



International Forum on Innovating and Modernizing Energy and Water in Central Asia

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Venue: Kazakh-British Technical University
59 Tole bi street, Almaty, 050000 Republic of Kazakhstan

- Hybrid (in person conference and online)

Co-organizers: UNECE, UNESCAP, National Academy of Sciences of RK (NAS RK), The International Green Technologies and Investment Centre, International R&D Centre of Energy Integration (IRDCEI), and The Kazakh British Technical University (KBTU), Kazakhstan

Summary report

Over three days, about one hundred experts met to exchange views about the situation of energy and water infrastructure in Central Asia. Today the economies of Central Asia are looking for more diversification, economic complementarities and increasing intra-regional trade and scaled up regional cooperation. There are many constraints to this aspiration: from transport and trade connectivity and ageing infrastructure to industrial efficiency, energy security, market access and trade barriers. At the same time, Central Asia is highly vulnerable to climate change and in particular due to the short- and long-term implications of melting glaciers are facing an increased risk of natural disasters and depletion of water resource stock. These changes will have direct implications on people and economies. Providing solutions will require a significant effort of adaptation and improvement in the field of water and energy, including in the planning, building, and operations of infrastructure.

Reinforcing regional economic cooperation with a focus on productive sectors and green technologies presents an important factor for stability in the region and for the region's further integration into global value chains. Central Asian countries already agree on the importance of a more integrated approach towards structural economic transformation to recover better while staying on track to achieving the Sustainable Development Goals (SDGs) by 2030. Most recently, the Heads of State of Central Asia adopted a Joint Statement on the results of the 3rd Consultative Meeting in the city of Turkmenbashi (August 6, 2021), which, among other priorities emphasizes:¹

- *“the importance of further deepening multilateral cooperation in the transport and transit sector ... trade and tourism, the introduction of innovative, energy-saving and electronic technologies...”*
- *the “intention to join efforts for joint implementation of innovative programs and projects, as well as to promote effective cooperation in the field of science, technology and innovation, joint research ... in order to find new sources of social and economic growth”.*

¹ Excerpts from the Joint Statement are provided in an unofficial translation.

Furthermore, as discussed recently at the "High-level dialogue on the effective development of energy, water and land resources in the Central Asian countries" in Tashkent (15 October 2021) transboundary water cooperation is crucial to tackle climate change and to develop solutions to the problems the countries face collectively, based on common objectives, complementarities, and shared benefits.

This international Forum provided a platform for taking these priorities forward, and for strengthening regional cooperation. At this occasion, participants shared views in the wider areas connected to energy and water as the backbone to societal development, including renewable energy, decarbonising energy intensive industries, circular carbon economy, innovation, and trade and invites participants to set priorities that matter to Central Asia in a series of regional dialogues and workshops.

The objective of the Forum was to develop solutions for many of the challenges posed by the implementation of the 2030 Agenda on Sustainable Development and discuss the possibilities for investing in regional and transboundary projects and refining approach, financing mechanisms and partnerships jointly and in an interactive setting. The Forum looked at opportunities for projects that bring several Central Asian countries together, that are addressing transboundary or regional needs and opportunities and that may be funded via a combination of national budgets, donor funds and eventually private or IFI financing. Among others, the recommendations reached by the hands-on workshop in Almaty will be reported to the Governing Council meeting of the Special Programme for the Economies of Central Asia (SPECA) for consideration through this report. The recommendations may also be useful as countries of the region progress with specific forms of collaboration.

A high-level discussion about the role of economic cooperation and green technologies for stability in Central Asia kicked-off the event, which was preceded by an implementation workshop of the UNECE managed project *"Enhancing transboundary energy cooperation through introduction of wind and solar energy into power systems of the CIS countries to support achievement of SDG 7."*

Questions discussed with participants

- Innovation, modernisation, and infrastructure: what works, what does not and why in Central Asia? What is missing?
- Which regional and transboundary energy and water projects are turnkey in the context of innovation, environment and *just* transition?
- What are the current regional conditions for infrastructure investments in Central Asia? What are the challenges with regards to financing green infrastructure projects?
- How can we attract and sustain investments in energy and water innovations that are essential for growth and can avert a climate crisis?
- How can such investments be directed to modernizing fossil fuel infrastructure with *just* transition and environmental concerns in mind?
- How can such innovation investments be translated into regional results and collaboration?
- What role for research and innovation in *just* transition concepts?
- How can Central Asian countries learn from each other in the space of R&D, innovation, for example through existing or emerging science and technology clusters?
- What role for a SPECA fund? What role for the Technology Centre? For UN platforms?

Outcomes from the Forum

Central Asia is a diverse region, rich in resources and opportunities. As energy and water infrastructure is being modernised, planned, and built, there is an opportunity for an integrated innovative and forward-looking regional approach to save resources and connect systems for optimised results. The region has an appetite for information from international sources, global and regional developments to learn and apply lessons and recommendations to a local context. A regional approach was highlighted by most presenters to maintain energy security and protect the environment, acknowledging that it would not be easy. Many mentioned the unifying factor that a reliable, affordable energy and water infrastructure would play.

The high-level participants made the link with the Conference of the Parties (COP) 26, in progress at the same time, and reminded of the urgency to act, putting energy and water in the wider context of societal nexus areas, for example cities, transport and health. The Forum stressed that energy is crucial for achieving almost all the Sustainable Development Goals, from its role in the eradication of poverty through advancements in health, education, water supply and industrialization, to combating climate change. They called for an active role of the United Nations for concrete decisions.

Main points from the high-level panel

- Emissions of greenhouse gases must peak now if global warming is to be limited to 2°C. Only immediate and sustained action can decarbonize energy in time. Central Asia has a role to play and a contribution to make, especially since there is a gap between the international pledges made by Central Asian countries and progress on the ground, in particular when it comes to modernizing coal-based infrastructure and long-term national energy strategies.
- Central Asian countries are directly affected by the interplay of energy and water infrastructure and climate change and are ready to take steps to improve infrastructure and policies towards a more integrated, long-term interconnectivity.
- Improving energy efficiency and decarbonising energy supply are essential to meeting the Paris Agreement. Renewable energy, highly efficient fossil fuels with carbon capture use and storage (CCUS), nuclear power, and hydrogen must all be part of the energy mix to achieve energy security and decarbonise the economy in the long-term. Like in all other regions, decarbonisation of the energy system will be challenging, and the region is looking towards and innovative approaches and shared learning from other countries.
- CO₂ removal is key to eliminate GHG emissions from the existing, predominantly fossil fuel-based infrastructure, ensure reliable energy services and social cohesion, and enable a smooth transition. Central Asia has vast storage capacities, which it could develop. This would minimise emissions from the coal sector as long as it stays operational.
- A common rational use of resources needs to move up on the regional agenda, in particular when it comes to energy and water and common interests in Central Asia.
- Innovative financing tools and green bonds should also reach Central Asia, covering all clean energy technologies within a carbon neutral framework.
- Country specific experiences and challenges should be shared more regularly, including from other regions in the world, so that Central Asian countries can benefit and leapfrog in education and capacity building. United Nations platforms can pave the way, facilitating a much-needed dialogue between government, the private sector, regional and international experts.

- Participants highly supported the availability of monetary resources or unconditional funding mechanisms to the benefit of regional projects with high local impact. A SPECA fund could play such a role, catalysing additional donor monies from the international donor community.

Main points from the regional discussions and workshop

Renewable energy

- There is a need for a diversified and regional approach for developing renewable energy resources. Countries in Central Asia have a vast undeveloped potential for solar and wind energy deployment, but there is need for a more strategic diversified technology and regional approach to bring balance and cost effectiveness to the energy system. As there is no one-size-fits-all approach, each country must decide based on their resource endowment and national strategies yet will benefit from the stability a regional grid would bring.
- More work is needed to examine the impact of developing renewable energy on social entrepreneurship. In fact, a closer look at the social side was mentioned by many, also in the context of industrial development, jobs and *just* transition.
- Renewable energy is best developed at a regional level through a consortium of able partners. Looking at renewable energy more closely should include small hydro and geothermal energy. The regional geothermal potential is not yet well understood and could be developed better. There are good examples in China, where already over 50 cities have developed district heating based on geothermal energy.
- Kazakhstan has requested a second “hard talk” related to renewable financing and integration in Q1 2022. This follows a very successful event in 2018, paving the way for the auctioning system today in place.

Regional cooperation and approach

- Regional cooperation, connectivity and regional integration of the electricity system is key to achieving a resilient and balanced energy system in Central Asia. Countries from the region would benefit from identifying projects of common interest and coordinating electricity transmission planning and operation.
- Regional platforms can also play a role to shape commitments and explore which policies would be most beneficial when it comes to harmonizing policy and regulatory frameworks on a regional level. For this to happen, countries need to agree on common ground and a common future regional perspective. This required an honest and continuous dialogue that addresses all barriers in a systematic way.

Carbon-neutral energy intensive industries, *just* transition and regional restructuring

- There is no doubt that most participants were interested in the interconnectedness of energy and water technologies, in particular fossil fuel-based infrastructure and their phase out, the modernisation of a regional gas pipeline system, renewable energy uptake and small hydro, and market development issues.
- Many questions remain on the closure of coal plants, and how this would in practice happen in this region, given a lack of understanding, communication, and social aspects at all levels and across all stakeholders. Suggestions were made to adopt a new approach to modernize coal technologies with reduced CO₂ emissions and waste disposal and implement CCUS technologies to reach carbon neutrality.
- The role of gas and a modernized and stable gas grid was mentioned several times, both within Central Asia and with neighbours. In this context mentioned were nuclear and hydrogen and interregional electricity trade. Further work is required to explore innovative energy systems, and good data and modelling capabilities are required.
- Globally, energy intensive industries are responsible for about 25% of CO₂ emissions that need to be cut to reach 2°C. The numbers will be slightly different in Central Asia, but energy intensive industries will also bear the lion share and modernising this sector an imperative.

- Embracing the concept of circular carbon economy that encompasses reduce, reuse, recycle and removal of carbon can be a solution. Only international cooperation and innovation can deliver the accelerated and more ambitious strategies. If the gaps are not addressed urgently, progressively more drastic, and expensive measures will be required to avoid extreme and potentially unrecoverable social impacts as countries try to cope with climate change.
- Demonstration projects are needed that can over the medium term develop solutions and serve as a laboratory for a host of developments on the technology and policy as well as social front, as there is a distinct connection between *just* transition and social justice and countries' appetite to tackle coal mine closure: A suggestion was made to use Kazakhstan as a demonstration project for the modernisation of a major industrial cluster in the Karaganda basin, as it groups together steel, cement manufacturing based on coal mining. The area would be an excellent example for methane capture, CCUS and other technologies, while developing a forward looking, socially accepted programme for *just* transition (see more details in the list of fundable projects). To be effective, *just* transition strategies require local, bottom-up participation of all affected stakeholders and commitment by the governments to guarantee their buy-in and provide planning security. The proposed changes should focus not only on the broadly understood economic needs of people, but must also take under consideration their other substantial needs related to their sense of identity and belonging to a given community, adherence to a given culture and heritage, etc.

Carbon capture, use and storage

- The concept of carbon neutrality will require rapid deployment of carbon capture, use, and storage technologies to bridge the gap until innovative, next generation low-, zero-, or negative-carbon technologies are commercialized. Kazakhstan has vast potential to store CO₂ in its geological formations. *(estimates are about 403 Mt of storage in saline aquifers largely in the carbonate platforms in the pre-salt section of Precaspian basin and in post-salt clastic reservoirs trapped by salt-dome. Additional 250 related to EOR activities in oil & gas reservoirs)*. Realising these opportunities implies developing a transport infrastructure, which needs to be funded and regulated.

Hydrogen

- Hydrogen has been proposed as a backbone to a modern, decarbonised energy society. Hydrogen is already used a chemical feedstock, for example for ammonia used in fertilisers or in hydrocarbons used for plastics. In the future, hydrogen can be used as energy carrier and energy storage medium. It has vast, viable applications across a range of sectors that need to be decarbonised, such as transport, industry, power generation and heat for buildings, but many questions remain, including in the regional domain.
- UNECE is launching a project on how to improve sustainable hydrogen production and export potential of CIS countries with the objective to assess the potential of the CIS countries towards the development of a global hydrogen economy and raise awareness of hydrogen as a potential solution for carbon neutrality. If successful, the objective is to support pilot and demonstration projects in the region. Regional experts are invited to participate in this work.

Education, communication, and awareness

- Good communication and awareness is needed when developing future strategies. There is currently a shift in the way decision makers see the development of energy infrastructure. Many decisions directly concerning energy infrastructure are taken outside the energy "bubble" and concern socio-political acceptance, market acceptance, and community acceptance, and will impact financial risks and project development times. This needs to be considered in the planning process.
- Many panels reminded participants of the need to build capacity and train the younger generation in all issues related to energy and water technologies. Mostly mentioned electrical power generation, innovative

technologies and *just* transition. Panellists cautioned as good education would take time and resources, both not available. This could be a key project supported by a regional funding mechanism.

Digitalization, data, and statistics

- Digitalization and data collection are key for creation of a resilient and stable energy system. Regional platforms can help coordinate sharing data and information. Standardisation of data collection, statistical methods and their interpretation was mentioned here.
- Quantitative indicators standardized statistical approaches for the region and applied methodologies must be the basis for informed energy planning.

Resource management and critical raw materials

- The United Nations Framework Classification for Resources (UNFC) is a globally applicable tool for classifying and reporting natural resources, including minerals. UNFC provides uniform terminology for all resources, including mineral, petroleum, renewable energy, groundwater, nuclear fuel, and anthropogenic resources, and for geological storage e.g. of CO₂.
- UNFC has introduced new rules for social-environmental-economic reporting that can be adopted by governments and companies. UNFC defines clear standards for classification and reporting, which are continuously strengthened.
- Recently, UNECE was asked by countries and industry to develop a United Nations Resource Management System (UNRMS) as an addition to UNFC to provide a toolkit for integrated and sustainable management of all resources. UNRMS, which will have UNFC as a source of information, will provide the principles, standards, guidelines, and best practices for the responsible development of resources with key objectives such as zero-harm and zero-waste to support progress towards circular economy.
- The regions' national resource management systems for minerals and petroleum are based on the Former Soviet Union classification. Countries are currently exploring the possibility of adopting an international standard for petroleum resource reporting.

Circular economy

- Realization of the Sustainable Development Goals will require massive inputs of low-carbon energy, critical raw materials, and other natural resources, including land and water. These demands are aggravated by rapid urbanization of the world's population, which stresses grid-based power, availability of clean cooking fuels and other raw materials required to ensure energy and resource efficiency. With current patterns of resource use it will not be possible to reasonably meet demand.
- The world is currently experiencing only the first crisis of more to come on clean energy markets and rising prices. Rising future demand for raw materials, many of which come from Central Asia and China, will not be met. This mismatch needs to be anticipated, and circular economy and recycling will be key to reduce future demand and stabilize future energy prices.
- Rapid progress to a circular economy is seen as essential. However, energy efficiency improvements are stagnating, and the amounts of materials recycled remains at a very disappointing rate of about 8 per cent. A paradigm shift will be required to kick start a circular economy model and follow up workshops could explore much needed capacity building.

Energy and water nexus

- Climate change is projected to have a massive impact in Central Asia, with direct implications on the life of people (in cities and in rural areas); furthermore, Central Asia will have to deal with the short- and long-term implications of melting glaciers, which mean increased risk of natural disasters and slow depletion of resource stock.

- Quoting the latest IPCC report *“River runoff in snow dominated and glacier-fed river basins will change further in amount and seasonality in response to projected snow cover and glacier decline (very high confidence) with negative impacts on agriculture, hydropower and water quality in some regions (medium confidence). The average winter snowmelt runoff is projected to increase (high confidence), and spring peaks to occur earlier (very high confidence).”* And *“Hydropower operations will increasingly be impacted by altered amount and seasonality of water supply from snow and glacier melt (high confidence).”*
- Coping with these changes will require a significant effort of adaptation and improvement in the field of *water*, notably for infrastructure planning, building, and operations. Effective transboundary cooperation could play a crucial role in this.
- Countries may find better solutions to the problems they face through regional cooperation, rather than by moving individually. On the one hand, Central Asian countries are complementary in terms of resource availability, and on the other they share regional objectives of development. For example there could be merit in reviving the proposal for a “Water-Energy Consortium” in Central Asia, as proposed by Kazakhstan some years back.
- UNECE carried out a Water-Food-Energy-Ecosystems Nexus Assessment of the Syr Darya River Basin in 2014-15 and is going to work on a region-wide project on climate and nexus with the OECD and other partners. The result was an integrated energy-water model (multi-country with basin delineation to study the dependency of energy sector on water resources in the basin) and a toolkit to deploy renewable energy more sustainably.

Investment and finance

- Most international financial institutions are following the wish of their shareholders to offer innovative financing tools. A concrete proposal exists from one of the banks to get involved in the greening of power plants through ownership and advice to make sure that emissions are minimised during the remainder of the life of the power plants.
- Directing investments towards bankable projects is critical. Despite some increases in clean energy investments in the region, the regional economic recovery is uneven and unsustainable. Cost-benefit analysis could identify bankable projects, develop policy targets, and support further commercialization of zero- and low-carbon technologies across the region.
- Participants were informed about process of the establishment of the SPECA Trust Fund. In November 2019, the SPECA Governing Council in Ashgabat had given the UNECE secretariat the mandate to prepare the first drafts of the founding documents required to establish the SPECA Fund. The Forum agreed that an operational SPECA Fund could assist countries to develop an appropriate framework to facilitate transboundary cooperation in several economic sectors. The framework should be based on a shared vision and strategies amongst countries in the region supported by a transparent process with appropriate level of participation.
- The Forum assisted SPECA countries in preparation of a portfolio of potential projects to be implemented under the SPECA Fund. The SPECA Fund will be able to pay special attention to the impact of the COVID19 related economic crisis and immediate socio-economic response (see next chapter).

In conclusion

- The high-level dialogue conducted during the Forum focused on the necessity of the development of common and transparent rules in the operation of modernised energy markets and countries’ commitment to observe them in practice. Participants recommended to use existing United Nations platforms and tools to explore issues and opportunities and to develop a position on common needs and aspirations.
- Participants noted that Central Asian countries and United Nations can have joint activities in the fields of sustainable energy. These activities may include issues such as capacity/institutional building of public

energy sector, diversification of energy resources and energy transport routes, renewable energy market development, clean coal technologies. United Nations platforms can assist to build the critical elements in strategies for the countries to collaborate in enhancing energy security for a sustainable innovative socio-economic development of Central Asia.

- A coordinated approach to region's challenges in energy and water management, transport, intra-regional connectivity, trade, and other topics will help countries to cope with the vulnerability to COVID-19 related economic shocks through project-based activities to be implemented under SPECA Fund.

Suggested pipeline of fundable projects

Over three days, participants of the Forum suggested opportunities for projects that would further common interests and regional collaboration so that transboundary or regional needs and opportunities can be addressed with optimal impact. The recommendations reached by the hands-on workshop in Almaty will be reported to the Governing Council meeting of (SPECA) for consideration through this report. It is hoped that some of these ideas can receive support through a combination of national budgets, donor funds and private or IFI financing. Based on the interaction with participants, the following list of project proposal is made, in no particular order of priority. Some projects can be further developed if there is interest. They could not be further elaborated in the given timeframe. They are listed at the end for information:

1. Regional restructuring and *just* transition
2. Conjunctive wind and hydro energy for water management in Central Asia
3. Recycling of solar panels and batteries in the context of circular economy
4. Optimising R&D facilities and training and education of regional renewable energy specialists
5. Decarbonizing energy intensive industries in Central Asia
6. Developing a hydrogen economy in Central Asia
7. Geothermal development in Central Asia
8. Integrated energy and water planning: hydro
9. Cross-border connectivity and renewable energy integration in CIS member States
10. Recycling of Lithium batteries and solar panels through pyro- and hydrometallurgical methods
11. Creating enabling conditions for net-metering in Central Asian countries
12. Green villages as demonstration projects for sustainable living
13. List of projects to be further developed upon demand.

1. Regional restructuring and *just* transition

Modernization of Kazakhstan's energy sector cannot be avoided, particularly not in light of its voluntary international environmental pledges, nor can it be further delayed as the energy infrastructure in many cases is at the very end of its life cycle. This requires decarbonization in all economic sectors and reduction of emissions of all potent greenhouse gases. In practice this means the modernization of the energy sector with a focus on gradual phasing out coal and finding innovative solutions for industries that rely on it and therefore constitute its "ecosystem", like e.g. steel or cement. It also implies a rapid mastering of growing atmospheric concentrations of methane and the role its increasing concentration plays in climate change. The proposed changes should focus not only on the broadly understood economic needs of people, but must also take under consideration their other substantial needs related to their sense of identity and belonging to a given

community, adherence to a given culture and heritage, etc. Effective *just* transition strategies require local, bottom-up participation of all affected stakeholders and commitment by the governments to guarantee their buy-in and provide planning security.

The project seeks to assist Kazakhstan in developing a demonstration platform to allow long-term prudent development of a framework for structural change. The objective is to develop replicable, forward looking business models that provide the country and the financial/lending institutions with tools to improve resource efficiency and to lower emissions through the application of modern energy technologies and solutions leading the region into the future that matches local population's needs, capabilities, and desires. The project will focus on Kazakhstan. As it is to produce replicable business models, it could later be repeated in any country facing similar challenges, and other UNECE member States have been approached to serve as demonstration projects. The project will help Kazakhstan to:

- Modernize its coal-based energy infrastructure,
- Improve methane capture and use in mines which will continue to operate,
- Close selected coal mines according to international standards and preparing the gassy mines for methane extraction and use or abatement,
- Repurpose mined land, and
- Deliver on an effective *just* transition to a sustainable green economy by helping the country to:
 - Innovate and clean the country's mining sector so that it can achieve sustainable and competitive mode of production based on responsible use of resources and meet the 2030 Agenda,
 - Reorient the profile of the coal mining regions in accordance with capabilities and desires of their local population,
 - Improve the quality of life of communities located in coal mining areas,
 - Reduce inequalities that hinder balanced and sustainable development of the society and a country's economy and avoid regional desertification, and
 - Develop a replicable framework for socially and environmentally sensitive modernization of coal mining regions.

The initial phase is to produce the following deliverables:

- Project structure, major building blocks of a framework for transition, identifying stakeholders and solidifying their commitment and ownership, establishing division of labour among project partners,
- Recommendations for assistance in strengthening existing regulatory and policy framework,
- Mapping of coal mines in the targeted region requiring and being suitable for improvement of their methane capture and use infrastructure, or ready for closure and transition in the targeted region,
- A strategy/theoretical framework for closure and transition of the coal mines in the targeted region
- Practical aspects of implementing the theoretical framework for transition and closure of the coal mining sector to the specific technical, economic, and social characteristics encountered in the targeted region,
- A case-specific campaign raising awareness about consequences, opportunities, and potential benefits of the transition for the targeted population and the region, and a case-specific strategy for effective ownership-building among the targeted community promoting a just transition and a framework for a socially equitable transition.

Successful delivery of the initial phase will allow to move forward to its next stages:

- Phase II - Development of a case-specific framework for modernizing/closing/repurposing selected coal mine(s);

- Phase III - Pilot mines' (of both types, i.e., mines selected for closure, and those set for restructuring and modernization) project's pre-feasibility;
- Phase IV - Pilot mines' feasibility phase;
- Phase V - Pilot sites' modernization planning phase;
- Phase VI - Pilot sites' modernization stage;
- Phase VII - Pilot sites' evaluation and business model adjustment phase.

An initial investment of USD1 mio would kickstart the first two phases and allow to bring the stakeholders together to determine the most optimal approach to the next phases (over two years).

2. Conjunctive wind and hydro energy for water management in Central Asia

Tajikistan and Kyrgyzstan have identified the exploitation of rivers for electricity production with peak demand in winter as a priority. At the same time neighbouring downstream countries Kazakhstan, Uzbekistan, and Tajikistan need water resources for irrigation purposes during the summer, drawing largely on the regional hydropower potential. Exporting of electricity is a revenue provider for upstream countries in summer, but cannot always be guaranteed, during times of drought. Tajikistan and Kyrgyzstan have therefore identified the exploitation of rivers for electricity production in combination with wind power as a priority project. With a firmly established wind component in national power systems, upstream countries will be able to reduce vulnerability to drought cycles and maintain water reservoirs which can be used for agricultural purposes. Upstream countries could then also increase export of clean power to Afghanistan with less risk of water shortages and thus expand the regional hydro and wind network even further.

The electricity grid in Kyrgyzstan and Tajikistan experiences regular power shortages, especially during the winter. More supply is needed to maintain energy security for households and industry. The use of wind energy would be profitable in this context, as it would make electricity supply more reliable, mitigate risks of drought and diversify domestic energy sources. Downstream countries will see an immediate benefit from reduced vulnerability to flooding in wintertime and drought problems during summertime. It is expected that the higher price of wind compared to hydro sources could be compensated through increased regional electricity trade, for example with Afghanistan and Kazakhstan.

In order to implement this project, an initial investment of USD500-600 thousand is required for a feasibility study. Follow up projects will include the installation of 30 to 100 MW (commercial scale) facilities. At 30 MW the power would mostly be consumed in the local areas, while at 100 MW it is anticipated that a significant amount of electricity could be exported along the national transmission lines, for example to Afghanistan. This decision will follow the recommendations of the feasibility study and significant consultations between the local population and governments. It is estimated that a 50-100 MW wind farm will be financially feasible at a feed-in tariff of 6 - 7 US c/kWh.

Details: The first step would be the implementation of a targeted measurement programme and the preparation of a feasibility study for Balykchi, Kyrgyzstan and Kujand. Tajikistan, which has already identified as the best potential locations for the development of wind power projects based on site visits and analysis of UNECE experts. The objectives of the Measurement Program and Feasibility Study are to introduce recommendations to commercialize the project, develop adequate wind power targets for the power plan, attract technology providers and investors, and enable competitive pricing based on significant local production.

Countries' extensive water release in wintertime creates tension with the neighbouring downstream countries, which tend to suffer from flooding in winter and severe summer draughts. The development of wind energy will

enable Kyrgyzstan and Tajikistan to depend less on hydroelectricity, thus helping to curb the water shortages in the region, alleviating tension between upstream countries and their downstream neighbours. This approach does not only focus on the existing problems but also on adapting to climate change and necessary infrastructure modernization needs. If implemented strategically, this project will:

- Improve the regional water management capacity and increase the exploitation of the hydro potential, thus contributing to energy security and manage climate change;
- Introduce innovative technologies, meet renewable energy goals and targets and access remote locations;
- Improve the understanding of local stakeholders on energy management and cleaner electricity production; and
- Improve regional electricity trade and energy access and thus improve regional tensions and understanding.

The impact of this project goes far beyond a measurable economic impact, due to its political implications. However, with wind power capacity at 10%, hydro production in upstream countries will allow not only to generate electricity, but also to achieve average annual water savings of 6 Km³ (at Toktogul with a 19 km³ reservoir) in Kyrgyzstan and 3 km³ (at Nurek with a 10 km³ reservoir) in Tajikistan.

This project has the character of a turnkey project for like regions and challenges, demonstrating how various renewable energy resources can be combined for reliability, diversification, and regional trade. While the proposed project is aimed at the development of a wind energy feasibility study, followed by a tendering and investment stage, it also meets the main pillars of sustainable development and the 2030 Agenda for Sustainable Development: it enhances economic development through the creation of a local renewable energy industry, improves social development through employment and poverty alleviation in remote areas, strengthens environmental protection through targeted and practical clean energy and water resources management. Further, the project will help mitigate regional water and energy problems, will address the differences between electricity producers in Tajikistan and Kyrgyzstan and water consumers in Uzbekistan, Kazakhstan, and Turkmenistan, and will help develop a coordinated regional energy/water policy, highly needed.

3. Recycling of solar panels and batteries in the context of circular economy

Demand for solar panels and lithium ion batteries has exponentially increased in the last decade and continues to expand. The energy generated by solar panels alone increased over 2.5 times in the period 2015-2020, from 7,509 to 19,221 MWp. The development of renewable energy sources leads to building a circular economy and a future sustainable economy. The question is, how do we deal with the waste that green energy technologies create? Once recovered, all the materials from solar panels can be recycled and sent to various industrial sectors, e.g.:

- Glass is used to create new glass
- Aluminum frame is sent to an aluminum manufacturing plant
- Plastics are used as fuel in cement production
- Silicon wafers can be melted and used by specialty recycling companies
- Cables and connectors are sold as copper scrap to be recycled

Recycling lithium batteries takes place in five steps:

- Batteries are received and dismantled
- The cells are extracted from the battery module
- A machine shreds the cells

- The remains are fed into a separator to segregate the paper and plastic, metal scraps, and the black mass
- Recovered materials are reused in new batteries or other industrial processes

This project intends to help Kazakhstan to build capacities in the recycling and upcycling of the solar panels and batteries wastes at the end of their life. This project can represent an example for other countries of the region to be replicated and adapted. Regional cooperation will allow to benefit from various country experiences including from outside the region and optimize the development of a regional strategy towards a circular economy in the region. By recycling materials like copper, silver, gold, palladium, and aluminium, we can reduce mining efforts further for future industrial and energy processes. The savings made by the reduction of mining and metal production as well as by the reduced negative environmental impact would have to be estimated by the project but can be envisaged in more than USD10mio per year for Kazakhstan alone.

The experience of Kazakhstan would create the basis for a regional strategy for a circular economy in the region with the creation of green jobs which are estimated in the range of millions net jobs expected to be created by 2030, offsetting the losses derived from the reduction of carbon-emitting industries.

4. Optimising R&D facilities and training and education of regional renewable energy specialists

As the UN International Forum on Innovating and Modernizing Energy and Water in Central Asia has shown, it is extremely important for Central Asian countries to integrate renewable energy sources into education and prepare cadres in the field of alternative energy. With the development of renewable energy sources and their spread soon, many qualified specialists in this field will be required. Our Scientific and Educational Center in The Kazakh British Technical University (KBTU) has the necessary basic experience to train and educate young professionals. Nevertheless, to complete the entire technology, as well as in the changing reality, it is necessary to purchase modern expensive and innovative equipment. In addition, KBTU solar cell technology excludes the use of toxic gases and hazardous processes and includes unique technologies for the formation of diffusion barriers, a copper contact system and antireflection coatings SiC/MgF₂. Therefore, the completion of this technology is extremely important.

Through this project, a unique solar cell technology based on safe processes will be completed. Several specialists in the field of alternative energy will be trained, both for Kazakhstan and for Central Asia as a whole. Cooperation with regional universities and manufacturing companies will be established to exchange experience, which will help improve the qualifications of specialists in this field. Moreover, it is planned to build a pilot solar power plant based on solar modules produced according to the technology developed at KBTU (150 kW - 1 MW).

Since the own technology to produce solar modules is at the final stage, the technological chain will be supplemented with additional installations. For this, the existing offers on the market will be analyzed. After that, the following will be purchased: an exposure and alignment setup for photolithography, a plasma-chemical etching setup (ionic), a laser setup for removing edge short-circuits, with a total cost of ~1 million USD. After the completion of the technology, the manufacture of solar modules and their further assembly into a solar power plant will begin.

The total cost of the project is 1800 thousand USD, 600 thousand USD every year for three years. The allocated funds will be used to form scholarships for students from Central Asian countries with a Bachelor, Master and PhD degrees in field of Nanotechnology and Alternative Energy. In Kazakhstan, it is very difficult to find qualified specialists in this field, especially with English as the language of instruction, therefore it is necessary to attract foreign specialists to transfer the best experience to a new generation. Throughout the entire period of the

project, specialists from far abroad will be attracted to train students. Participation in conferences of young specialists is planned. During this project will be published at least 3 articles in international peer-reviewed journals.

The implementation of the course that the Central Asian countries have taken on the development of renewable energy sources requires the presence of a large number of specialists in this field. Unfortunately, at the moment there is a great deficiency of such cadres. Our Center in KBTU has the necessary basic experience and technical equipment for training specialists in the field of renewable energy. Students who study at our university will be able to acquire the necessary knowledge that they can spread in their region. Moreover, these specialists will become a kind of bridge for cooperation between our countries in the field of alternative energy. Consequently, the training of specialists based on the laboratory is expected not only for Kazakhstan, but also for the whole Central Asian countries. Moreover, it is planned to exchange experience with neighboring countries, such as Uzbekistan, Tajikistan, Kyrgyzstan, Turkmenistan, etc.

In the long term, this project will be able to substantially affect the green economy of the Central Asian countries and solve the problem of the shortage of highly qualified personnel in the field of alternative energy. Therefore, for the development of renewable energy sources, first, an increase in qualified human resources is required. Moreover, own production of solar modules will be established, which in the future will be able to provide Central Asia with products and jobs. Based on the obtained technology to produce solar panels, it will be possible in the future to develop a full-fledged production in international scale. By the time the production is implemented, enough professionals will have already been trained who know the intricacies of the entire production chain, production technologies and research methods for materials in alternative energy. Thus, the countries of Central Asia will be able to successfully implement the course for the development of a green economy within the country and abroad.

5. Decarbonizing energy intensive industries in Central Asia

Energy intensive industries contribute to 25% of total GHG emissions globally. The heavy-to-abate sectors, such as cement, iron and steel, and chemicals and petrochemicals sectors are the largest industrial CO₂ emitters, contributing with 27%, 25%, and 14% respectively. (IEA 2020) Reducing carbon intensity of the energy intensive sectors is crucial to attain carbon neutrality and meet Paris Agreement targets. These industries are the backbone of the economies and play important role in driving a low-carbon post-covid recovery. Demand for steel and concrete structures will grow to support construction of increasing wind capacity. Chemicals will be needed for insulation for energy efficiency and production of light materials for cars. Cement sector plays an important role in countries in Central Asia like anywhere else. Across the region there are over 25 cement plants that produce over 35 Mt/year, and the sector is growing. Steel market is also growing, with Kazakhstan as a main player.

It is a vast challenge to decarbonize energy-intensive and carbon-emitting industries to produce carbon neutral products. Deep decarbonization of energy intensive industries is technically possible but will require major shifts across the value chains. A range of technologies and solutions, such as energy efficiency, electrification of heat, use of biomass, carbon capture, use and storage (CCUS), and hydrogen, will play a role in reducing carbon intensity of energy intensive industries.

This project tries to find answer to the following three questions:

- How can we address the challenge of energy intensive industries across the region?
- What are the technology solutions that can be deployed to decarbonise target industries across the region having social impact and cost effectiveness in mind?

- To what extent are the concepts of circular carbon economy and industrial clusters applied in the region?

The project could include the following activities:

- Identification of the situation of targeted energy intensive industries across the region → status report
- Identification of suitable technology options → Workshop on technologies to raise awareness with subregional focus with representatives from private and public sector. Use products from carbon neutrality project as a basis
- Identification of successful business models applicable in the region → Workshop on lessons learned and exchange of best practices to understand if projects from other countries, such as the Brevik CCS project (HeiderbergCement) or the Humber industrial cluster (United Kingdom) are replicable in this region or can be adapted
- Design of a carbon neutral industrial cluster or business model for the region → feasibility study
- Identification of related policy solutions → Regional Workshops on regulatory frameworks and financing mechanisms needed to attain carbon neutral energy intensive industries.

This project proposal is a first step towards development of a carbon neutral energy intensive industry ecosystem in Central Asia. The project will help countries to improve understanding and build capacity about technology solutions and concepts that can decarbonise energy intensive industries across the region. It will provide a platform for exchange of best practices and lessons learned to raise awareness about the solutions amongst the regional players. Findings and recommendations from this project will lead to concrete policy actions and infrastructure projects. It can provide a basis for a needed exchange of Central Asian countries on common needs and opportunities when decarbonizing energy intensive industries. A holistic regional energy system could be developed through this project towards net-zero industry clusters in the context of a circular carbon economy. Carbon neutral technology solutions and concepts are needed to:

- Address GHG emissions from energy intensive industries through technologies such as industrial energy efficiency, electrification of industrial processes, application of CCUS, application of hydrogen
- Create green and sustainable jobs supporting the concept of just transition
- Create green and sustainable energy infrastructure that ensures long-term competitiveness of today energy-intensive and carbon-emitting products.

6. Developing a hydrogen economy in Central Asia

Hydrogen has been recognised as a possible approach to decarbonisation of otherwise hard-to-abate sectors such as heavy industry or long-haul transport. In addition, hydrogen can provide a solution for long-term energy storage. By 2050 hydrogen could deliver up to 24% of the world's energy needs. Despite its vast potential to decarbonise the energy system, high costs and unclear regulatory frameworks are obstacles to emergence of a hydrogen economy take off. There is need for coordinated action on national, subregional and regional levels in to enable full commercialization of hydrogen projects.

There are various unexplored questions associated with hydrogen production, transport and applications that could be assessed across all countries in Central Asia to develop a hydrogen economy further:

- Production: assess potential sustainable hydrogen production pathways (note: some work in this area is starting Q4 2021 through a UNECE led project)
- Transportation: assess of different options of hydrogen transportation, including the role of the existing gas infrastructure in creating national, subregional and regional hydrogen market;
- Application: assess export potential, hydrogen applications for industrial use, long-haul transport, heating etc.

This project proposes the following activities:

1. Market diagnosis across the hydrogen value chain
 - Identification of suitable sustainable hydrogen production technology options à status report with country-by-country analysis
 - Assessment of existing regional gas infrastructure as a backbone for a regional hydrogen market à status report
 - Assessment of potential hydrogen markets across Central Asian countries:
 - Hydrogen application in transport sector
 - Hydrogen application in industry – namely, chemical and steel production
 - Hydrogen application for district heating
2. Policy dialogue to raise capacity and exchange of best practices and lessons learned to develop a regional hydrogen market in Central Asia. To achieve that it is important to raise awareness about solutions, create the regulatory framework, and attract financing.
3. Workshops and policy dialogues with UNECE and UNESCAP member States and other stakeholders from private sector, academia and civil society will increase the understanding of hydrogen potential across Central Asia subregions, discuss ways to overcome policy and regulatory barriers, and identify financing mechanisms to allow full commercialization of this technology across the region. Such policy dialogue will enhance cross-border cooperation based on mutually beneficial efforts to ensure sustainable energy supply and a development of regional hydrogen hubs.
 - Optimizing existing gas infrastructure and avoiding stranded assets - the natural gas transmission network can be used to integrate hydrogen in a cost-efficient way at 10-15% of the cost of a newly built hydrogen pipeline.
 - Support scaling of renewable energy resources and accelerate deployment of electrolyzers. Hydrogen can be a form of energy storage. It is important to support the deployment of electrolyzers connected to the electricity grid and low carbon generation plants.
 - Hydrogen can be an important source for production of green products -> steel, chemicals, synfuels à green jobs and green & sustainable economies.

This project proposal is a first step towards development of a Central Asian hydrogen hub market. The project will help countries to improve understanding and build capacity about the potential that region can play in development of the hydrogen value chain. It will provide a platform for exchange of best practices and lessons learned to raise awareness about the solutions amongst the regional players. Findings and recommendations from this project will lead to concrete policy actions and infrastructure projects.

7. Geothermal development in Central Asia

Geothermal energy is untapped in Central Asia. In Kazakhstan, for example, the utilisation of geothermal energy for heat and power production, with early studies estimating resource available in about 40% of the country. The increase exploitation of geothermal energy would support the country plan to switch to a green economy with 10% increase in the share of alternative energy sources by 2030 and a 50-percent increase by 2050. All Central Asian countries have ambitious targets to substantially increase the uptake of renewable energy. Hydro, wind and solar are the main technologies used in these countries. However, to achieve these targets, it is important to have a broader range of renewable energy technologies, including geothermal sources. The geothermal power and heat is a more stable renewable energy source which can balance the fluctuation of power generation of solar and wind power plants. Successful examples exist, for example in China, where more than 50 cities have been developed based on optimal geothermal resources.

The overall cost estimate is USD200,000 for (1) analysis of existing geothermal sources and case studies of concrete projects in the region and (2) for a building capacity workshop dedicated to key government experts who will be trained to consider and develop PPPs geothermal projects in the region. The experts to be trained will be from Central Asian countries, mainly Kazakhstan, Tajikistan, and Kyrgyzstan. The exchange of experience on existing geothermal projects in the respective countries would increase the capacity to develop, promote and implement new geothermal projects.

Central Asia is not yet investing enough resources in geothermal power. The current project could develop a pipeline of bankable project proposals for at least USD20mio in Central Asia after the analysis of existing successful projects and capacity building activities. Strengthening expertise and capacity in the sector is intended to increase investment confidence and therefore mobilize private sector investment.

8. Integrated energy and water planning: hydro

The impact of climate change has been increasing the need for water-energy cooperation. Hydropower is a key resource in Central Asia; seasonal reservoir operations is the key to regional energy-water cooperation: Climate change in mountains will “[...] pose challenges for water supply, energy production, ecosystems integrity, agricultural and forestry production, disaster preparedness, and ecotourism (high confidence)” (IPCC, Sixth Report, 2021).

The proposed project will help to build capacities to reduce pressure to existing water resources and adopt a more integrated approach to renewable energy development. It complements an existing project focusing on energy-water-food nexus in Central Asia with partners UNECE, OECD, EBRD, FAO and SIC-ICWC. The additional project has a total cost of USD300,000 over two years. The project will help evaluate the impact of energy choices on water resources in SPECA countries, using an existing water-energy toolkit, developed by UNECE with partners. The toolkit will be used for (1) capacity building workshops in terms of nexus multi-stakeholder dialogues focused on specific renewable energy projects; and (2) to build a pipeline of bankable proposals that a high water-energy nexus component.

The project will involve the SPECA countries. Water cooperation is necessary at the regional level to «untangle» cross-sectoral issues in transboundary contexts. To complement the existing project, these activities will contribute to establishing active platforms for political dialogue on:

- Water Convention - global
- SPECA – regional
- National Policy Dialogues (UNECE and OECD) - national

The project will consider policies and plans that are increasingly intertwined, e.g.:

- Climate action: mitigation (energy, land use) & adaptation (water management, agriculture)
- Water planning: reconcile various uses including energy and agriculture
- Clean energy transition: decarbonization, reduction of resource intensity
- Infrastructure planning and modernization: anticipating & addressing trade-offs, multi-purpose
- Political commitment (cross-sectoral vision).

Expected outputs include an enhanced capacity (“nexus-proofed” sectoral plans, policies, projects across sectors, more effective transboundary/regional cooperation (cross-sectoral strategies); better water management to support the increase uptake of renewable energy with important economic benefits, including an expanded activity and productivity in economic sectors (agriculture, energy generation, nature-based tourism) and reduced cost of carrying out productive activities. It is further expected to reduce economic impacts of water-related hazards (floods, droughts).

9. Cross-border connectivity and renewable energy integration in CIS member States

CIS countries have vast renewable energy potential that can be developed and exported to potential global energy market. There is need for diversified technology and regional approach to balance energy system. Integration of renewable energy into energy system can further strengthen electricity trade between the CIS countries. The joint operation of thermal power plants and renewable energy capacities, including wind and solar power plants, has significant advantages and may become a viable option for cross-border cooperation based on mutually beneficial efforts to ensure sustainable energy supply by strengthening cross-border power systems interconnections of the CIS member states. This cooperation can be strengthened through strategic partnerships with all stakeholders, including governments, international development bodies, financial institutions / banks and private sector.

This project will help countries build capacity and improve understanding about what is required to enhance the inter-connectivity of electricity system in CIS countries and support further deployment of RES across the region. Activities will include:

- Analytical studies of international (EU, USA and Asia-Pacific countries) and regional experience of technological, regulatory and market support for maintaining the balance of capacity and energy in national energy systems under conditions of large-scale integration of wind and solar energy.
- Technical workshops to discuss and validate findings of studies. The workshops will review the results of analytical study and provide the recommendations for its finalization.
- Policy dialogue and development of recommendations for the application of technological, regulatory and market-based measures and mechanisms to maintain the balance of capacity and energy in the power system under conditions of large-scale integration of wind and solar energy into power systems. The recommendations will be included into draft National Action Plans to meet SDG 7.

The anticipated long-term impact of the project is to develop a collective capacity of CIS countries to transform energy sectors towards low carbon power systems and hence contribute to climate change mitigation and sustainable development. Providing a clear vision for UNECE member States on how the balance between RES and traditional power generation can be achieved and what measures should be undertaken will serve as the short-term impact. The following positive change within the beneficiary countries is expected for the timeframe of 2-4 years:

- Improved understanding of the optimal balance between renewable energy sources and fossil fuel power generation technology and policy, such as the interplay between flexible clean coal, natural gas and wind, solar and hydro power production. Concrete technology and policy options are identified that contribute to the provision of clean and affordable energy.
- Data measurement: At least one sustainable energy policy or administrative measure towards low carbon energy system revised or taken by each country and at least three countries contribute to progress tracking based on the framework of low carbon power systems.
- Regional or national power sectors and energy intensive industries are strengthened and apply best-practice technologies and innovative business models.
- Capacities of national statistic units and data quality is improved.

The project will address regional and cross-border issues in the context of a forward-looking carbon neutrality concept. It will also help countries develop and apply common methodological approaches to ensure the reliable and efficient functioning of the electric power industry of the CIS member states under conditions of large-scale integration of wind and solar energy through expanding power systems interconnections, improving joint

planning and operation, effective regulatory and technological measures and mechanisms for maintaining the balance and improving the planning and operation of power systems. The project will foster confidence among countries by encouraging the exchange of information, knowledge and best practices. The project will also promote synergies with other initiatives in the field of economic cooperation and integration.

10. Recycling of Lithium batteries and solar panels through pyro- and hydrometallurgical methods

Nowadays, the consumption of lithium batteries and solar panels is increasing every year. At the same time, the amount of the corresponding waste material increases from year to year. Along with this, waste materials can also serve as a good source of valuable metals, such as lithium, in which the concentration of the valuable metal is several times higher than in the natural raw materials from which they are originally extracted. Considering that the consumption of lithium is increasing from year to year, the recycling of this waste is an important urgent task. This project encourages regional cooperation and joint learning. Consumption of products with lithium batteries and solar panels is increasing every year and becomes universal, which requires solving problems of recycling waste products for everyone. The project involves an important component of R&D and capacity building led by KTBU. The development of methods for extracting lithium from used lithium batteries and solar panels will lay the foundations for creating a technological base for the development of such science-intensive industries as the production of chemical power sources, radio electronics, optoelectronics, laser technology, production of medical and cosmetic products that have a social focus.

This project seeks to progress the processing of used lithium batteries and solar panels using a set of pyro- and hydrometallurgical methods for extracting lithium. In this case, either sorption or extraction hydrometallurgical processes can be used, which can provide high selectivity of the extracted target component. The main areas of activity will be aimed at research of new processing methods based on modern scientific and technical activities. The composition and properties of the processed material have been studied, acceptable methods for extracting the valuable component have been studied and tested. The use of the selected processing method will be based on the nature, properties, and composition of the material to be processed. Various types of batteries, based on the variations in their chemistries, may require specific types of processing. When processing the target material, modern pyro- and hydrometallurgical methods will be used. The conditions for each redistribution of the technological scheme will be worked out.

The establishment of new production facilities based on technology developed will enable to expand the scope and range of products, produce export-oriented products, create new jobs and, increase amount of taxes paid to the state budget accordingly. The project must be carried out for 3 years with relevant financial support, since it requires qualified personnel with the necessary professional training, instruments, and materials for conducting research are needed, and the continuous analytical. Investments for the implementation of the project may amount to USD2 million, but it depends on initial and medium-term scope.

What is important to note is that there is no systematic work on this issue in Kazakhstan. Lithium has extremely important economic and strategic significance. In addition to use in energy, it gets application in the most usual sectors of consumer market (production of air conditioners, packaging glass for pharmaceutical and cosmetic products, mini batteries for electronic toys). Wide use at the domestic level is combined with growing application in the field of high technologies: ultralight alloys, batteries for mobile and cell phones, in ferro-electrics in new types of electro-optical materials, etc.

11. Creating enabling conditions for net-metering in Central Asian countries

Overall installed capacity of Kyrgyzstan's electric power system is almost 4GW and it provides the country with around 15 billion kWh of power yearly. However, since 2014, with exception of high-water years, has become a

net importer of electricity, as high transmission, and distribution losses (up to 20%), coupled with ever-increasing demand for electricity are already exceeding the supply. Additionally, most of generating capacity was commissioned in 1970's, and grid deterioration is over 50% on average. The investments needed for adding new generation capacity and updating networks are not attractive, as local electricity tariffs are highly subsidized and are below cost of production and delivery by 20%. At the same time, there is no normative framework for net-metering, which would enable to decrease the load of generation capacity, grid capacity, and to allow population to contribute to resolving the energy crisis. The project can later lead to a larger project on integration of distributed producers and energy communities in energy markets, with introduction of such a market in EAEU.

There is a need for assessing international experience and results in implementing net-metering and energy communities legislation, and development of regulative documents that would allow implementation of these practices in Central Asian countries, especially the ones that are susceptible to climate –induced changes in precipitation and river flows. Some of the key changes from allowing the consumers to participate in generation are:

- The consumers will become more energy-conscious;
- Additional generation of solar power allows saving of water and decreasing coal consumption in large dam hydro and CHP plants, that constitute 92% b 8% of power generation capacity of Kyrgyzstan;
- Extra electricity that is generated from roof solar panels is fed back to the power grid and will reduce the need for utility companies to spend extra funds on infrastructure updates;
- Reduction of transmission-line congestion that can cause rolling blackouts and other inconvenient power outages for repairs and upgrades;
- Increasing share of distributed solar energy will decrease the vulnerability of energy system to extreme climate events.

Key activities of the proposed project would include (3-4 years):

- Research and development of recommendations, tailored to each Central Asian country on introduction of net-metering and energy communities;
- Development of the legislative and regulatory documents on the ground for each country, backed by Ministries of Energy, and involving wide range of stakeholders;
- Advocacy of developed legislative and regulatory documents;
- Practical implementation of several net-metering and energy-community projects and monitoring them to assess the effect they have on local network and electricity supply.

The problems of the Kyrgyz Republic are mirrored in other Central Asian countries, and, as all of them are now in energy crisis, with outdated generation and grid capacity, and cross-country cooperation in developing local net-metering systems will be beneficial to assess the extent to which net metering policies may adapt to or enable different electricity system structures, such as one with increased distributed elements for advanced reliability and resilience, and the adoption of different technologies, such as behind-the-meter storage systems and rooftop and community energy cooperatives.

The potential generated and saved energy can reach up to 10-15% of generation in each country. For Kyrgyzstan, that would be up to 1 billion kWh, in current prices – USD15 million.

12. Green villages as demonstration projects for sustainable living

Aging generation, transmission, and distribution infrastructure, coupled with increasing energy-demand and high losses, as well as expected climate change effects on water supply call for development of energy-

independent communities. Additionally, deteriorating natural resources and inefficient agricultural practices in the Central Asian countries lead to decrease of yields, and of food quality. Large amounts of livestock are a popular investment activity of villagers, are raised without implementation of resource-saving technologies, and additionally contribute to CO₂e emissions of the country. Over 60% of the population live in rural areas, but economic conditions push them to migrate to large cities, creating poverty rings in city suburbs, where inhabitants are the largest contributors to air pollution through an integrated “green village” model, developed with attention to energy production and resource saving, adhering to green and circular economy principles, as well as economically viable, implemented in several countries and conditions, will give a great example to follow and will become the basis for testing of new innovative approaches in Central Asian countries.

The project can use the results of several UNDP projects that have developed foundation for Green villages’ development in the Kyrgyz Republic, and experience of several local organizations, including local producers of RE equipment and ecological products. There is a need for integration of developed and new business models that would allow local villages to become more energy independent, to have better economic development, to restore depleted natural resources and decrease CO₂e emissions.

Key activities of the proposed project would include (4-5) years :

- Research and integration of experience up to date in privately supported and project-supported sustainable development of villages, implementation of renewable energy and resource-efficient technologies and business models into customized “Green village” concept ;
- Open call for participation and feasibility studies for selected villages;
- Selection of 2-3 green village pilots;
- Practical implementation of technological solutions and business models;
- Implementation and monitoring;
- Sharing experience between pilot green villages in Central Asian countries;
- Knowledge sharing between countries and mentorship for 2-3 new villages in each country by the pilot green villagers.

The problems of rural citizens in all CA countries are similar, and inter-regional cooperation and knowledge sharing will be beneficial for all involved states. The potential saved energy and resources, assuming even 5% of Kyrgyzstan village will adapt developed Green village model, can reach USD60 million. The project be continued through capacity building and experience exchange.

13. List of suggested projects to be further developed upon demand

The following projects were also suggested. Expert participants believe that these projects could have a turkey role, if funded and further implemented. They could not be further developed for this report in the interest of time:

Provide targeted and regular platforms for exchange between government, business and other societal stakeholders on questions about energy, integration and sustainable development. The objective is to build consensus between government and business to find optimal development pathways and ways that further strengthen strategic communication and project management. This would allow to take into account the private sector objectives and needs at an early stage, and if conducted in an international setting, it would allow for shared experiences from like regions outside Central Asia.

- Requested was also that education and training should focus specifically on working with and raising awareness of the financial sector, both at the national and international level, so that investments in renewable energy sources would increase in an efficient manner.

- In view of having the level of investments which is needed to substantially increase the uptake of renewable energy, ad hoc renewable energy hard talks could be envisaged in countries of the region, in particular in Kyrgyzstan and Tajikistan, using the hard talk in Kazakhstan held in 2018 as an example.

Develop financing guidelines for clean energy projects in the region. This project idea builds on missing investments in the region in all clean energy technologies beyond renewable energy. Suggestions were made to work with a range of stakeholders to determine clear, long-term guidelines for investors that allow the modernisation of and building of innovative energy and water infrastructure across the region within a carbon neutral framework.

Provide capabilities for regional statics and modelling for sustainable energy systems planning. Good data collection and statistics is the basis for informed decision making. The need for a better regional modelling capability was made several times that would allow to conduct a regional gap analysis to support research & development, to explore technology interplay that can support decarbonization of the energy system and to develop pathways acceptable for governments and business alike. This could be linked to a national project assessment body that would develop assessment criteria to align national requirements with international pledges for example from COP meetings, so that projects will be developed that meet the criteria of international investors and FDI. In general, scenario planning based on modelling capabilities can lead to:

- Recommendations to governments of the benefits of future pathways
- Raised awareness to what happens next, actions
- Public private partnerships and shared ownership
- Shared responsibility for information exchange.

This could build on the existing UNESCAP roadmap for SDG7 implementation and the UNECE carbon neutrality project.

Develop an eco-park or green villages as a demonstration zone for societal awareness raising and capacity building. There is a need for a platform to consolidate knowledge and understanding to build or strengthen education and train capacity. A demonstration zone could be created where targeted educational programmes could be tested and rolled out. All aspects to energy and water could be developed, including waste management, biogas, and their economically successful approach. This could be done in collaboration with local or regional universities so that solutions can be demonstrated that allow a cohesive sustainable living concept and capacity of future workforce can be built based on target local projects.

Adapt the United Nations Framework Classification (UNFC) tool to local conditions, involving the understanding of the tools and their relation to fiscal systems, infrastructure and education. The project is to identify which capabilities re needed so that they can be developed and to implement the tools.

Upscale an existing biogas concept for a rural facility in Kyrgyzstan to like areas across the entire region. The upscaling can be adapted to the available financing. This would equally allow to revisit different approaches and business plans for biogas as an energy resource across the region. A collaboration with existing incubator and demonstration centres will be sought in order to avoid duplication and speed up implementation.

Explore the impact of developing renewable energy technologies on social entrepreneurship in the region. The request was made to explore more the impact of renewable energy as a unifying factor across the region on social entrepreneurship and job creation. There was also a request to explore the correlation between renewable energy deployment and the development of a free market.

Conduct more research on waste management in the context of circular economy, renewable energy, and resource management. Given the exponential demand for materials, raw materials and critical raw materials, the need arises to conduct feasibility studies about waste amounts and locations, and the potential hierarchy in the context of circular economy concepts.

Explore the potential of electrification of the transport sector across the region. The topic of transport had not been the focus of this Forum, so has not been further investigated during the event, however, expert participants proposed this topic in the context of solutions to sustainable living and clean air.

Annex

PROGRAMME OVERVIEW

Monday, 1 November 2021: IMPLEMENTATION WORKSHOP

Enhancing transboundary energy cooperation through introduction of wind and solar energy into power systems of CIS countries to support achievement of SDG 7

This workshop is the final event of the above-mentioned project. Results and recommendations will be presented and discussed. Participants will explore future possible projects and activities.

From 09.00 Registration and coffee

- **Project overview and achievements**

10.30-11.00 Introductory remarks

- Stefanie Held, Chief Sustainable Energy Section, Sustainable Energy Division, UNECE

11.00-12.30 Findings and recommendations

- Iva Brkic, Project Lead, Economic Affairs Officer, Sustainable Energy Division, UNECE
- Georgy Ermolenko, Director of the Department of External Relations of IC EES CIS
- Michail Saparov, Head of the CIS EPS Working Group on ecology, energy efficiency and renewable energy sources

This session will be moderated by Gianluca Sambucini, Economic Affairs Officer, UNECE

12.30-14.00 Lunch break

14:00-14:15 Key findings from the REN21 UNECE Renewable Energy Status Report and from the study on Renewable Energy Financing and Investment in four UNECE member States

- Rana Adib, Executive Director, Renewable Energy Policy Network for the 21st Century (REN21), France (online)
- Matija Vajdic, Consultant, UNECE (online)

14:15-16:00 Views from countries and stakeholders

- Shamsiev Khamidula, Director, Coordination and Dispatch Center "Energiya" UES of Central Asia
- Karen Asatryan Director of the Renewable Energy and Energy Saving Foundation, Armenia
- Rauf Rzayev, Deputy Head of the Energy Department, Ministry of Energy, Azerbaijan
- Andrey Molochko, Supervisor, General Energy Department of RUE "BelTEIClose of the implementation workshop, Belarus
- Ruslan Nurmaganbetov, Head of the management for Development of Renewable Energy Sources, Department for Renewable Energy Sources of the Ministry of Energy, Kazakhstan
- Bekov Kubanych, Director, Strategic Planning and Human Resources Department, JSC "National Energy Holding Company, Kyrgyzstan
- Tatiana Vedeneva, President, Center for Renewable Energy and Energy Efficiency Development (CREEED), Kyrgyzstan
- Nurzat Abdyrasulova, CEO, Unison Group, Kyrgyzstan (online)
- Alexandru Chudin, Director, Energy Efficiency Agency, Moldova
- Alexei Zhikharev, Director, Renewable Energy Development Association, Russian Federation
- Sorbon Kholmuhamadzoda, Ministry of Energy and Water Recourses, Chief of Power Engineering Department, Tajikistan

- Nizomiddin Rahmanov, PromStroyBank, Uzbekistan

This session will be moderated by Georgy Ermolenko, Director of the Department of External Relations of IC EES CIS

16.00-16.30 *Coffee break*

16:30-16:45 **Renewable energy hard talks: key recommendations and future activities**

- Gianluca Sambucini, Economic Affairs Officers, Sustainable Energy Division, UNECE

16:45-17:00 **Future collaboration and projects**

- Viktor Badaker, Economic Affairs Officers, Sustainable Energy Division, UNECE

17:00-18:00 **Discussion and recommendations**

18.00 *Close of the implementation workshop.*

Tuesday, 2 November 2021 AM: HIGH-LEVEL DIALOGUE

Defining and prioritising regional needs in energy and water

The Forum will be kicked off by this high-level discussion about the role of economic cooperation and green technologies for stability in Central Asia. The interactive roundtable discussion will set the scene by defining priorities and opportunities on the backbone of energy and water.

From 09.00 Registration and coffee

10.00-10.30 **Opening remarks**

- Maratbek Gabdullin, Acting Director, The Kazakh British Technical University (KBTU)
- Dmitry Mariyasin, Deputy Executive Secretary, UNECE
- Nikolay Pomoshchnikov, Head of Subregional Office, North and Central Asia, UNESCAP (online)
- Kalmenov Marat, Executive Director, KazEnergy
- Bakhytbek Baiseitov, Chairman of the Board of Director and Supervisory Board of Bank CenterCredit JSC, Chairman of the Business Council of the Financial and Business Association of Euro-Asian Cooperation (online)

10.30-12.00 **Economic development and green energy technologies as means for regional stability**

Interactive moderated high-level roundtable discussion

- What is happening in Central Asia and elsewhere? What is needed?
- Which projects are turnkey in energy, water and innovation to further growth and regional stability and avert a climate crisis?
 - Carbon neutrality: Industry infrastructure, energy intensive industries and technology clusters
 - Oil, gas, and coal as market drivers
 - Just transition, modernisation, and innovation
 - Resource management and circular economy
 - Nexus areas environment, water, trade, innovation
- How can we attract and sustain investments?
- What works and what does not and why?

Panelists

- Farhod Bilolzoda, Deputy Minister of Industry and New Technologies, Tajikistan
- Serdar Saparov, Deputy Minister of Energy, Turkmenistan (online)

- Serik Tyutebaev, Samruk Energy, Managing Director, Member of the Board, Kazakhstan
 - Vladimir Shkolnik, Academician, NAS RK, Vice-President of The Kazakhstani National Academy of Natural Sciences, Former Minister of Energy, Kazakhstan
 - Oleg Budargin, Vice-Chair of the World Energy Council, 25th World Energy Congress Vice-Chair (online)
 - Keisuke Sadamori, Director, Energy Markets and Security, International Energy Agency, Paris (online)
 - Gürbüz Gönül, Director of Country Engagement Partnership, International Renewable Energy Agency (IRENA), Abu Dhabi (online)
 - Raymond Pilcher, Chair, UNECE Group of Experts on Coal Mine Methane and Just Transition; President, Raven Ridge Resources Inc., United States (online)
 - Elena Kuanbaeva, Deputy Chairman of the Management Board), The International Green Technologies and Investment Centre, Kazakhstan
 - Nurzat Abdyrasulova, CEO, Unison Group, Kyrgyzstan (online)
 - Hongpeng Liu, Director Energy Division, UNESCAP (online)
 - Aida Sitdikova, Director, Energy Eurasia, Middle East & Africa, Sustainable Infrastructure Group, European Bank for Reconstruction and Development, London (online)
 - Nariman Mannapbekov, Country Director, Asian Development Bank (ADB) Kazakhstan Resident Mission
- This session will be moderated by Dmitry Mariyasin, Deputy Executive Secretary, UNECE*

12.00-12.30 Summary and closing remarks

- Maratbek Gabdullin, Acting Director of The Kazakh British Technical University (KBTU)
- Dmitry Mariyasin, Deputy Executive Secretary, UNECE (in person)

12.30-14.00 Lunch break

Tuesday, 2 November 2021 PM: REGIONAL DIALOGUES

Defining and prioritising regional needs in energy and water

14.00-15.00 Prioritising the needs for a sustainable energy system of tomorrow

This session is dedicated to presenting a roadmap for the region towards sustainable economic development and decarbonisation in the context of the 2030 Agenda for Sustainable Development. Presentations and interventions will be made to define gaps and identify possible turnkey projects. Participants will be able to react to toolkits and solutions and their applicability to the region. How can innovation investments be translated into regional results and collaboration?

Presentations and discussion

- Tracking the progress of the sustainable energy agenda in Central Asia
 - Sergey Tulinov, Energy Division, UNESCAP (online)
- Development of an SDG 7 roadmap for Tajikistan and Kyrgyzstan as an example for the region
 - Anis Zaman, Economic Affairs Officer, UNESCAP (online)
- Global energy sector: Kazakhstan and cutting-edge fundamental research
 - Siddhardt Saxena, Director, Cambridge Central Asia Forum, Jesus College, University of Cambridge, United Kingdom
- Kazakhstan energy transition to low-carbon development by 2030 and carbon neutrality by 2050
 - Marat Koshumbaev, Research Coordinator, International Scientific Center for Energy Integration (online)

This session will be moderated by Professor Chokan Laumulin, The Kazakh-British Technical University, Research Affiliate, Cambridge Central Asia Forum, Jesus College, University of Cambridge, United Kingdom

15.00-16.00 Energy security, decarbonisation and the power sector

Presentations and discussion

- Carbon neutrality and energy intensive industries: The UNECE toolkit for decarbonisation
 - Iva Brkic, Economic Affairs Officer, Sustainable Energy Division, UNECE
- Coal phase out as an important step towards decarbonisation of the power sector
 - Michael Williamson, Energy Division, UNESCAP (online)
- Electricity connectivity roadmap in Asia Pacific and its relevance to Central Asia and the neighbouring subregions
 - Matthew Wittenstein, Energy Division, UNESCAP (online)
- Central Asia – as - a - Digital Platform Strategy
 - Askar Tazhiyev, consultant, UNESCAP

This session will be moderated by Stefanie Held, Sustainable Energy Division, UNECE

16.00-16.30 Coffee break

16.30-17.30 Energy and water nexus: Toolkits and regional cooperative mechanisms

- Toolkit to sustainably deploy renewable energy considering water and the environment
- Regional mechanisms for the low-carbon, climate-resilient transformation of the energy-water-land nexus in Central Asia
- Opening remarks:
 - Lucia de Strasser, Environment Division, UNECE (online)

Panellists and presenters:

- Takayoshi Kato, Policy Analyst, Organisation for Economic Co-operation and Development (OECD) (online)
- Andrey Zhironkin, Principal Banker, Agribusiness CEE South, European Bank for Reconstruction and Development, London (online)
- Alberto Troccoli, World Energy and Meteorology Council (online)

Reactions and discussion

This session will be moderated by Lucia de Strasser, Environment Division, UNECE

17.30-18.00 Discussion and recommendations

This session seeks to summarize the lessons and recommendations made during the day, considering:

- Economic development and innovation: Priority setting: what works, what does not, gaps, project areas and investments
- How can these tool and projects be better adapted to the region?
- Which projects are turnkey and how can innovation investments be translated into regional results and collaboration?
- Successful financial models and partnerships
- Lessons learnt and recommendations
- Conclusions

This session will be moderated by Stefanie Held, Sustainable Energy Division, UNECE

Wednesday, 3 November 2021: WORKSHOP

Innovating and financing energy and water in Central Asia

09.00-18.00 Developing a pipeline of fundable regional projects

This day is dedicated to exploring with participants ideas for fundable projects and undertakings that would make a difference in the region. The objective is a set of recommendations and a list of fundable regional projects to be presented to the Governing Council of the United Nations Special Programme for the Economies of Central Asia (SPECA) later in the month in Tashkent.

09.00-10.00 Investments in clean energy technologies and innovation in Central Asia

This session will kick off the day with a view on innovative thinking in energy and reactions from the financial community and participants about what is possible in the region.

- Energy of the future and climate
 - Vladimir Shkolnik, Academician, NAS RK, Vice-President of The Kazakhstani National Academy of Natural Sciences, Former Minister of Energy, Kazakhstan
- Innovation and finance in Central Asia
 - Nizomiddin Rahmanov, PromStroyBank, Uzbekistan
- Management of regional ecological risks – an innovative model
 - Zhaksylyk Tokayev, International Green Technologies and Investment Centre

Reactions and discussion with financial sector participants

This session is moderated by Stefanie Held, UNECE

10.00-11.00 Renewable energy projects: Solar, wind, bioenergy, and hydropower

In this session, concrete ideas for scalable renewable energy projects in the region will be presented.

Participants will be invited to refine the proposals with scale up in mind.

- Wind and hydropower for water management in Central Asia
 - Viktor Badaker, Economic Affairs Officer, UNECE
- Biogas project experience in Kyrgyzstan and opportunities for wide-spread application
- Renewable Energy Model Center for Central Asia
 - Alaibek Obozov, Kyrgyzstan
- Creation and development of silicon solar cells, wind turbines and thin films
 - Dina Bakranova, KBTU

Reactions and discussion with financial sector participants

This session is moderated by Stefanie Held, UNECE

11.00-11.30 Coffee break

11.30-12.30 Cross-border electricity networks and trade

This session will present the results of an ongoing study of electricity connectivity and invite reactions from participants.

- Cross-border connectivity: Tajik perspective
 - Furugzod Usmonov and Parviz Atoev, Tajikistan
 - Luis Lopez, Analyst, International Energy Agency (IEA), Paris (online)
- Clean Household Energy Consumption in Kazakhstan
 - Aiymgul Kerimray, EU4Energy Programme
- Creation of a unified energy system of the Eurasian continent: with the participation of the energy sector of Kazakhstan
 - A. Trofimov, Advisor to General Director «AlatauEnergoProekt»

Reactions and discussion with financial sector participants
This session is moderated by Stefanie Held, UNECE

12.30-13.30 *Lunch break*

13.30-15.00 **Decarbonising energy intensive industries**

This session will provide an overview of inherent challenges and opportunities resulting from the modernisation of aging infrastructure with decarbonisation in mind. Panellists will discuss regional restructuring, just transition, solutions for energy-intensive industries, clean technologies, hydrogen and innovation clusters.

- Opening remarks: Economic and social aspects of decarbonisation, cleaning up coal infrastructure and regional restructuring
 - Raymond Pilcher, Chair, UNECE Group of Experts on Coal Mine Methane and Just Transition (online)

Panellists:

- Birlesbek Aliyarov, Academician of the National Academy of Sciences of the Republic of Kazakhstan
- Michal Drabik, Economic Affairs Officer, Sustainable Energy Division, UNECE
- Iva Brkic, Economic Affairs Officer, Sustainable Energy Division, UNECE
- Judd Swift, Synfuels, United States (online)
- Saidzhon Saidrahmonzoda, Chief, Department of Coal Industry, Ministry of Industry and New Technologies, Tajikistan

Reactions and discussion with financial sector participants

This session will be moderated by Raymond Pilcher, UNECE Group of Experts on Coal Mine Methane and Just Transition

15.00-16.00 **Circular carbon economy and sustainable resource management**

- Critical raw materials and resource management in the region
 - Arkady Rogalsky, Executive Director, Kyrgyz Society of Subsoil Experts, Kyrgyzstan
 - Georgiy Freiman, Chairman of the Executive Committee, Public Association of Independent Subsoil Experts of Kazakhstan and General Manager, GeoMineProject LLP, Kazakhstan
- Industrial and Urban Waste Management
 - Dzhamilya Aitmatova, Vice-Chair of the UNECE Group of Experts on Cleaner Electricity Systems, Kyrgyzstan

Reactions and discussion with financial sector participants

This session will be moderated by Stefanie Held, UNECE

Discussion questions for all segments:

- Which projects make sense at a regional scale or can be scaled up?
- What are the current regional conditions for infrastructure investments? Challenges?
- Financing larger energy infrastructure, incl. cross-border. How can such innovation investments be translated into regional results?
- Could a regional fund play a role?
- Successful partnering for implementation

16.00-16.30 *Coffee break*

16.30-18.00 **Summary of project pipeline continued**

- Summary of toolkits
- Linkages with a Fund for the SPECA region/financing options
- Recommendations for further work and partnerships
- Next steps.
 - Stefanie Held, Viktor Badaker, Gianluca Sambucini, and Iva Brkic, Sustainable Energy Division, UNECE

18.00 International Forum closes.

Side meetings for implementation work possible.

Drafting of documents continues on 4 November in a smaller voluntary group.