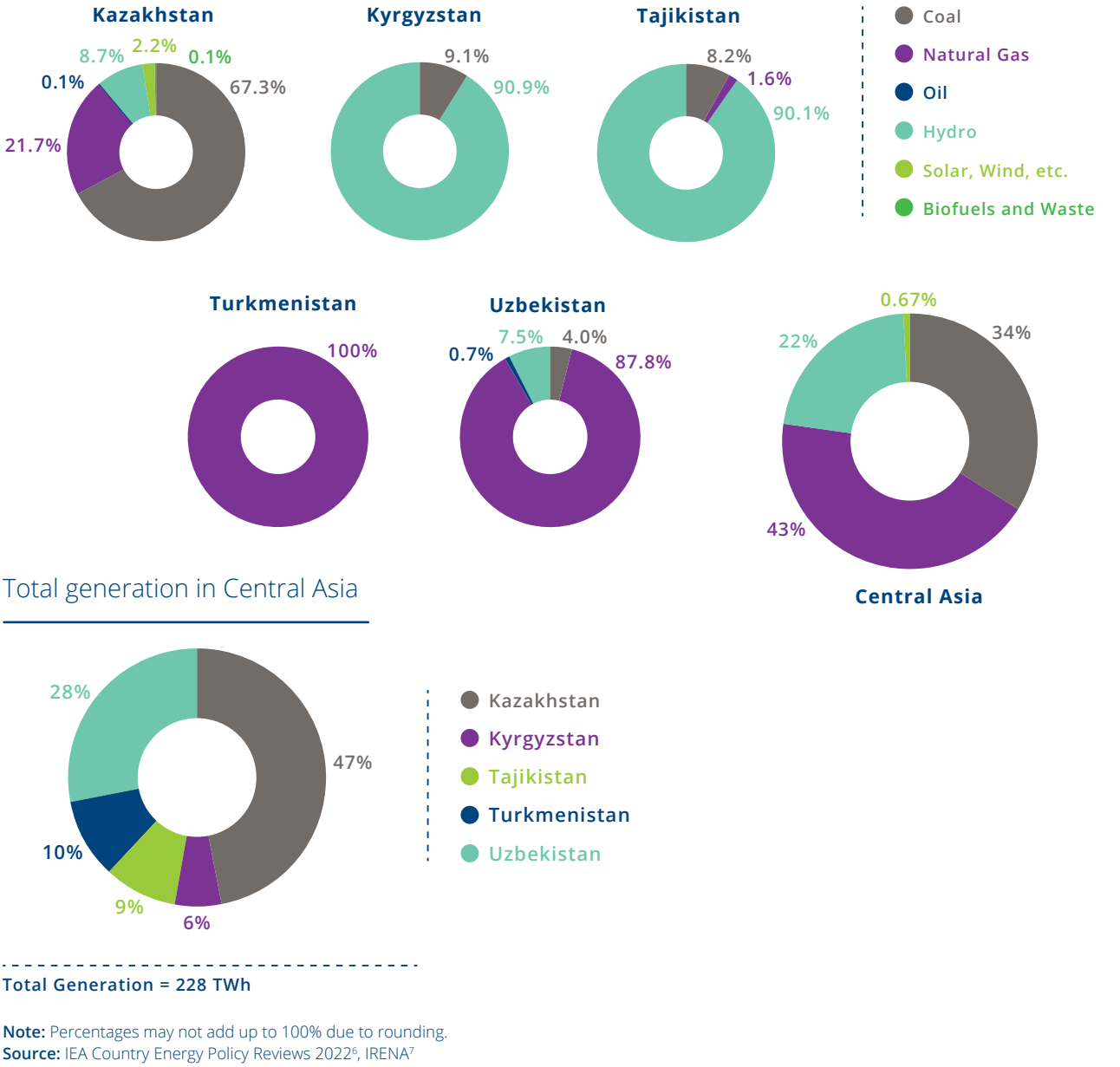
Though Central Asia has significant oil, gas and coal reserves, it also has great potential to develop solar, wind, and hydropower. Figure 3 displays the distribution of hydrocarbon reserves and the potential renewable sources by country.

Figure 3.
Hydrocarbon reserves and potential renewable energy sources in Central Asia



Source: OSCE, 2022

Figure 4.
Electricity generation by source and country, 2020

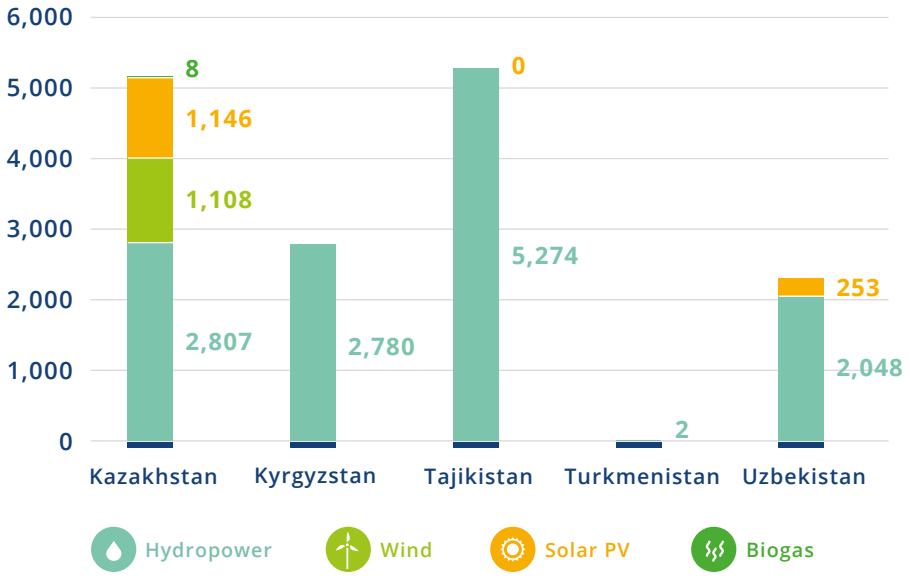


Note: Percentages may not add up to 100% due to rounding.
Source: IEA Country Energy Policy Reviews 2022[6], IRENA[7]

In 2020, hydropower contributed 22 per cent of the region's electricity generation, and wind, solar and other renewables added another 0.67 per cent (Figure 4). In Kyrgyzstan and Tajikistan, hydropower accounts for more than 90 per cent of the generation capacity.[8]

Renewables other than hydropower are gaining importance in Kazakhstan, but remain mostly absent in other countries. Solar, wind and small hydro account for more than 10 per cent of total generation capacity in Kazakhstan, with 2,388 MW of installed renewable energy capacity as of 2022 (Table 1).[9]

Table 1.
Renewable energy capacity in Central Asia, 2022 (in MW)



Note: Absence of data for Solar PV, Wind, Biogas technologies for some countries either reflects data gaps or the installed capacities are insignificant.
Source: IRENA and Laldjebaev et al., 2021[10]

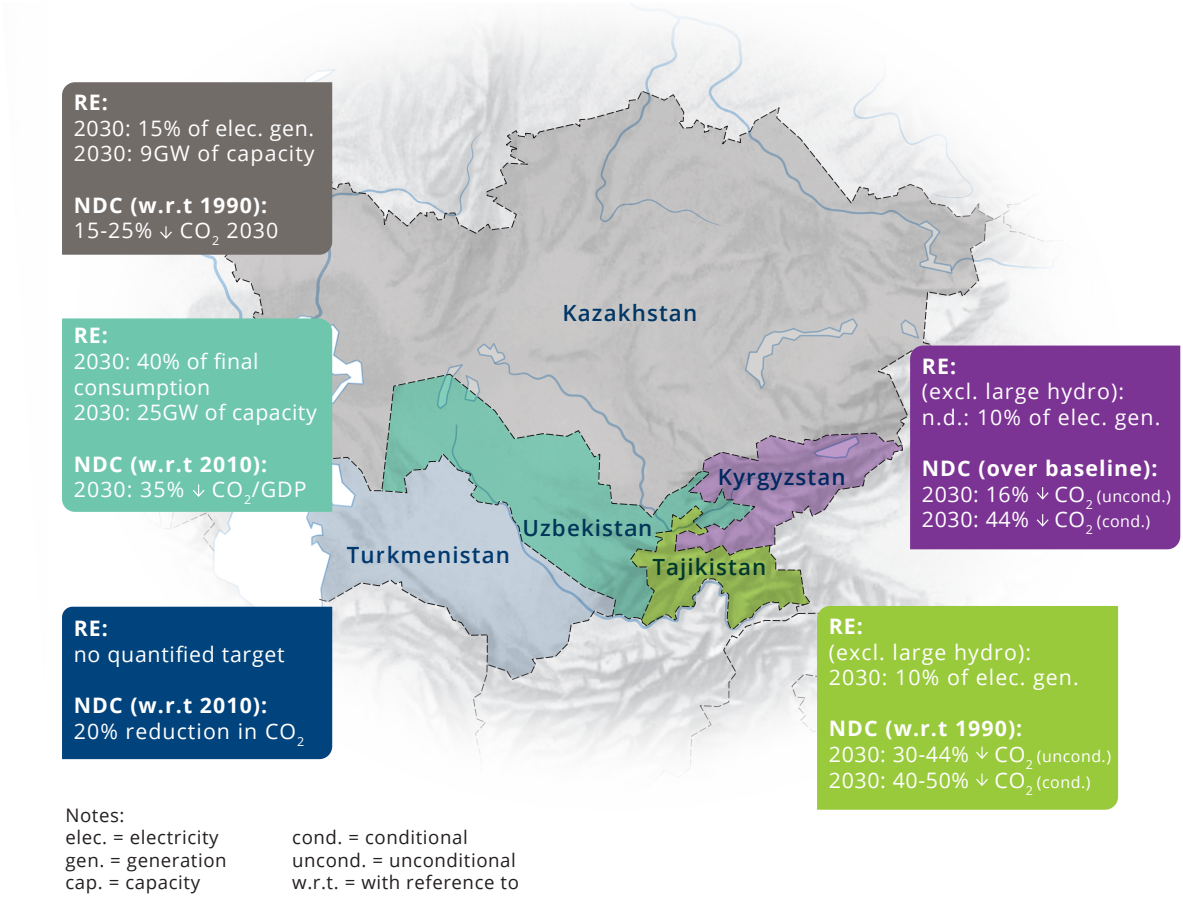
With the exception of Turkmenistan, the countries in Central Asia have adopted quantified renewable energy generation targets. All have submitted Nationally Determined Contributions (NDCs) setting mitigation targets under the Paris Agreement on Climate Change. Kyrgyzstan, Tajikistan and Uzbekistan submitted updated NDCs in 2021; Turkmenistan submitted an updated NDC in early 2023.

Uzbekistan's renewable energy targets are the most ambitious in the region. Initially in 2020, Uzbekistan set the target of 8 GW wind and solar capacity or 25 per cent renewables in electricity generation by 2030.[11] The recent success with commissioning utility-scale solar power plants, enabled through the updated legal framework conducive to foreign investments and long-term power purchase agreements encouraged the Government of Uzbekistan to revise the target up to 25 GW, or 40 per cent renewables in the energy mix by 2030.[12]

Kazakhstan has also made significant progress in attracting private investments in the renewable energy sector, particularly wind energy. The country's pioneering auction system, introduced in 2018, has enabled it to accelerate the deployment of renewables through a competitive bidding process. The next challenge to overcome is the development of financing mechanisms to provide small-scale, distributed renewable energy generation in remote areas.

Hydropower is a cost-effective source of energy in Kyrgyzstan and Tajikistan, with production costs significantly lower than the regional and global average cost of electricity. During non-peak times (usually in the summer), Kyrgyzstan exports energy mainly to Kazakhstan and Uzbekistan, while Tajikistan exports electricity to Afghanistan and Uzbekistan. Neither country has been able to fully capitalize on this competitive advantage, however, due to seasonal shortages leading to an inability to meet domestic demand in peak periods. Expanding hydropower, solar PV and wind energy generation in Kyrgyzstan and Tajikistan, while cutting down on domestic consumption through energy conservation, could free up electricity for export, thus creating economic value for the countries.[13]

Figure 5.
Renewable energy and emission reduction targets



Notes:
elec. = electricity
gen. = generation
cap. = capacity
cond. = conditional
uncond. = unconditional
w.r.t. = with reference to

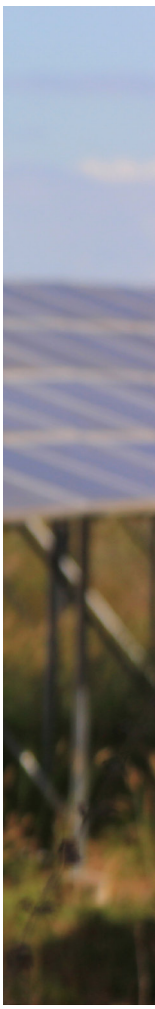
Sources: Multiple sources for targets. Climate Promise and Climate Action Tracker for NDCs.

Another opportunity the countries can capitalize on, using their significant renewable energy potential, is the production of green hydrogen, which can be used domestically to decarbonize industry and transport, and can be exported. The European Union has signed an agreement with Kazakhstan's government to develop supplies of green hydrogen and raw materials that are critical in the manufacture of wind turbines and batteries for electric cars. Kazakhstan has also signed a US $50 billion agreement with a European renewables group, Svevind, to build one of the world's largest green hydrogen plants in the Mangystau Region, and an agreement with Fortescue Future Industries, an Australian renewable energy company, to explore renewable energy and hydrogen production opportunities in Mangystau and other regions of Kazakhstan.[14]

The Saudi-Arabian company ACWA Power has signed agreements with the Uzbek Ministry of Energy and Uzkimyosanoat, a state-owned chemical company, to develop a green hydrogen facility and a green ammonia pilot project. The first green hydrogen project will be an integrated facility connected to an existing ammonia plant in Chirchiq. The project is expected to generate 3,000 tonnes of green hydrogen a year.[15]

WOMEN IN THE ENERGY SECTOR WORKFORCE

02



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To tap into their vast renewable energy potential and ensure a just and inclusive transition as per their commitment to the Paris Agreement and the Sustainable Development Goals, Central Asian countries will need to address existing skills and gender employment gaps in the energy sector.

> "We almost never see any women employed in the field in the broader energy sector."
>
> Energy professional in the region.

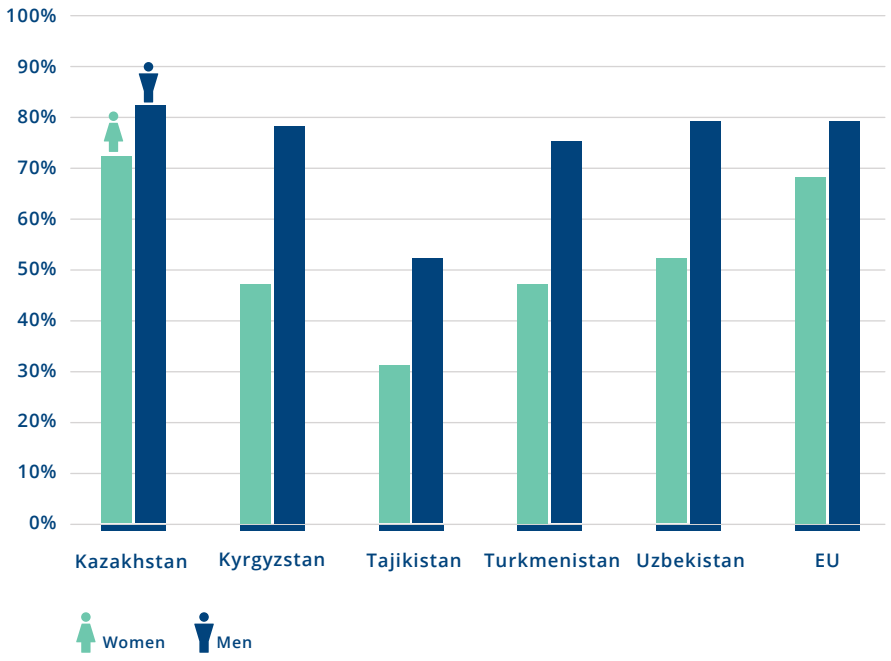
Worldwide, the share of women in the renewable energy workforce – at 32 per cent – is well above that in the oil and gas sector, where it has remained at 22 per cent since 2017,[16] but participation varies by technology. The estimated share of women is around 21 per cent in wind energy, and 40 per cent in the solar PV sector.

The higher share of women in the renewable energy sector compared to the traditional energy sector is attributable to several factors. Evidence suggests that women are more attracted to renewable energy than to the conventional energy industry, in part because the renewable energy sector offers jobs with a clear social and environmental purpose.[17] Renewable energy is also a young sector dominated by relatively new companies that lack the traditional, male-centred working cultures of many traditional energy companies. And the broad range of skillsets required in the renewable energy sector means that women from different educational backgrounds can enter and thrive in the sector.

Further up the career ladder in the renewable energy workforce, the share of women decreases. They occupy close to 14 per cent of managerial positions, and 12 per cent of board positions. In the traditional energy sector, women hold 27 per cent of the entry-level jobs that require a college degree and 25 per cent of mid-career jobs, but their representation drops to 17 per cent in senior and executive positions. Only one in a hundred CEOs in this sector is a woman.[18]

Figure 6 compares the current overall labour force participation rates of women and men in the five Central Asian countries with the European Union. The lower participation rates for women point to a reservoir of female labour that could be unlocked to accelerate the necessary modernization, restructuring, and greening of the region's energy systems.

Figure 6.
Labour force participation (% of population ages 15-64)



Source: ILO/World Bank Data, 2019

In their Nationally Determined Contributions (NDCs) under the Paris Agreement, countries have set mitigation and adaptation targets.

> **NDCs are a powerful tool for advancing gender equality, and many countries refer to gender issues and the need for gender equality in their NDCs.**

In Central Asia, however, these references still primarily focus on differential vulnerabilities and the need to include women in local planning processes related to adaptation (Table 2). With the exception of a brief mention of the need for women's economic empowerment in Tajikistan's NDC, the region's NDCs ignore the need to harness women's talents and expertise to accelerate the energy transition and climate action more broadly, and imply that gender equality is beneficial for women rather than for society as a whole.

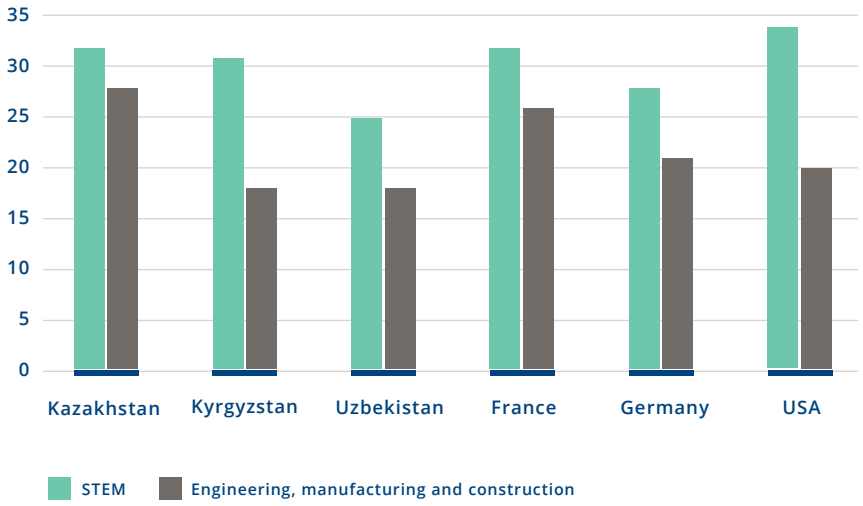
Table 2.
References to gender in Central Asian NDCs

		References to gender
Kazakhstan	2023	Gender is considered only in the sections on climate change adaptation, in the context of women's differential vulnerabilities, and the need to ensure gender equality in adaptation planning and project portfolios.
Kyrgyzstan	2021	A chapter on gender issues discusses women's differential vulnerabilities and underrepresentation in decision-making.
Tajikistan	2021	The NDC discusses women's differential vulnerabilities and refers to the need for women's economic empowerment and access to new skills.
Turkmenistan	2022	The NDC describes legislation related to gender equality and discusses the need for inclusion of women's perspectives in climate adaptation planning at the local level.
Uzbekistan	2021	Increased participation of women is mentioned only in the context of climate adaptation at the household level.

Source: Nationally Determined Contributions

The fact that fewer women than men tend to graduate with degrees in science, technology, engineering, and mathematics (STEM) means that the pool of qualified women available to fill positions is small. Figure 7 presents the shares of female graduates in STEM and in the fields of engineering, manufacturing, and construction in three Central Asian countries, two EU countries and the United States. It shows that the differences between the countries are relatively small, and that this issue is not unique to Central Asia.

Figure 7.
Share of women graduates in energy-related fields



Source: World Bank Open Data

A 2020 study by Kazenergy and the European Bank for Reconstruction and Development (EBRD) found that the Kazakh energy sector, which contributes nearly 25 per cent of the country's gross domestic product (GDP), employs on average 24 per cent women in its workforce. The share of women employees was actually higher – at 24–26 per cent – in traditional energy than in renewable energy companies – at 17 per cent.[19] Across the sector, more women work at lower levels and in administrative positions than at management levels or in technical positions, and they hold just 20 per cent of managerial positions and 12 per cent of jobs in senior management.[20] This imbalance occurs despite the fact that 64 per cent of women compared to 48 per cent of men in the energy sector has a university degree.[21] Globally, women hold 28 per cent of STEM-related positions in renewable energy, compared to 45 per cent in administrative positions.[22] Samruk Energy, a key energy sector developer in Kazakhstan, reported that the share of women among its field workforce was 21 per cent, which was lower than their 26 per cent share in overall workforce.[23]

In Uzbekistan, a study by the Asian Development Bank (ADB) used employment in the state-owned energy company Uzbekenergo as a proxy for employment in the energy sector overall. Just 17 per cent of Uzbekenergo's workforce was made up of women in the 2014–2017 period, and no women were in top management. Much like elsewhere, women were more likely to be found in administrative and lower-level positions.[24]

OSCE-GWNET-IRENA Survey on women's participation in the Sustainable Energy Sector in Central Asia

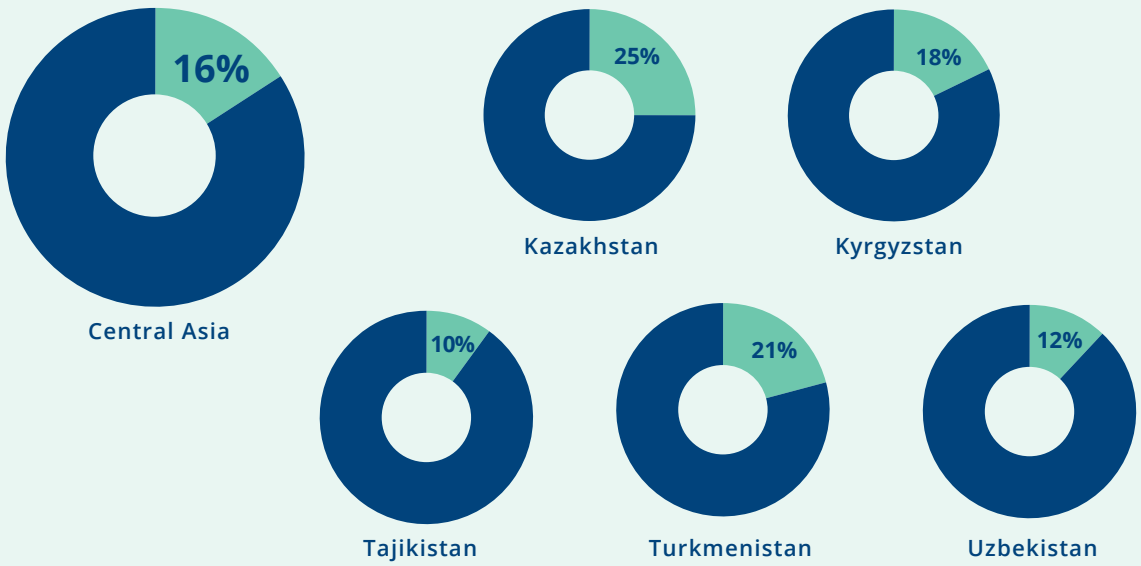
In an attempt to bridge remaining data gaps, the OSCE, the Global Women's Network for the Energy Transition (GWNET) and IRENA conducted a survey on the participation of women in the renewable energy sector in Central Asia.

The data contributed by 22 renewable energy companies and organizations suggest that women account for approximately 20 per cent of the workforce in the renewable energy sector in the region. The Kazakhstan Ministry of Energy reports that in 2022, its 130 renewable energy facilities, with a total capacity of 2,388 MW, generated 1,615 jobs, of which 16 per cent were held by women.[25] Company-level data reveal a similar story. Uzbekhydroenergo, which operates 51 renewable energy projects in Uzbekistan, has a total workforce of 4,423 people of whom 14 per cent are women, and Uzbekenergo employs 17 per cent women.[26]

The survey finds that in Kyrgyzstan, Tajikistan and Uzbekistan, as in most of the world, the share of women in renewable energy is higher than that in the energy sector overall while in Turkmenistan it is equal and in Kazakhstan it is lower.

Labour markets in Central Asia are highly segregated; women tend to form the majority of the workforce in sectors that offer low-paid, insecure employment, such as education, social services and hospitality. Meanwhile, sectors that offer more security and higher salaries, including the energy sector, predominantly employ men.[27] This segregation is partly the result of legislation stemming from the Soviet era that banned women from being employed in long lists of professions considered unsuitable or potentially harmful to their reproductive health. Uzbekistan repealed its list of banned professions in 2019 and Kazakhstan did the same in 2021, but in Kyrgyzstan, Tajikistan, and Turkmenistan, the lists are still in force.[28] Kyrgyzstan's list includes professions such as bus and truck driver, commercial diver, bulldozer operator, and bricklayer.[29] Kyrgyzstan and Tajikistan, however, have been taking steps to revisit the legislation.[30]

Figure 8.
Estimated share of women in the energy sectors of Central Asian countries



Source: Findings from the OSCE Regional workshop on «Fostering Women's Participation in the Energy Sector in Central Asia». Astana, 7-8 December 2022

Gender discrimination in hiring practices is common. A study conducted in Uzbekistan found that an applicant's gender is key in determining the odds that an application receives a response: "for a woman to get a call back for a job as a driver she would have to submit 180 per cent more applications than a man with identical qualifications. For a man to get an interview as an accountant, he would have to send 79 per cent more applications than a woman candidate, and for an office manager job as many as 685 per cent more applications."[31] This occupational segregation is one of the core drivers of Uzbekistan's gender wage gap, where pay among working women is about 39 per cent less than men's pay on average, according to government statistics. The study argues that this is due at least in part to prejudice and discriminatory norms. Even if there were no other forms of gender discrimination in the labour market, these biases alone are enough to strongly segment the labour market into "men's jobs" and "women's jobs" in Uzbekistan.

Benefits of wider female participation in the workforce

There is ample evidence from a wide range of global sources that increasing the participation of women in the labour force generates many benefits, ranging from higher profits for companies to society-wide impacts such as higher GDP and increased household spending on education and health. The International Labour Organization (ILO), for example, estimates that if women's participation in the labour force in Central Asia was at the same level as men's, that could boost the region's GDP by 23 per cent.[32]

With its World Development Report 2012 on Gender Equality and Development, the World Bank underscored the message that gender equality is a core development objective in its own right, while pursuing it is also smart economic policy, as it enhances productivity and improves other development outcomes, including prospects for the next generation and for the quality of societal policies and institutions. The report highlights the need for corrective policies that focus on persisting gender gaps.[33]

The ripple effect: How women's incomes benefit communities

Economically empowering women can have significant ripple effects, as women tend to invest a larger share of their income than men in their families and communities. On average, women spend 90 cents out of every dollar earned on education, health care, and housing, compared to men who spend 60 cents on these categories. Women entrepreneurs are more likely to spend their earnings on children's education and health, compared to male entrepreneurs.[34]

As women entrepreneurs grow their businesses, they often take on leadership roles in their communities and become role models for other women. By demonstrating that women can run successful businesses and advocate for their interests, they help transform cultural and social norms. Women leaders can also amplify the voices of women in political roles and bring about positive change in their communities.[35]

Kyzzhibek Ryszhanova is the founder and CEO of Smart ReEnergy LLP. As an entrepreneur, she has been working with international companies to develop renewable energy projects in the region. She believes that being a woman gives her a unique perspective that allows her company to navigate difficult situations through a mix of diplomacy and tenaciousness. She was part of the OSCE-GWNET mentoring programme "Empowering Central Asian Women in Renewable Energy", and with the help and guidance of her mentor, she secured funding for the region's first hybrid solar PV and hydropower project. As a role model in the community, she gives lectures to girls in schools to inspire them to pursue STEM careers and join the renewable energy sector.

In its latest Gender Gap Report, the World Economic Forum warns that while some parts of the world have seen partial recoveries following the regression in gender equality that resulted from the COVID-19 pandemic, deterioration continues in other areas due to other crises, such as more frequent climate change-related disasters and rising energy and food costs. Women's economic empowerment has further regressed globally. In the Central Asian countries included in the sample (Kazakhstan, Kyrgyzstan and Tajikistan), gender equality has either stagnated or is improving slowly.[36]

In a 2015 study, McKinsey estimated that realizing gender equality worldwide could add US $12 trillion to global growth.[37] In 2020, McKinsey also demonstrated that gender-diverse companies outperformed non-diverse companies significantly. This study examined a data set of more than 1,000 large companies in 15 countries and found that companies in the top quartile for gender diversity were 25 per cent more likely to have above-average profitability than companies in the bottom quartile. Companies in the top quartile of ethnic and cultural diversity were 36 per cent more likely to outperform the bottom quartile on profitability. The research also found that, "companies in the bottom quartile for both gender and ethnic diversity were 27 per cent more likely to underperform in comparison to the industry average than all other firms."[38]

Studies have also found that gender-diverse teams are more effective at problem solving, provide a company with access to a broader knowledge base and wider networks, can more effectively serve a diverse customer base, and tend to have higher staff retention rates.[39] Companies that make accommodations for women to maintain a good work-life balance also have more satisfied male staff; after all, many modern men want to spend as much time with their families as women do. Anecdotal evidence suggests that the inclusion of women in previously male-dominated workplaces can lead to healthier, friendlier workplace cultures.

Figure 9 shows the range of benefits that can result from investments in women's renewable energy businesses – improvements in energy access and in the wellbeing and economic growth of communities, among many others.

Central Asian countries have opportunities to benefit from diversifying their energy workforces, in particular by mobilizing the talent and life experiences of women. This mobilization will prove particularly beneficial as the region embarks on the transformation of its energy systems with the two-fold objective of mitigating global warming through rapid and deep decarbonization, while ensuring security, accessibility and affordability of sustainable energy services for the entire population.

Energy transitions in Central Asia will lead to the creation of large numbers of high-quality jobs, not just in urban centres but also in rural areas, and will afford the countries the opportunity to ensure that women and men benefit equally.

> **Including women in the design, development, operation, and management of new energy systems will ensure that these systems benefit from a wider variety of perspectives and serve the needs of the entire population.**

Empowering women to participate fully in the energy transition will also help make progress towards the Sustainable Development Goals, particularly on gender equality and decent work and economic growth.

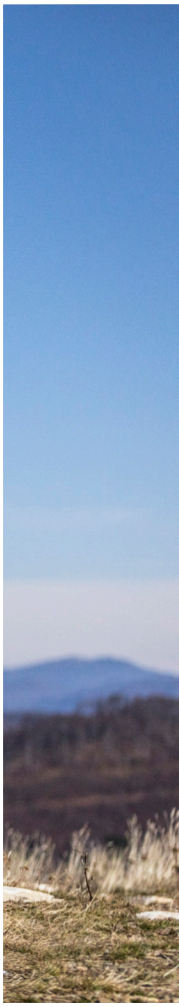
Figure 9.
Benefits of women's participation and leadership in the energy sector

Source: Adapted and refined from UNEP 2020[40]

BARRIERS TO GENDER EQUALITY

Based on the OSCE Survey on the Participation of Women in the Sustainable Energy Sector in Central Asia, 2022

03



© Daniel Balakov
A wind energy engineer working in wind farm.

The barriers to gender equality in the energy sectors of the countries of Central Asia range from laws banning women from certain professions to workplace environments that women experience as unwelcoming.

> "The cultural expectation in Central Asia is for women to get married, start families and take care of the children at home"
>
> Energy professional in the region

A review of the literature reveals significant obstacles that prevent gender equality in Central Asian labour markets. The World Bank reports that in Tajikistan, 49 per cent of young women between the ages of 15 and 24 compared to 7 per cent of young men are not in education, employment, or training. In addition to these lower labour force participation rates, women's average wages are lower – 60 per cent of men's average wage irrespective of job type – and so women account for only a quarter of gross national income.[41]

The survey conducted for this report received 22 responses on behalf of organizations and 81 from individuals. Complementing the results of this small sample are the findings of similar studies in other regions, and interviews with men and women working in renewable energy in Central Asia.

A majority of respondents to the survey stated that they thought that women faced gender-related barriers while working in the renewable energy sector or seeking such work. This result aligns with a global renewable energy industry survey that finds that 64 per cent of all respondents, and 75 per cent of all women respondents, believed that women face gender-related barriers.[42]

Barriers to entry

The survey asked participants to rank the relevance of ten possible barriers to women's entry into the renewable energy sector, whether at the graduate level or at a more advanced stage of their careers. These barriers were identified in global studies on gender equality in the renewable energy sector. Table 2 shows the composite rankings of the survey responses.

These barriers are all related in their causes and effects, and in many cases may be mutually reinforcing. The barrier of prevalent hiring practices is closely linked to other key barriers such as cultural and social norms and prejudices about women's capabilities. The ranking of barriers is closely aligned with the results of past IRENA surveys, which also highlighted social and cultural norms, gender roles, lack of gender targets, and hiring practices as key impediments to entry into the workforce.[43]

Table 2.
Barriers to entry into the renewable energy sector
(ranked most significant to least significant)

1. Prevalent hiring practices (preference for male candidates)
2. Cultural and social norms (gender stereotypes)
3. Lack of gender diversity targets (hiring quotas, overall workforce target)
4. Lack of awareness of opportunities (among women)
5. Limited ability to move or travel for work (family support, social responsibilities)
6. Prejudices about women's capabilities (technical capabilities, physical strength requirement)
7. Inadequate workplace policies for work-life balance
8. Self-perception (lack of confidence)
9. Lack of the right STEM background
10. Lack of the right non-STEM background

Prevalent hiring practices and lack of awareness

Respondents to the survey identified prevalent hiring practices, or a preference for male candidates, as the most significant barrier to women's employment in the energy sector. In recruitment processes, all-male hiring panels tend to favour male candidates. Even if women are invited to interview, they still may be at a disadvantage. If a shortlist of candidates includes only one woman, she is regarded as a "wild card" rather than a serious candidate and almost never receives a job offer.[44]

Differences in the ways men and women approach the job search can reverberate through the prevalent hiring practices. Men tend to apply for jobs even if they only meet 60 per cent of the requirements, whereas women typically wait until they meet all requirements before applying.[45] As a result, fewer women apply for jobs, especially in traditionally male-dominated sectors, unless companies make a special effort to recruit women. Still, women who work in such sectors have regularly pointed out a discrepancy between corporate rhetoric about hiring and retaining women and the reality of entrenched preferences for men.[46]

The lack of easily available information on employment in the energy sector places women at a disadvantage. Personal networks can be essential to entry and success in some fields, but women in non-traditional occupations find it more challenging to access such networks in the same way men do.[47] In studies conducted around the world, women who are currently employed in the field report that they were not interested in working in renewable energy in high school or even at the beginning of their college or university degrees.[48] The failures of families, teachers, and society at large to encourage girls to take an interest in technical subjects, or to pursue careers in technical sectors such as energy, helps explain this finding. In fact, many Central Asian women interviewed for this report had considered dropping out of their studies or quitting the energy field because their families considered their career choice unsuitable for women.

Apprenticeships and internships are crucial gateways into the renewable energy industry, and here again gender disparities are common. In member countries of the Organisation for Economic Co-operation and Development (OECD), for example, women make up 94 per cent of childcare apprentices but only 4 per cent of engineering trainees.[49] And in the EU, female students are significantly less likely than male students to have access to paid work-based learning experiences.[50] In most countries, securing an internship or an apprenticeship is an unregulated process in which informal networks play a large role. This often translates into a barrier to women's entry into fields for which such apprenticeships are important. One interviewee reported that her university only encouraged male students to apply for internships, and did not even provide the necessary information to female students.

Cultural and social norms

Deeply ingrained cultural and social norms are difficult to alter, and prevent women from participating fully and equitably in many sectors of the economy in two main ways. In most countries, women still undertake the majority of household and unpaid care duties, leaving them with less time to pursue careers. And cultural norms define which professions are considered suitable for men and women.

Most technical professions, including those in the energy industry, have traditionally been viewed as jobs for men. One widely held belief is that certain vocations need more physical strength than the majority of women have, or are too dangerous for women. The mechanization and automation of many processes, however, have greatly diminished the significance of physical strength.

Other biases are based on misperceptions of women's technical aptitude. Despite having the same or better credentials and work experience than their male colleagues, women are often perceived as being less qualified to assume technical positions than men.[51] These biases are held not just by men but also by some women themselves, and can affect their confidence.

OSCE Project on Empowering Central Asian Women in the Energy Transition

Responding to the need to address barriers that prevent women from thriving in the energy industry, in 2022 the OSCE launched a regional project to empower Central Asian women and girls as change agents in the energy transition.

By tapping into the job creation potential of the energy transition, the project equips Central Asian women and girls with the skills, tools and support network needed to pursue or advance a career in the renewable energy sector. As gender imbalances in the workplace are largely an outcome of educational pathways that remain male-dominated, this project takes a strong youth focus aimed to encourage more girls to enrol in technical subjects and kick off a career in the energy sector. In July 2023, the OSCE launched its first Scholarship Program for Young Women in Renewable Energy,[52] supporting young women from Central Asia, Afghanistan, and Mongolia to undertake a two-year Master's programme in Strategic Management of Renewable Energy and Energy Efficiency at the Kazakh-German University.

The OSCE also helps Central Asian governments and companies integrate women's needs and gender equality targets into their energy and hiring policies.

Women in STEM

The under-representation of women in STEM careers is attributable to the same cultural and social norms that form a barrier to women's entry into the energy sector. Perceptions about what it takes to succeed in a male-dominated environment can dissuade women from pursuing STEM careers, as can well-founded fears that they may be made to feel unwelcome. The lack of the right STEM background was ranked low by survey respondents, but according to the literature and to interviews, this remains a key barrier.

The share of female students choosing to pursue STEM degrees is small. The share of female students in energy-related university programmes is 25 per cent in Kazakhstan, 17 per cent in Kyrgyzstan, and 15 per cent in Uzbekistan. Fewer women in Uzbekistan complete university degrees in general – just 38 per cent of first-year students in 2019 were female. The need for more women to gain technical qualifications is clear, but as the renewable energy sector requires a range of skills and offers many non-technical jobs, greater awareness of career options for women and men with non-STEM backgrounds is also desirable.

> "I prefer to hire men in projects involving field work. They tend to be technically sound and easier to work with. I believe that the demand for female perspective is already fulfilled through my guidance"
>
> **A female CEO based in Central Asia**

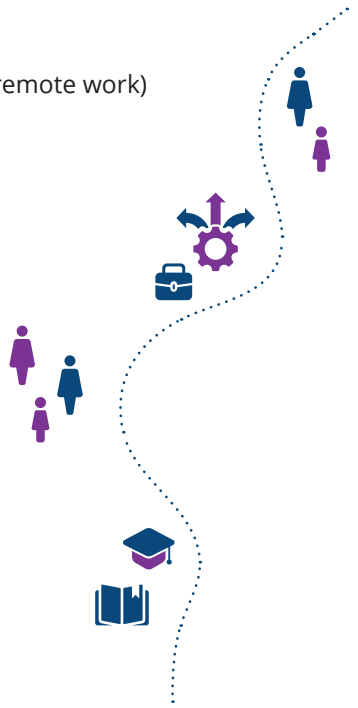
Barriers to advancement

Survey respondents ranked cultural and social norms as the biggest impediment to women's advancement in the renewable energy workplace. These are the same norms that prevent women from entering the field, and the analysis of the dynamics at work are the same for advancement as they are for entry. The barriers of interest here are, therefore, lack of flexibility, limited mobility, and the glass ceiling.

Where policies such as parental or family care leave and flexible working hours to allow for school drop-off and pick-up times are non-existent or inadequate, women are often forced to leave the workforce altogether to take care of children and household duties. However, even when the policies and facilities are adequate, women who take maternity leave or are unable to work the same hours as men often view this as an obstacle to their advancement. Interviewees said that employers view married women as less flexible than men or unmarried women. One interviewee said that leave entitlements exist only on paper; whenever she had taken leave, she was called into work anyway.

Table 3.
Barriers to advancement in the renewable energy sector
(ranked most significant to least significant)

1. Cultural and social norms (gender stereotypes)
2. Lack of flexibility in the workplace (flexible working hours, job sharing, remote work)
3. Lack of gender diversity targets (overall workforce target)
4. Limited mobility (family support expected, social responsibilities)
5. Glass ceiling
6. Lack of role models
7. Lack of mentorship opportunities
8. Lack of childcare facilities
9. Lack of required skills and qualifications
10. Discouraging workplace practices (exclusion, harassment)
11. Lack of training opportunities



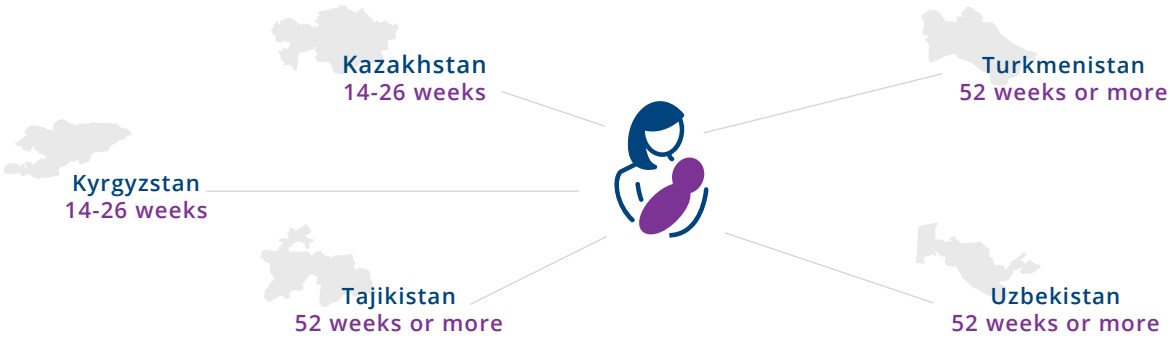
Technical careers in the renewable energy sector, particularly field jobs (project planners, installers, operators) often require frequent travel and/or relocation to remote areas, as plants tend to be located away from population centres. Wind and hydropower installations in particular are often located in remote, inaccessible areas with few facilities. For women with extensive care burdens and household duties, spending long periods away from home and family is difficult. In addition, safety concerns arise where women spend time in remote locations surrounded by men, especially when, due to the historical lack of women in such places, companies have not invested in separate sanitary and housing facilities for women. One interviewee mentioned that her workplace was poorly lit, lacked separate female sanitary

facilities, and that she was forced to use tools that were too heavy for the average woman to comfortably use, or required larger hands or more grip strength than the average woman has. Policies requiring the provision of certain accommodations exist, but implementation can be lacklustre; the same interviewee said that the mandated breastfeeding room at her workplace was just an area behind a curtain.

As a result of culturally entrenched gender biases, many people assume that women would prefer not to work in remote areas or under challenging or dangerous conditions, but just like many men, many women view such work as an adventure and a way to see the world. In addition, many women now work in unfavourable conditions for significantly lower pay than they would in the renewable energy industry. Given the choice, some women could favour employment in the renewable energy sector merely due to the possibility of greater pay.

There are enduring obstacles to increasing the number of women in senior executive roles and in board of director positions found all along the value chain for renewable energy. The term "glass ceiling" refers to the unequal representation of men and women in positions of power, when invisible barriers prevent women from achieving high-level positions despite their qualifications. Some studies also point to the effect of the "broken rung" – the fact that from the very beginning of their careers, women are promoted with lower frequency than men and cannot climb the ladder to higher management levels.[53]

Figure 10.
Paid leave for new mothers



Source: World Policy Analysis Center, 2020

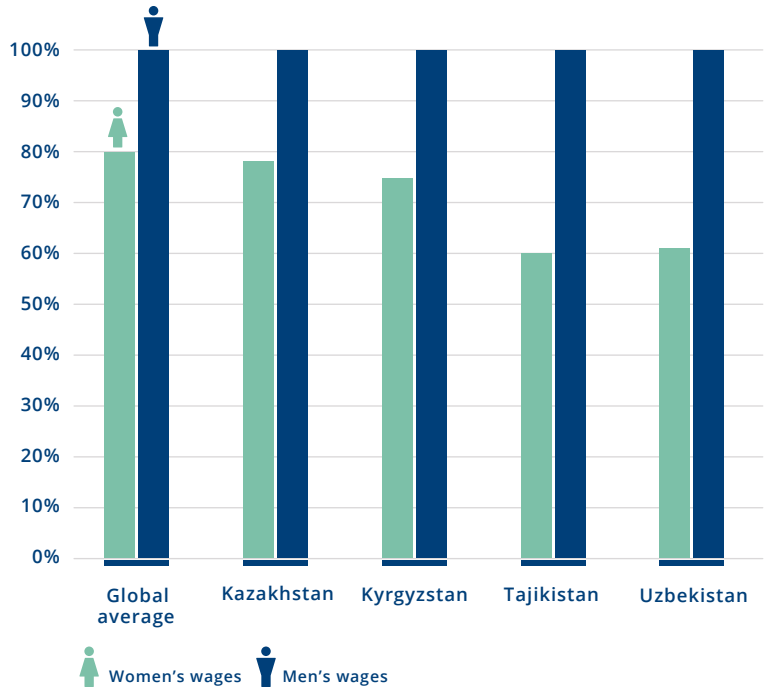
"Empowerment activities are crucial to help women build confidence and overcome challenges instilled by gender stereotyping. This will in turn help women to achieve their full potential for success and leadership in the energy sector."

Ainur Sospanova, CEO of the Qazaq Green RES Association

Gender pay gap

The biases women experience in the workplace are also reflected in their compensation. Significant gender pay gaps, defined as the differences between the wages of women and men, persist (Figure 11).

Figure 11.
The gender pay gap in Central Asia



Source: Proskuryakova and Seitz, 2023

The gender pay gap exists in part because women are more likely than men to work in sectors that offer relatively low wages (hospitality, social care, education), or to hold low-paid positions in high-wage sectors (administrative positions in technical industries). Cultural and social norms are at work here, but recent studies have also shown that when women gain a foothold in a profession that was historically male-dominated, wages decrease. A 2022 study found that a 10 per cent increase in the share of women in an occupation leads to a 13.7 per cent decline in average female wages and a 9.4 per cent decline in average male wages in that occupation over ten years.[54]

Women are also more likely than men to take career breaks to care for children and other family members and work fewer hours to accommodate their household duties, which are on average much more onerous than those of men. This higher care burden is another reason women tend to advance more slowly in their careers than men.

Women are also paid less than men for equivalent work. This is the result of prejudices about women's abilities and biases against women who are assertive in salary negotiations. While assertive men are often praised for their ambition, assertive women tend to be viewed as too aggressive.[55]

Though the number of survey respondents who provided an insight into their current career status was too low for the results to be statistically significant, the results are

Implementation of gender equality policy at Uzbekhydroenergo

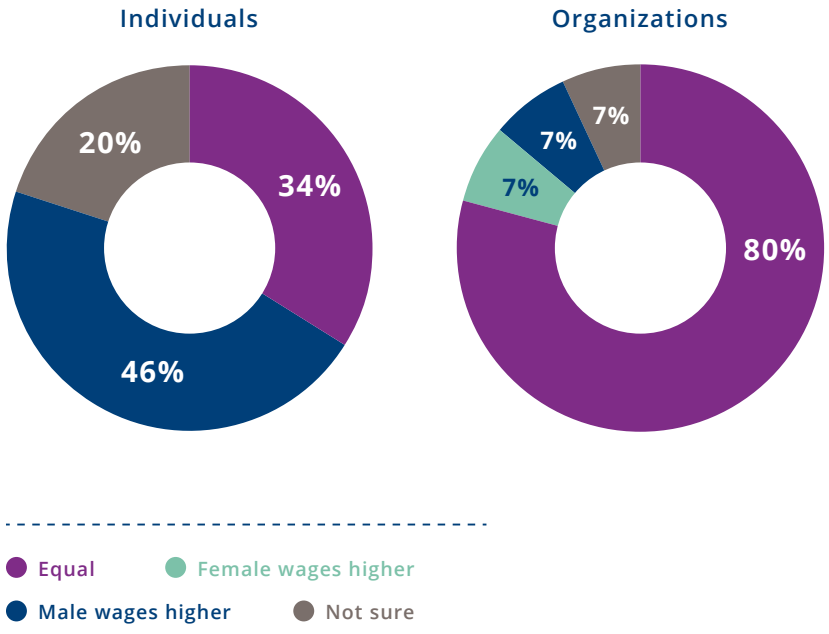
Uzbekhydroenergo, a state-owned energy company that operates 51 stations with a total installed capacity of 2,054 MW, has made steps in promoting gender equality. The company employs over 4,400 people, including 629 women, representing 14.2 per cent of the total workforce. This is an increase from the previous year's number of 586 women. Uzbekhydroenergo also has 14 women in leadership positions, up from 10 women in 2021.

The increase in Uzbekhydroenergo's number of female employees can be attributed to several factors, including the establishment of a Gender Equality Advisory Board and the implementation of a comprehensive programme to promote gender equality. The company has also focused on strengthening the role of women in society and identified a pool of talented women to prepare for leadership positions. Additionally, the company has established practical co-operation with higher education institutions and introduced a scholarship for students.[56]

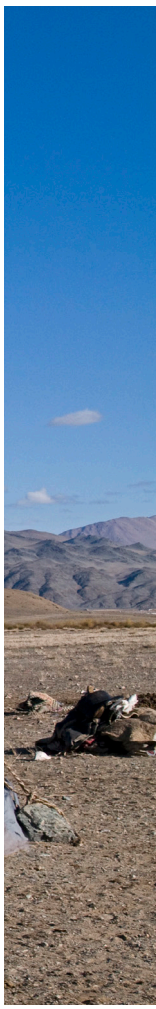
nonetheless interesting. The survey responses of individuals to the question of whether men and women in their companies received equal wages diverged widely from the responses of organizations. Overall, 46 per cent of individual respondents believed that men were paid more than women for equivalent work, while 34 per cent believed that the pay was equal. None of the respondents thought that women were paid more (Figure 12). Respondents completing the survey on behalf of their organizations, however, overwhelmingly believed (80%) that women and men were paid equally.

When asked to explain the gender pay gap, respondents most frequently cited cultural norms or gender stereotypes, followed by the lack of a standard wage scale or business policies, and by different negotiation abilities of women and men.

Figure 12.
Gender pay gap responses by individuals and organizations



Source: OSCE-GWNET-IRENA Survey on women's participation in the Sustainable Energy Sector in Central Asia



SOCIO-ECONOMIC BENEFITS OF ENERGY TRANSITIONS

04

In most countries, energy transitions only gained momentum in earnest once the price of renewable energy fell below that of fossil fuel-based energy. In certain countries with abundant, cheap fossil fuel resources, such as Kazakhstan and Turkmenistan, this point has not yet been reached, but the price gap is narrowing as the cost of technologies such as solar PV and wind continues to fall.[57] Instead of waiting for renewable energy to become cheaper than fossil fuel-based energy, however, the countries of Central Asia have several reasons to consider investing heavily in their energy transitions now.

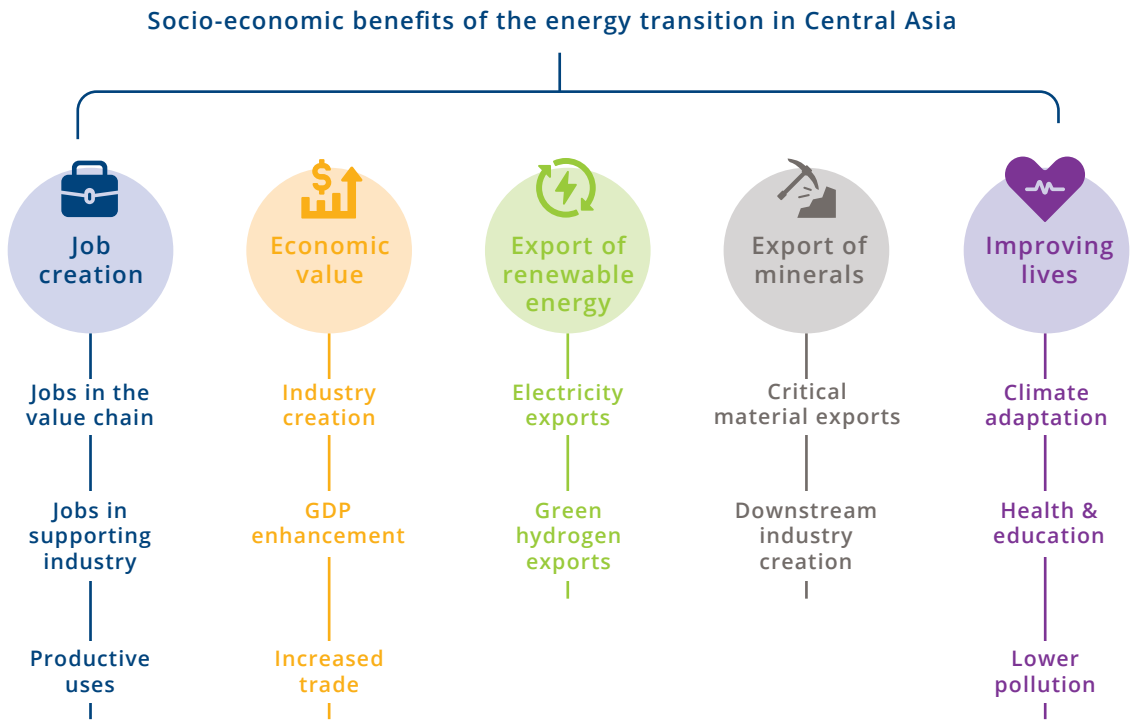
The energy systems of Central Asia are unable to cope with growing populations and growing demand, leaving many people, especially in rural areas, unserved or underserved and resulting in severe supply disruptions particularly in winter. Significant investment will be required to modernize and restructure these ageing systems, and this investment should align with the goals of the Paris Agreement. Moreover, in sparsely populated countries such as Kazakhstan, the higher cost and infrastructure requirements of transporting renewable energy to remote areas across large distances makes off-grid and distributed generation the more economically viable option.

Energy systems based on distributed renewable generation are more resilient than centralized systems; they are able to withstand extreme weather events and fossil fuel supply disruptions.[58] Therefore, investment in modern energy industries will enhance the resilience of Central Asia's economies to shocks – an important consideration given the effects of the COVID-19 pandemic and the latest geopolitical developments, and the related supply chain disruptions and rising inflation.[59]

The energy transition also opens up avenues for societal transformations with the potential to achieve greater social justice and gender equality in line with existing gender equality policies and frameworks, including through the creation of large numbers of new jobs.

Finally, the transition provides opportunities for the countries to meet their NDC commitments under the Paris Agreement, and to play their part in reducing greenhouse gas emissions and combating climate change, while also reducing pollution and improving air quality locally. Figure 13 lists these and other socio-economic benefits of the energy transition in Central Asia.

Figure 13.
Socio-economic benefits of the energy transition in Central Asia



Source: ILO/World Bank Data, 2019

As the example of Pamir Energy shows, improving the availability and affordability of modern energy services contributes greatly to improving the living conditions of village residents, especially women.

Pamir Energy – Contributing to women's empowerment in Tajikistan[60]

In 2002, Pamir Energy was formed as a partnership between the Aga Khan Fund for Economic Development, the Government of Tajikistan, and the International Finance Corporation. The company aims to restore the electrical infrastructure of the Gorno-Badakhshan Autonomous Oblast (Province) in Eastern Tajikistan, expand hydroelectric capacity, and transmit surplus energy from Tajikistan to Afghanistan.

When Pamir Energy launched its operations, only 13 per cent of the households in the region had access to electricity, but now the company supplies reliable, clean, and affordable electricity to 96 per cent of the population. Pamir Energy has implemented more than 30 projects (mostly hydropower) with more than 50 MW in total capacity, fully rehabilitated the majority of the region's 11 hydropower plants, and installed a 200 kW solar power plant.

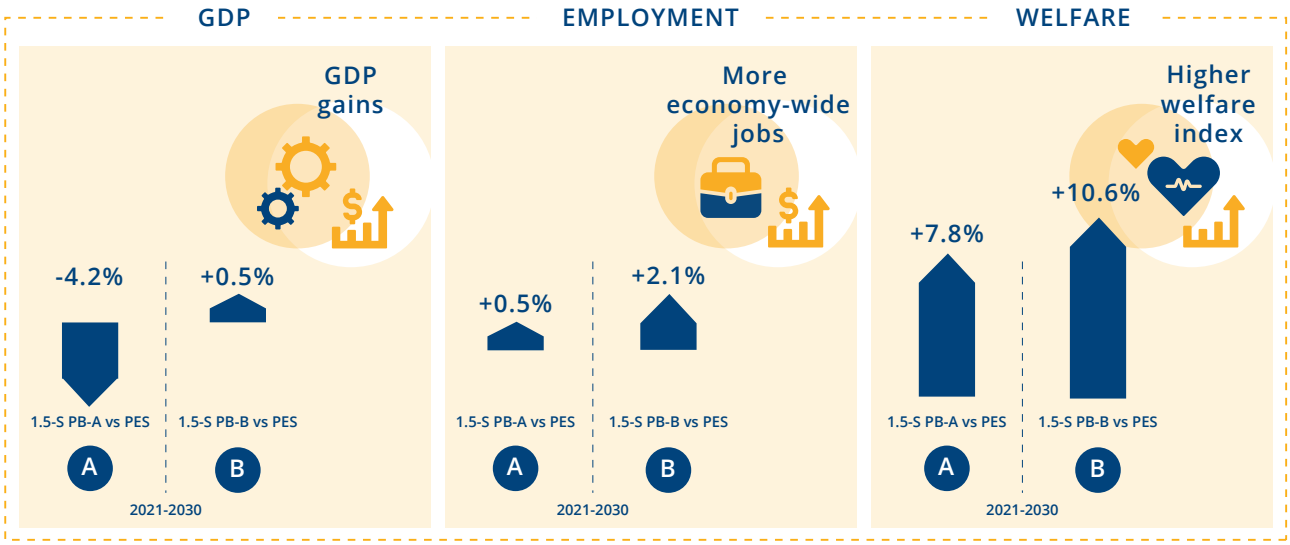
Pamir Energy's projects have had a significant positive impact on the lives of the residents in the region, particularly women. The provision of reliable electricity to homes has reduced the respiratory problems resulting from smoke inhalation from the burning of traditional biomass and coal, and has facilitated the development of advanced medical services in clinics and hospitals. Midwives have reported a considerable reduction in infant mortality rates as a result of a reliable electricity supply to delivery wards.

Pamir Energy's projects have reportedly reduced the time women and girls spend on collecting firewood and performing household chores by an estimated four hours per day, thus providing more opportunities for them to engage in other activities.

The company has created over 600 permanent and 200 temporary jobs in the region, and is providing scholarships to women students through one of its ongoing projects.

Images: Maintenance workers at a hydropower plant (Left) and 200kW solar PV plant (Right)

Figure 14.
Socio-economic benefits of the transition in Kazakhstan



Note: 1.5-S - 1.5 degree Celsius Scenario, **PB-A -** Policy Basket A, **PB-B -** Policy Basket B, **PES -** Planned Energy Scenario
Source: based on unpublished IRENA data

A detailed IRENA analysis available only for Kazakhstan shows that in addition to job creation, the renewable energy transition can also lead to additional GDP growth (by 0.5%), an economy-wide increase in jobs (2.1%), and improved welfare – the IRENA Energy Transition Welfare Index, which combines economic, social, environmental, distributional and energy access indicators, measures a 10.6 per cent improvement in welfare, in part as a result of improved health through reduced indoor and outdoor air pollution.

Air pollution in urban centres in Central Asia

Many large cities in Central Asia suffer from severe air pollution. The air quality in Bishkek, Kyrgyzstan, for instance, was ranked as the second worst in the world in the winter of 2022. Some of the main sources of air pollution in Bishkek include the use of coal in homes for heating, a coal-fired heat and power station, the city's municipal dump, and vehicles.[61]

While air pollution affects everyone, vulnerable groups such as children, the elderly and pregnant women face the highest risks. Air pollution is estimated to have led to 4,000 premature deaths in Kyrgyzstan in 2016.[62]

By replacing fossil fuels (especially coal) in heating and power generation, renewable energy can reduce air pollution. As of 2022, heating with electric boilers cost more than twice as much as equivalent coal-fired heating.[63] Improved access to affordable and reliable electricity from the Kyrgyz electric grid (which is predominantly powered by hydropower) could help reduce the burning of coal in homes.

Vehicular emissions can be reduced through increased use of non-motorized and public transport and the uptake of electric vehicles. The Kyrgyz Republic already has a zero customs duty on the import of electric vehicles and has expressed interest in starting joint ventures with Korea to produce electric vehicles domestically.[64]

Images: Smog over Almaty, Kazakhstan (Left) and Bishkek, Kyrgyzstan (Right)

Promoting modern energy services for activities that employ electricity to generate income and improve welfare is an effective means of improving the living conditions of rural populations. If a gender-responsive lens is adopted, renewable energy can also act as a strong catalyst for the empowerment of women. With reliable access to affordable, modern energy, women can start their own new businesses or extend operating hours of existing businesses until after dark. Access to electricity also improves access to information and knowledge through phones, radios, televisions, and computers. Solar home systems have contributed to the creation of economic opportunities for 4.9 million people worldwide, powering an estimated 2.6 million small and micro enterprises and generating additional income of US $7 billion for users since 2010. Small off-grid products, such as lanterns and multi-light kits, have improved the financial situation of low-income households by generating savings.[65]

Clean energy access and training for women in Yaghnob Valley, Tajikistan

In the mountainous areas of Tajikistan – as in many rural communities worldwide – energy poverty disproportionately impacts women's lives. As they perform the bulk of traditional household chores, such as cooking and heating, they are exposed to indoor air pollution and to the safety risks of walking long distances to collect biomass and fuelwood.

To help overcome these challenges, the OSCE provided 20 households in the Yaghnob Valley of Tajikistan with off-grid clean energy technologies and trained the women whose homes received the new technology. The training sought to build the capacity of the recipients so they could make the best and most efficient use of these devices, ultimately enabling them to drive positive change within their communities.

The villages of Khishortob, Qul, and Gharmen, where the households are located, lie at 2,700 m above sea level and are isolated from central energy networks. Inhabitants rely on firewood, manure and coal for their cooking and heating needs. The existing small hydropower plants are sufficient only for lighting during the spring and summer period. From October to May, the villages are closed off from the rest of the country due to heavy snowfall and avalanches.

Image: Women receiving solar parabolic cookers and mini-solar power stations in the Yaghnob Valley of Tajikistan.
Source: OSCE (https://www.osce.org/oceea/550879)

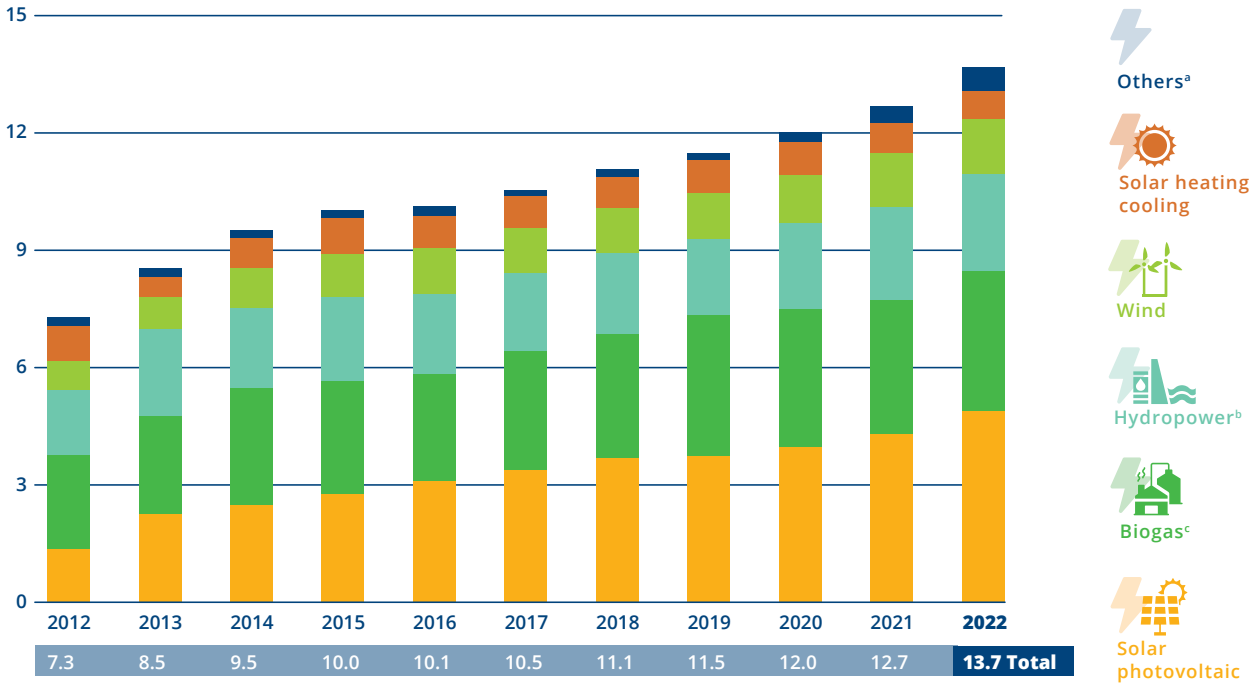
JOB CREATION OPPORTUNITIES IN THE ENERGY TRANSITION

05

© Shutterstock
A cotton field irrigated with solar energy.

IRENA's Renewable Energy and Jobs Annual Review 2022 counts a total of 12.7 million jobs in renewable energy worldwide and shows continued growth in renewable energy jobs over the last decade, with the anticipation that this growth will continue in parallel with the increase of installed renewable electricity capacity.[66] Under its renewable energy sector development pathway compatible with average global temperature rises of below 1.5°C, IRENA projects that the global renewable energy sector could account for 38 million jobs by 2030 and 43 million by 2050, double the number under current policies and pledges. Jobs in the energy sector as a whole will grow to 122 million in 2050 under the 1.5°C pathway, compared with 114 million under the pathway that assumes only current policies and pledges will be implemented.[67]

Figure 15.
Global renewable energy employment by technology



a «Others» includes geothermal energy, concentrated solar power, heat pumps (ground based), municipal and industrial waste, and ocean energy.

b Direct jobs only.

c Includes liquid biofuels, solid biomass and biogas.

Source: IRENA, 2023[68]

The World Economic Forum (WEF) expects the transition to clean energy to generate 10.3 million net new jobs globally by 2030, offsetting the 2.7 million jobs expected to be lost in fossil fuel sectors. According to the WEF, most of the anticipated job gains are likely to be in electrical efficiency and power generation, and in the automotive sector.[69] In its World Energy Outlook 2021 on People Centred Energy Transitions, the IEA projects that 13 million jobs will be created in its scenario that assumes the implementation of already announced pledges, and double this number under a scenario that results in net-zero emissions from energy globally by 2050.[70]

Figure 16.
Global employment growth in clean energy and related areas to 2020 (in million jobs)

Source: IEA 2021

As is the case today, solar will account for the largest share of renewable energy jobs in 2050, with 19.9 million jobs, followed by bioenergy (13.7 million), wind (5.5 million) and hydropower (3.7 million).[71]

How many new jobs will materialize and whether these jobs will indeed offer decent employment according to the standards of the International Labour Organization will depend on national policy choices, the ambition of the decarbonization efforts and the provision of necessary training and skilling opportunities, keeping in mind that there are no one-size-fits-all solutions.[72] International discourse on humanizing energy transitions stresses that national energy transitions should be structured in a participatory fashion, should aim at leaving no one behind and should ensure that current imbalances and gender biases are not carried forward into the emerging energy systems, so that women and men can equally contribute to building the new energy systems and benefit from new employment. Energy transitions are deep societal transformations that call for access to innovation talent, the involvement of entire communities, and a commitment to diversity and inclusion of citizens, with a special consideration of those living in remote areas and members of ethnic minority groups.

The Sustainable Energy Jobs Platform,[73] a multi-stakeholder coalition that forms part of IRENA's Coalition for Action, provides international best practices that countries can draw on as they embark on transforming their energy systems.

Current renewable energy employment

Employment in renewable energy in Central Asia is currently estimated at around 16,529 (Table 4). Hydropower is by far the largest employment provider among the renewable energy subsectors, and accounts for more than 85 per cent of all renewable energy jobs in the region. It is followed by solar PV and wind, which are rapidly growing in Kazakhstan.

Table 4.
Estimated levels of current employment in renewable energy

	Hydropower	Solar photovoltaic	Wind	Biogas	Solar heating / cooling	Other	Total
Kazakhstan	2,379	430	533	23	-	-	3,365
Kyrgyzstan	2,000	30	-	60	20	150	2,260
Tajikistan	6,793	-	-	-	-	-	6,793
Uzbekistan	2,961	1,150	-	-	-	-	4,111
Total	14,133	1,610	533	83	20	150	16,529

Note: Given that official employment data are not available for most renewable energy technologies, these estimates have been developed through an employment factor estimate refined by advice from regional experts. Absence of data does not mean zero jobs, but highlights a data gap. Other includes equipment manufacturing for all renewable energy technologies.
Source: Unpublished data from IRENA

To facilitate the shift towards cleaner and more sustainable sources of energy in the region, the countries will need to build new infrastructure and retrofit existing energy systems, and will need a workforce with specialized skills and knowledge. In addition to direct employment in the renewable energy sector, the shift to renewables can also have positive spillover effects on the wider economy. Investments in renewable energy projects can help vitalize sectors such as construction, metal production, electrical and electronic equipment manufacturing, glass production, and mining.

This in turn could drive innovation and economic growth in the region, not only in urban centres, but – because of the distributed nature of renewables – also in rural areas.

A well-managed energy transition in Central Asia presents a significant opportunity to create new, high-quality jobs in the region, advance women's participation in the energy sector, mitigate high levels of youth unemployment and support the development of a skilled workforce in the renewable energy sector.

Employment model projections

This analysis of the job creation potential of just energy transitions relies on an employment model to develop projections of the number of jobs that the countries of Central Asia can create by investing in renewable energy generation capacity under three scenarios:

- One that extrapolates from current renewable energy investment trends into the future – business as usual (BAU);
- A second based on current national commitments and the assumption that these commitments will be fulfilled in a timely fashion; and
- A third based on higher ambitions than those in the national commitments.

The third scenario assumes that all five Central Asia countries will have achieved an electricity mix with 75 per cent renewable energy capacity, excluding large hydropower, by 2050. This scenario is not necessarily realistic for all countries, especially since some have already invested heavily in large hydropower, but it serves to illustrate the potential gains of greater investment in renewable energy.

The model excludes large hydropower because it is already well-established in Central Asia, and because capacity additions in large hydropower may be undesirable for environmental reasons. Therefore, little job growth is expected in this sector. The exercise aims to demonstrate the job creation potential of investment in other renewable energy technologies that have not yet been widely adopted in the region. The exclusion of large hydropower means that low job growth does not necessarily equate to poor energy transition performance, particularly in the case in Kyrgyzstan and Tajikistan, which already generate the vast majority of their electricity sustainably using large hydro.

Besides generating new employment opportunities in renewable energy, energy efficiency and related occupations (such as education, policy development, permitting, and advocacy), the energy transition will also displace jobs in the current fossil fuel energy sector. Global models project that the number of jobs created will be larger than the number of jobs lost, and assuming sufficient investment in renewable energy, this will also be the case in Central Asia.

Model assumptions

Table 5 shows the projected capacities for solar, wind and small hydro for each of the countries under each of the scenarios. Annex 2 provides further details on the basis for these assumptions.

> "As the energy sector goes through a transformation, automation and systems such as SCADA are reducing the need for manual labour and field work."
>
> **An economist in Central Asia**

Table 5.
Assumed 2050 capacity, by scenario and country

Kazakhstan

	Business As Usual	Current Commitments	Higher Ambitions
	6 GW	16.5 GW	24.4 GW
	6 GW	16.3 GW	24.4 GW
	300 MW	960 MW	1.9 GW
Total	12.3 GW	33.76 GW	50.7 GW

Turkmenistan

	Business As Usual	Current Commitments	Higher Ambitions
	300 MW	1.9 GW	10 GW
	-	600 MW	2.5 GW
	150 MW	117 MW	501 MW
Total	0.45 GW	2.617 GW	13 GW

Kyrgyzstan

	Business As Usual	Current Commitments	Higher Ambitions
	1.2 GW	1.9 GW	6 GW
	-	250 MW	600 MW
	270 MW	400 MW	900 MW
Total	1.47 GW	2.55 GW	7.5 GW

Uzbekistan

	Business As Usual	Current Commitments	Higher Ambitions
	3.5 GW	16.5 GW	22.4 GW
	2.5 GW	8 GW	8 GW
	300 MW	500 MW	650 MW
Total	6.3 GW	25 GW	31.05 GW

Tajikistan

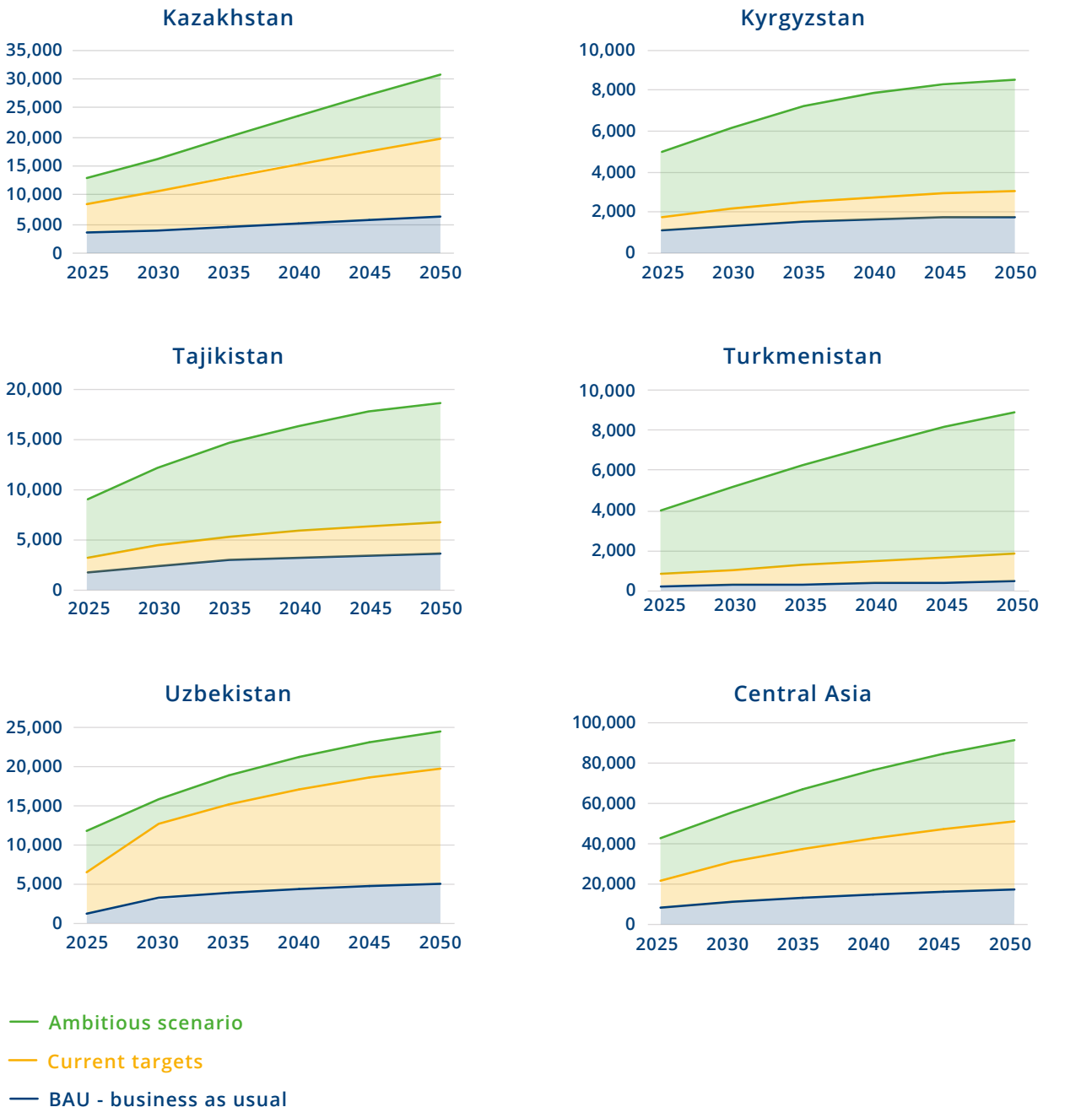
	Business As Usual	Current Commitments	Higher Ambitions
	585 MW	1.8 GW	3.7 GW
	150 MW	600 MW	1.1 GW
	1.2 GW	1.8 GW	5.6 GW
Total	1.935 GW	4.2 GW	10.4 GW

Source: Assumptions developed by authors[74]

Job creation projections

The analysis shows that if renewable energy capacity additions continue at the current BAU pace, 17,345 jobs are likely to be created by 2050. Meeting the Central Asian countries' current renewable energy commitments will require a significant increase in the pace of renewable energy deployment and will result in the creation of more than 51,090 jobs. Finally, if the countries increase their ambition and achieve 75 per cent renewable generation capacity by 2050, the renewable energy sector will employ more than 91,000 jobs.

Figure 17.
Projected employment in renewables to 2050, by scenario



Source: Based on IRENA employment-factor modelling

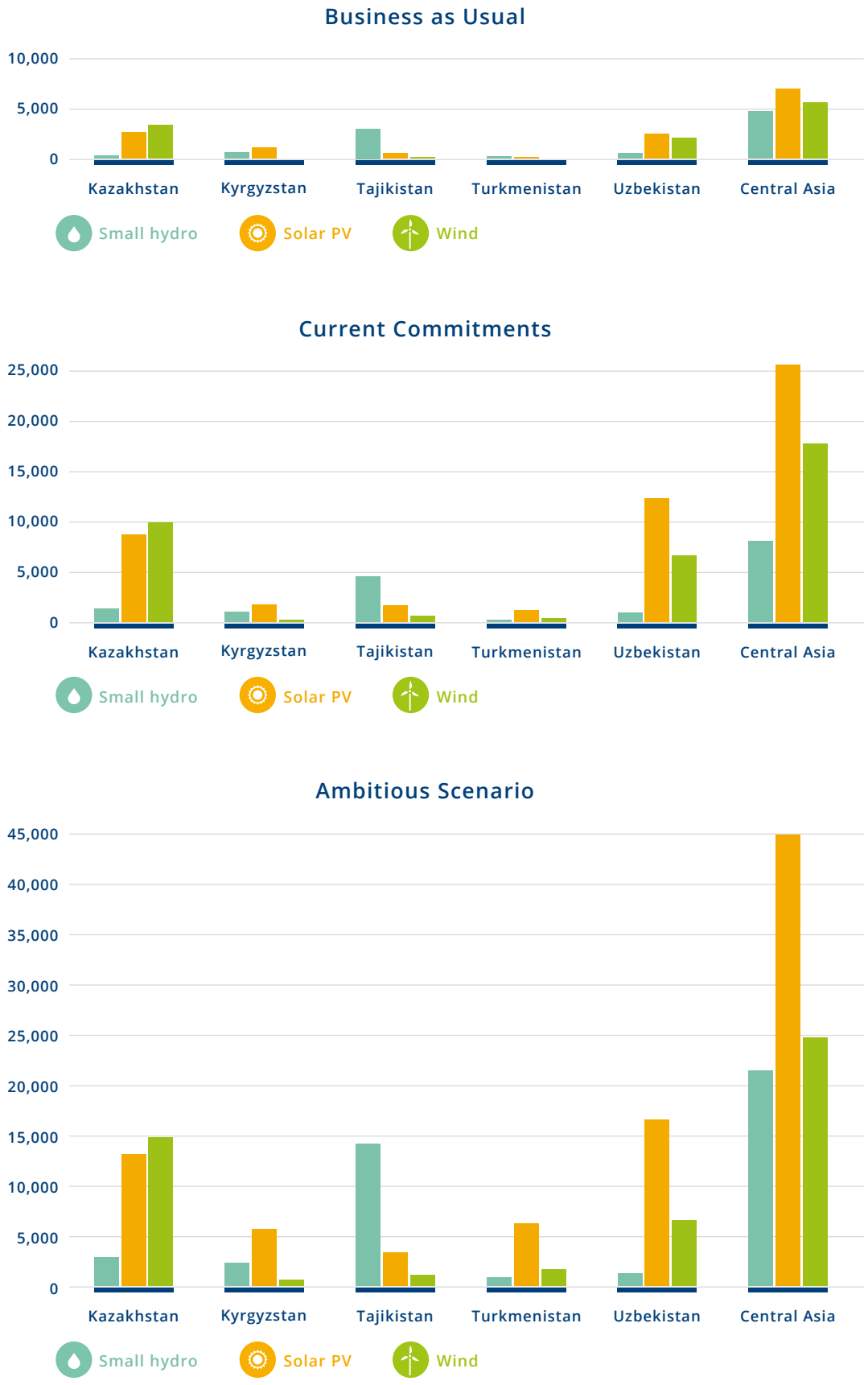
The model assumes that the rate of renewable energy capacity growth will increase over time, so that capacity additions are much larger in 2049 than in 2024. At the same time, labour productivity improvements reduce the number of jobs created per installed MW capacity. On the other hand, the increasing operation and maintenance requirements for a growing number of renewable energy facilities together with the increasing localization of renewable energy value chains help increase the sector's workforce.

Under all scenarios, wind and solar PV are the largest job creators, primarily due to the higher level of deployment in these sectors. Small hydro is the most important technology deployed in Tajikistan. It creates more jobs per unit of deployment than wind and solar PV due to higher employment intensity for construction, installation, operation, and maintenance, and due to its distributed nature. Figure 17 shows that the mix of technologies in each country remains fairly consistent under the different scenarios.

Initially, the majority of jobs are created in construction and installation. Over time, as more projects are deployed, the share of operations and maintenance jobs increases. The share of manufacturing jobs remains small, but the development of local supply chains for the production of equipment and components, based on domestically mined raw materials, can unlock new jobs in the manufacturing and assembly of renewable energy technology.

© Giulia Manconi
Control room in Nurek Hydropower Plant.

Figure 18.
Employment by technology, by scenario, 2050



Source: Based on IRENA employment-factor modelling

Implications for workforce development

Low-carbon energy systems require a broader range of skills than traditional energy systems, and these skills are needed everywhere, not just in cities or manufacturing hubs. Every community will need workers who can install, maintain, operate, and decommission small-scale renewable energy generation and storage systems and electric vehicle charging points. At the regional scale, manufacturing, assembly, and recycling capacity will be needed. Economy-wide energy efficiency efforts require skills in energy auditing, retrofitting, and the installation of efficient technologies such as heat pumps, and in the application of efficiency and circular economy principles in new construction. Significant numbers of civil servants at all levels of government will need to be trained in renewable energy permitting and the application of updated building codes.

To meet their renewable energy targets, the countries of Central Asia will need significant numbers of skilled personnel within the next three to five years. Public policy therefore needs to encourage young women and men to start building those skills now. All the countries need to rapidly develop workforce skills in the installation, operation and maintenance of solar PV facilities.

As the renewable energy subsector with the highest percentage of women among its workforce, solar PV offers a head start on ensuring greater gender equality in the renewable energy sector. Kazakhstan needs to build significant skills for wind energy deployment, and this new workforce could potentially serve the wider Central Asia market as other countries start to develop their own wind power capacity. Tajikistan could use its high potential for small hydropower to become a regional (or even global) knowledge and skills hub for small hydro development.

> **The job creation, and indeed energy transition as a whole, will not happen if skilled labour is not available in sufficient numbers. This will require proper labour force planning and investment in training.**

In Europe and the United States, for example, skills shortages are already viewed as a key threat to the energy transition, and the realization is growing that the full participation of women in the energy sector will be key to accelerate the energy transition.[75] In Central Asia, too, governments will need to make a specific effort to attract more women to the sector.

The fact that many jobs will be created in relatively young, growing companies, provides an enormous opportunity to pursue greater gender equality in the new energy sector. Women can benefit from the lack of entrenched male-dominated workplace cultures in these companies and help establish an inclusive environment from the outset. A large enough influx of women into the renewable energy sector at the early stages of its development can tip the cultural balance and establish renewable energy as a natural, desirable career choice for both women and men.

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RECOMMENDATIONS

06

Changing social and cultural norms calls for concerted action and will take time. But as norms change, measures that advance gender equality are likely to become more effective.

The survey respondents suggested a range of measures to empower women in the energy sector, and showed a clear preference for greater training opportunities, followed by gender diversity targets, mentorship opportunities, fairness and transparency policies, and flexitime work. These results largely align with an earlier study that found that women in Kazakhstan and Uzbekistan considered gender policies, mentoring, women's networks, and the promotion of female role models in the energy sector the most important measures to advance equality.[76]

The findings of the desk study, survey, interviews and stakeholder consultations inform the following recommendations for actions that governments, companies, academic institutions, civil society, and other stakeholders can take to enhance women's participation in Central Asia's energy transition.

01

Initiating an inclusive and participatory energy transition

As a first step, governments should initiate formal energy transition processes in line with their Nationally Determined Contributions under the Paris Agreement in collaboration with a broad array of stakeholders to develop a vision for a transformed energy system. Part of this vision could be for Central Asian countries to maximize their comparative advantages in the global energy transition and position the region as a hub and exporter of renewable electricity and green hydrogen. Other important steps include developing domestic manufacturing industries based on critical materials and encouraging women's entrepreneurship in these industries. Integrating women's visions and needs into energy transition planning is vital to ensuring gender equality in the energy sector, and supports the gender equality targets in the NDCs. Since women have been under-represented in the energy sector, special care is necessary to involve them in energy transition processes and to ensure full inclusion of women's experiences, perspectives, needs and priorities.

After agreement is reached on a vision, stakeholders should explore the ways in which they can contribute to maximizing the benefits of this transition, and governments should begin the design of a comprehensive roadmap toward the desired vision. Development of the roadmap should include the active involvement of all stakeholders and should prioritize gender equality. To facilitate effective implementation of the roadmap, participants should identify awareness and capacity gaps and implement measures to close them. Governments should also develop a sound strategy to finance the energy transition.

02

Enhancing the collection of disaggregated data in the energy sector

Enhancing data collection and analysis is crucial to improving baselines and keeping track of progress on the status and representation of women in the energy sector. The public sector should advance the gathering of gender-disaggregated data, and should mandate the private sector to collect such data. Conducting gender audits within companies, government agencies, and other organizations can help identify gender gaps and inequalities. These audits should include anonymous surveys to gather information from staff and other stakeholders. Furthermore, governments should conduct or commission gender audits of legislation, regulations, taxation, and specific projects to assess their differential effects on the status of women in society. The lessons learned from these audits should be integrated into gender-responsive policymaking. Setting targets for women's representation in the energy sector at all levels can provide a clear framework for progress.

03

Support women in acquiring the necessary skills to effectively participate in the energy transition

Women should be supported to develop the necessary skills to enhance their inclusion in the energy sector. Efforts to attract more women to STEM and technical and vocational education and training fields should start in primary school through targeted programmes and initiatives to address stereotypes and empower girls in STEM. These initiatives should include schools, communities and the private sector. In addition, the development of degree programmes in renewable energy technology and energy system planning should promote equal enrolment of women and men. The participation of women and men in apprenticeships should be equal. The retraining of current workers in the traditional energy sector is important, as is bringing new participants, including women, into the labour force. Companies, government agencies, and other organizations should provide training in gender awareness to mitigate biases and create more inclusive and welcoming work environments.

04

Building an inclusive and diverse energy workforce

The energy sector should make efforts to empower women in their careers and to support their advancement. Establishing women's networks within the industry can provide women with valuable networking opportunities and help them find mentors and role models. Highlighting success stories of women in the energy sector can inspire and encourage more women to pursue careers in this field, and normalize their presence across organizational levels including in leadership. Employers should promote gender equality beyond the workplace by providing workplace accommodations that allow women and men to balance work and household duties, and by encouraging men to make use of these accommodations. Governments can develop guidelines to support companies in developing inclusive workplaces. Entrepreneurship training, including guidance for business plan preparation and pitching, can empower women to pursue their own ventures. To ensure gender strategies are not just adopted but also implemented, energy sector stakeholders should allocate dedicated budgets to strengthen gender equality in energy transition processes and financial institutions should prioritize investment in female entrepreneurship.

05

Strengthening regional co-operation for just and inclusive energy transitions

The Central Asian countries should consider establishing forums for co-operation and peer learning on gender equality in the energy transition. These should involve a wide range of stakeholders and facilitate knowledge exchange and collaborative efforts. Events and conferences that highlight the importance of gender equality in the renewable energy sector can provide a platform for women in the industry to showcase their expertise and experiences. Facilitating joint target-setting for gender equality in the sector can foster collective action and ensure progress is made across the region.

By implementing these actions, Central Asian governments, businesses and other stakeholders can ensure the energy transition harnesses the full potential of women's participation and leadership and leaves no one behind.

ANNEX

Employment model assumptions for each country[77]

Kazakhstan is currently installing approximately 200 MW each of solar and wind generation capacity, and 10 MW of small hydropower capacity per year. Its current renewable energy target is 50 per cent by 2050 – assumed here to refer to 50 per cent of capacity rather than generation – which would require 34 GW of renewable capacity (excluding large hydro). The focus is expected to be primarily on solar and wind energy. The ambitious scenario assumes 75 per cent renewable generation capacity by 2050, which would require 50.7 GW of total capacity.

Kyrgyzstan is currently installing approximately 10 MW of small hydropower capacity per year. It also has some solar PV projects in the pipeline. No wind projects are planned. Its current renewable energy target (excluding large hydro) is 10 per cent, but it has not set a date for meeting this target. The analysis assumes 10 per cent capacity by 2035 and 25 per cent by 2050. This is expected to be met primarily through the expansion of solar PV and small hydro, with a few wind projects. The ambitious scenario assumes 75 per cent renewable generation capacity by 2050, which would require 7.5 GW of total capacity. The country will have fulfilled its potential capacity for small hydro. Wind energy generation is expected to remain minimal. Most of the growth will be in solar PV.

Tajikistan has added approximately 200 MW of hydropower capacity per year. The analysis assumes 20 per cent of this is small hydropower. In addition, it is adding 20 MW of solar and 5 MW of wind energy capacity per year. In its 2016 Strategy 2030, Tajikistan set a goal of diversifying energy generation sources by 10 per cent. The analysis assumes that the target for 2050 will be 30 per cent. For the ambitious scenario, which assumes 75 per cent of non-large-hydro renewable generation capacity, the analysis assumes that most of the capacity additions will be in small hydropower, followed by solar PV. Wind energy generation capacity is also assumed to have grown, as the country has considerable wind potential.

Turkmenistan currently has no renewable energy generation capacity. For the BAU scenario, the analysis assumes nominal additions of 10 MW of solar and 5 MW of small hydro per year. Wind capacity remains at zero. Turkmenistan has not published any renewable energy targets, so the analysis assumes 15 per cent by 2050 for the current commitments scenario. For the ambitious scenario of 75 per cent generation capacity, the analysis assumes that Turkmenistan will make use of its considerable solar energy potential and develop large solar PV projects. The country also has good wind energy potential and is expected to exploit that as well.

For **Uzbekistan**, the analysis assumes that the renewed national renewable energy target of 25 GW, announced in September 2023, is achieved by 2050, based on the current level of deployment in Uzbekistan. In the current commitments scenario, Uzbekistan will have reached 65% renewables share in total installed capacity by 2050. Therefore, the ambitious scenario has been raised from 75% to 80% in the modelling assumptions.

ENDNOTES

1 IRENA, 2019. Renewable Energy: A Gender Perspective, https://irena.org/publications/2019/Jan/Renewable-Energy-A-Gender-Perspective.

2 OSCE Ministerial Council, 2011. Decision No. 10/11 "Promoting equal opportunity for women in the economic sphere", https://www.osce.org/mc/86085.

3 OSCE Ministerial Council, 2013. Decision No. 5/13 "Improving the environmental footprint of energy-related activities in the OSCE region", https://www.osce.org/mc/109342.

4 Central Asia Regional Economic Cooperation (CAREC), 2019. Energy Ministers Dialogue, https://energy.carecprogram.org/wp-content/uploads/2021/08/Ministerial-Declaration-v26Nov2019-1.pdf.

5 OSCE, 2022. Advancing Energy Security in Central Asia, https://www.osce.org/oceea/513787.

6 IEA, 2022. Kazakhstan – Energy Policy Review (p. 71), https://www.iea.org/reports/kazakhstan-2022.
IEA, 2022. Kyrgyzstan – Energy Policy Review (p. 45), https://www.iea.org/reports/kyrgyzstan-2022.
IEA, 2022. Tajikistan – Energy Policy Review (p. 35), https://www.iea.org/reports/tajikistan-2022.
IEA, 2022. Uzbekistan – Energy Policy Review (p. 67), https://www.iea.org/reports/uzbekistan-2022.

7 IRENA, Regional figures based on IRENA calculations, unpublished data, retrieved 7 July 2022.

8 IRENA, Internal data, retrieved 7 July 2022.

9 L. Omarkhanova, 2022. Round table on "Promoting Women's Participation in the Energy Sector", unpublished presentation at the OSCE Regional workshop, Fostering Women's Participation in the Energy Sector in Central Asia, Astana, 7-8 December 2022.

10 M. Laldjebaev et al., 2021. Renewable Energy in Central Asia: An overview of potentials, deployment, outlook, and barriers. https://www.sciencedirect.com/science/article/pii/S2352484721002924.

11 REN21 and UNECE, 2022. UNECE Renewable Energy Status Report 2022 (p.15), https://www.ren21.net/2022-unece-renewable-energy-status-report/.

12 Republic of Uzbekistan, 2023. Decree of the President of the Republic of Uzbekistan on the Strategy "Uzbekistan - 2030", Target 51, https://lex.uz/ru/docs/6600404#6605092.
IEA, 2022. Solar Energy Policy in Uzbekistan: A Roadmap, https://www.iea.org/reports/solar-energy-policy-in-uzbekistan-a-roadmap.
Ben Aris (bneINTELLINEWS), bneGREEN, "Uzbekistan becomes Central Asia's number one in renewable energy", 22 May 2023, https://www.intellinews.com/bnegreen-uzbekistan-becomes-central-asia-s-number-one-in-renewable-energy-279371/.

13 IRENA, 2022. Renewables Readiness Assessment: The Kyrgyz Republic, https://www.irena.org/Publications/2022/Dec/RRA-Kyrgyz-Republic.
Vikrant Panwar et al., 2022. Opportunities and co-benefits of transitioning to a net-zero economy in Kyrgyzstan, Tajikistan and Uzbekistan, ODI Report, https://cdn.odi.org/media/documents/ODI_Opportunities_net-zero_economy_Kyrgyzstan_Tajikistan_Uzbekistan.pdf.

14 Vanessa Dezem (Bloomberg), "Kazakhstan Signs Deal to Make Hydrogen at a $50 Billion-Plant", 27 October 2022, https://www.bloomberg.com/news/articles/2022-10-27/kazakhstan-signs-deal-to-make-hydrogen-at-a-50-billion-plant.
Joanna Lillis (Eurasianet), "EU taps Kazakhstan for rare earths, green hydrogen", 9 November 2022, https://eurasianet.org/eu-taps-kazakhstan-for-rare-earths-green-hydrogen.

15 ACWA Power, "ACWA Power to develop Uzbekistan's first green hydrogen and green ammonia projects", 19 January 2023, https://www.acwapower.com/news/acwa-power-to-develop-uzbekistans-first-green-hydrogen-and-green-ammonia-projects/.

16 IRENA, 2022. Solar PV: A Gender Perspective, https://www.irena.org/publications/2022/Sep/Solar-PV-Gender-Perspective.

17 Hugo Lucas, Stephanie Pinnington and Louisa F. Cabeza, 2018. Education and training gaps in the renewable energy sector. *Solar Energy*, 173, 449–455, https://doi.org/10.1016/j.solener.2018.07.061.

18 Katherina Rick, Ivan Marten and Ulrike Von Lonski, 2017. Untapped reserves: Promoting gender balance in oil and gas: A collaboration between the World Petroleum Council and The Boston Consulting Group, https://www.bcg.com/publications/2017/energy-environment-people-organization-untapped-reserves.

19 Ergon Associates, 2021. Supporting renewable energy and promoting gender equality in Kazakhstan; Baseline Assessment Report.

20 A. Abdykerimova, 2022. The Role of Women in Energy in Central Asian Countries, unpublished presentation at the OSCE Regional workshop, Fostering Women's Participation in the Energy Sector in Central Asia, Astana, 7-8 December 2022.

21 dena, 2021. The role of women in energy: Female empowerment in Eastern Europe and Central Asia, https://www.dena.de/fileadmin/dena/Dokumente/Themen_und_Projekte/Internationales/Laenderdialog/2022-03-03_Study_The_Role_of_Women_in_Energy.pdf.

22 IRENA, 2019. Renewable Energy: A Gender Perspective, https://irena.org/publications/2019/Jan/Renewable-Energy-A-Gender-Perspective.

23 M. Aisarieva, 2022. Women's inclusion in the workforce at Samruk Energy, unpublished presentation at the OSCE Regional workshop, Fostering Women's Participation in the Energy Sector in Central Asia, Astana, 7-8 December 2022.

24 dena, 2021. The role of women in energy: Female empowerment in Eastern Europe and Central Asia, https://www.dena.de/fileadmin/dena/Dokumente/Themen_und_Projekte/Internationales/Laenderdialog/2022-03-03_Study_The_Role_of_Women_in_Energy.pdf.

25 L. Omarkhanova, 2022. Round table on "Promoting Women's Participation in the Energy Sector", unpublished presentation at the OSCE Regional workshop, Fostering Women's Participation in the Energy Sector in Central Asia, Astana, 7-8 December 2022.

26 S.N. Pulatova, 2022. Implementation of gender equality policy at Uzbekhydroenergo JSC, unpublished presentation at the OSCE Regional workshop, Fostering Women's Participation in the Energy Sector in Central Asia. Astana, 7-8 December 2022.

27 Asian Development Bank, 2018. Kazakhstan Country Gender Assessment, https://www.adb.org/documents/kazakhstan-country-gender-assessment-2018.
Asian Development Bank, 2018. Uzbekistan Country Gender Assessment: Update, https://www.adb.org/documents/uzbekistan-gender-assessment-update.

28 Anti-Discrimination Centre Memorial, 2020. All Jobs for All Women: Cancel lists of types of jobs and professions banned to women in all Eastern European and Central Asian countries, https://adcmemorial.org/en/all-jobs4all-women/.

29 Ministry of Justice of the Kyrgyz Republic, 2012. On the List of industries, jobs, professions and positions with harmful and (or) dangerous working conditions, where the use of women's labor is prohibited. [О Перечне производств, работ, профессий и должностей с вредными и(или) опасными условиями труда, на которых запрещается применение труда женщин], http://cbd.minjust.gov.kg/act/view/ru-ru/7182.

30 AVESTA Information Agency, "Restrictions on women's work will be revised", 12 May 2023, https://avesta.tj/2023/05/12/ogranicheniya-na-trud-zhenshhin-budut-peresmotreny/.

31 William Seitz and Sevilya Murodova, "Examining the scale of gender discrimination in hiring practices in Uzbekistan", World Bank Blogs: Eurasian Perspectives, 7 March 2022, https://blogs.worldbank.org/europeandcentralasia/examining-scale-gender-discrimination-hiring-practices-uzbekistan.

32 Anna Bjerde, "Europe and Central Asia Economies Need More Women Entrepreneurs and Business Leaders", 8 March 2022, The World Bank, https://www.worldbank.org/en/news/opinion/2022/03/08/europe-and-central-asia-economies-need-more-women-entrepreneurs-and-business-leaders.

33 World Bank, 2012. World Development Report 2012: Gender Equality and Development, https://openknowledge.worldbank.org/entities/publication/51c285f6-0200-590c-97d3-95b937be3271.

34 UNEP, 2020. Powering Equality: Women's entrepreneurship transforming Asia's energy sector, http://www.unep.org/resources/report/powering-equality-womens-entrepreneurship-transforming-asias-energy-sector.

35 Soma Dutta, 2018. "Supporting last-mile women energy entrepreneurs: What works and what does not", Energia, the international network on gender and sustainable energy, https://www.energia.org/assets/2019/01/Supporting-Last-Mile-Women-Entrepreneurs.pdf.

36 World Economic Forum, 2023. Global Gender Gap Report 2023: Insight Report, https://www3.weforum.org/docs/WEF_GGGR_2023.pdf.

37 Jonathan Woetzel et al., 2015. How advancing women's equality can add $12 trillion to global growth, McKinsey, https://www.mckinsey.com/featured-insights/employment-and-growth/how-advancing-womens-equality-can-add-12-trillion-to-global-growth.

38 Mekala Krishnan et al., "Ten things to know about gender equality", 21 September 2020, McKinsey, https://www.mckinsey.com/featured-insights/diversity-and-inclusion/ten-things-to-know-about-gender-equality.

39 Sangeeta Bharadwaj Badal, "The Business Benefits of Gender Diversity", 20 January 2014, Gallup, https://www.gallup.com/workplace/236543/business-benefits-gender-diversity.aspx.

40 AVESTA Information Agency, "Restrictions on women's work will be revised", 12 May 2023, https://avesta.tj/2023/05/12/ogranicheniya-na-trud-zhenshhin-budut-peresmotreny/.

41 Ozan Sevimli and Alisher Rajabov, "Working towards gender equality in Tajikistan's labor market", 7 March 2022, World Bank Blogs: Eurasian Perspectives, https://blogs.worldbank.org/europeandcentralasia/working-towards-gender-equality-tajikistans-labor-market.

42 IRENA, 2019. Renewable Energy: A Gender Perspective, https://irena.org/publications/2019/Jan/Renewable-Energy-A-Gender-Perspective.

43 IRENA, 2019. Renewable Energy: A Gender Perspective, https://irena.org/publications/2019/Jan/Renewable-Energy-A-Gender-Perspective.
IRENA, 2020. Wind energy: A Gender Perspective, https://www.irena.org/publications/2020/Jan/Wind-energy-A-gender-perspective.
IRENA, 2022. Solar PV: A Gender Perspective, https://www.irena.org/publications/2022/Sep/Solar-PV-Gender-Perspective.

44 Stefanie K. Johnson, David R. Hekman and Elsa T. Chan, 2016. "If There's Only One Woman in Your Candidate Pool, There's Statistically No Chance She'll be Hired", *Harvard Business Review*, 26 April 2016, https://hbr.org/2016/04/if-theres-only-one-woman-in-your-candidate-pool-theres-statistically-no-chance-shell-be-hired.

45 Asia-Pacific Gateway Skills Table, 2017. Women's Participation in Transportation Careers – Moving Beyond the Status Quo, https://www.westac.com/application/files/8015/0161/4819/WIT-Report-2017-Final-Web.pdf.

46 Bipasha Baruah, 2018. Barriers and Opportunities for Women's Employment in Natural Resources Industries in Canada, Report Presented at Natural Resources Canada, Ottawa, 27 November. https://www.academia.edu/39431981/Barriers_and_Opportunities_for_Women_s_Employment_in_Natural_Resource_Industries_in_Canada.

47 UNESCO, 2017. Cracking the code: Girls' and women's education in science, technology, engineering and mathematics (STEM), UNESCO International Symposium and Policy Forum, (Paris: UNESCO). https://unesdoc.unesco.org/ark:/48223/pf0000253479_eng.

48 Bipasha Baruah, 2018. Barriers and Opportunities for Women's Employment in Natural Resources Industries in Canada, Report Presented at Natural Resources Canada, Ottawa, 27 November. https://www.academia.edu/39431981/Barriers_and_Opportunities_for_Women_s_Employment_in_Natural_Resource_Industries_in_Canada.

49 Young Women's Trust, 2016. Making apprenticeships work for young women, https://www.youngwomenstrust.org/our-research/making-apprenticeships-work-for-young-women/.

50 Kinga Szebeni, 2022. "The Skills Agenda promotes gender balance in view of a just twin transition in Europe", PowerPoint, https://ec.europa.eu/regional_policy/rest/cms/upload/17102022_090352_1__kinga_szebeni_euregionsweek_2022.pdf.

51 Bipasha Baruah, 2018. Barriers and Opportunities for Women's Employment in Natural Resources Industries in Canada, Report Presented at Natural Resources Canada, Ottawa, 27 November. https://www.academia.edu/39431981/Barriers_and_Opportunities_for_Women_s_Employment_in_Natural_Resource_Industries_in_Canada.

52 OSCE, 2023. OSCE Scholarship Program for Young Women in Renewable Energy, https://www.osce.org/oceea/548503.

53 Lean In, 2019. Women in the Workplace 2019. https://leanin.org/women-in-the-workplace/2019.

54 Jorgen Harris, 2022. "Do wages fall when women enter an occupation?", *Labour Economics*, Vol. 74, January, 2022, https://www.sciencedirect.com/science/article/abs/pii/S0927537121001378.

55 Include-Empower, 2018. "Gender Bias at Work: The Assertiveness Double-Bind", 10 March 2018, https://cultureplusconsulting.com/2018/03/10/gender-bias-work-assertiveness-double-bind/.

56 S.N. Pulatova, 2022. Implementation of gender equality policy at Uzbekhydroenergo JSC, unpublished presentation at the OSCE Regional workshop, Fostering Women's Participation in the Energy Sector in Central Asia. Astana, 7-8 December 2022.

57 UNFCCC, 2019. Information note: Analysis of levelised cost of electricity generation and penetration rates of grid connected solar PV and on-shore wind technologies, Clean Development Mechanism, https://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20190725082445910/Information%20note%20on%20LCOE%20and%20Penetration%20rate.pdf.

58 Sherry Stout et al., 2018. Distributed Energy Planning for Climate Resilience, National Renewable Energy Laboratory, https://www.nrel.gov/docs/fy18osti/71310.pdf.

59 OECD, 2022. Weathering Economic Storms in Central Asia: Initial Impacts of the War in Ukraine, https://www.oecd-ilibrary.org/development/weathering-economic-storms-in-central-asia_83348924-en.

60 AKFUSA, "Pamir Energy", 30 May 2015, Aga Khan Foundation USA, https://www.akfusa.org/our-work/pamir-energy/.
AKFUSA, 2022. Annual Report 2021: Locally Rooted Leadership, Aga Khan Foundation USA, https://www.akfusa.org/our-stories/annual-report-2021/.
Rayhon Jonbekova, Pamir Energy Tajikistan, Women's empowerment, Personal communication, 2022.
Daler Jumaev, "Pamir Energy and the future of clean electricity in Central Asia", 6 July 2020, https://the.akdn/en/resources-media/whats-new/our-stories/pamir-energy-and-future-clean-electricity-central-asia.

61 David Keenan, "The Dangerous Air Quality in Kyrgyzstan", 12 February 2023, The Borgen Project, https://borgenproject.org/air-quality-in-kyrgyzstan/.

62 UNEP, "UNEP sounds the alarm on air quality in the Kyrgyz capital", 9 February 2022, UN Environment Programme, http://www.unep.org/news-and-stories/press-release/unep-sounds-alarm-air-quality-kyrgyz-capital.

63 Tatyana Kudryavtsava, "Getting ready for winter: How much will it cost to heat with coal, electricity and gas", 3 September 2022, 24.kg https://24.kg/ekonomika/243819_gotovimsya_kzime_voskolko_oboydetsya_otoplenie_uglem_elektrichestvom_igazom/

64 AKIpress, "Kyrgyzstan interested in joint production of electric cars with South Korea", 26 September 2022, AKIpress, https://m.akipress.com/news:680639:Kyrgyzstan_interested_in_joint_production_of_electric_cars_with_South_Korea/.
IRENA, 2022. Renewables readiness assessment: The Kyrgyz Republic, https://www.irena.org/Publications/2022/Dec/RRA-Kyrgyz-Republic.

65 GOGLA, 2022. GOGLA Annual Report 2021, https://www.gogla.org/resources/gogla-annual-report-2021.

66 IRENA, 2022. Renewable Energy and Jobs: Annual Review 2022, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2022/Sep/IRENA_Renewable_energy_and_jobs_2022.pdf.

67 IRENA, 2021. Renewable Energy and Jobs: Annual Review 2021, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Oct/IRENA_RE_Jobs_2021.pdf.

68 IRENA, 2023. Renewable Energy and Jobs: Annual Review 2023, https://www.irena.org/Publications/2023/Sep/Renewable-energy-and-jobs-Annual-review-2023.

69 Omri Wallach, 2022. "How many jobs could the clean energy transition create?", World Economic Forum, https://www.weforum.org/agenda/2022/03/the-clean-energy-employment-shift-by-2030.

70 IEA, 2021. "People centred transitions", World Energy Outlook 2021, https://www.iea.org/reports/world-energy-outlook-2021/people-centred-transitions.

71 IRENA, 2021. Renewable Energy and Jobs: Annual Review 2021, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Oct/IRENA_RE_Jobs_2021.pdf.

72 ILO, 2023. Decent work indicators, https://www.ilo.org/integration/themes/mdw/WCMS_189392/lang--en/index.htm.

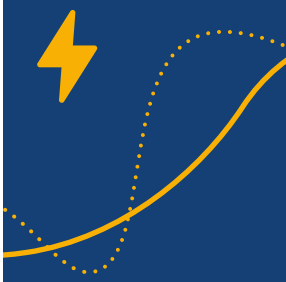
73 Sustainable Energy Jobs Platform, 2023, http://sejplatform.org/.

74 Arslan Khalid, Independent Consultant, Models based on IRENA methodology, 2023.

75 G7 Climate, Energy and Environment Ministers' Communiqué, Sapporo, 16 April 2023, https://www.meti.go.jp/press/2023/04/20230417004/20230417004-1.pdf, (see paragraph 22: Just Transition).

76 dena, 2021. The role of women in energy: Female empowerment in Eastern Europe and Central Asia, https://www.dena.de/fileadmin/dena/Dokumente/Themen_und_Projekte/Internationales/Laenderdialog/2022-03-03_Study_The_Role_of_Women_in_Energy.pdf.

77 Arslan Khalid, Independent Consultant, Models based on IRENA methodology, 2023.



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