Technical Assistance Report

Project Number: 52112-001
Knowledge and Support Technical Assistance Cluster (C-KSTA)
November 2018

Regional Cooperation on Increasing Cross-Border Energy Trading within the Central Asian Power System

Asian Development Bank

ABBREVIATIONS

ADB	–	Asian Development Bank
CAPS	–	Central Asian power system
CAREC	–	Central Asia Regional Economic Cooperation
CDC	–	Coordinating Dispatch Center
EDM	–	energy data management
HLT	–	high-level technology
kV	–	kilovolt
kWh	–	kilowatt-hour
TA	–	technical assistance

NOTE

In this report, "$" refers to United States dollars.

Vice-President	Wencai Zhang, Operations 1
Director General	Werner Liepach, Central and West Asia Department (CWRD)
Director	Ashok Bhargava, Energy Division, CWRD
Team leader	Bouadokpheng Chansavat, Senior Energy Specialist, CWRD
Team members	Editha Aguilar, Senior Operations Assistant, CWRD Shokhimardon Musaev, Senior Project Officer, Uzbekistan Resident Mission, CWRD

CONTENTS

KNOWLEDGE AND SUPPORT TECHNICAL ASSISTANCE AT A GLANCE

1. Basic Data — **Project Number:** 52112-001

Project Name	Regional Cooperation on Increasing Cross-Border Energy Trading within the Central Asian Power System	**Department/Division**	CWRD/CWEN
Nature of Activity	Capacity Development, Policy Advice	**Executing Agency**	Asian Development Bank
Modality	Cluster		
Country	AFG, KAZ, KGZ, TAJ, UZB		

2. Sector	**Subsector(s)**	**ADB Financing ($ million)**
✓ Energy	Electricity transmission and distribution	2.00
	Energy sector development and institutional reform	0.50
	Total	**2.50**

3. Strategic Agenda	**Subcomponents**	**Climate Change Information**	
Inclusive economic growth (IEG)	Pillar 1: Economic opportunities, including jobs, created and expanded	Climate Change impact on the Project	High
Environmentally sustainable growth (ESG)	Natural resources conservation		
Regional integration (RCI)	Pillar 1: Cross-border infrastructure Pillar 2: Trade and investment		

4. Drivers of Change	**Components**	**Gender Equity and Mainstreaming**	
Governance and capacity development (GCD)	Institutional development	Some gender elements (SGE)	✓
Knowledge solutions (KNS)	Application and use of new knowledge solutions in key operational areas Knowledge sharing activities		
Partnerships (PAR)	Implementation Official cofinancing Regional organizations South-South partner		

5. Poverty and SDG Targeting		**Location Impact**	
Geographic Targeting	No	Regional	High
Household Targeting	No		
SDG Targeting	Yes		
SDG Goals	SDG7, SDG13		

6. Risk Categorization Low

7. Safeguard Categorization Safeguard Policy Statement does not apply

8. Financing

Modality and Sources	**Amount ($ million)**
ADB	**2.50**
Knowledge and Support technical assistance: Regional Cooperation and Integration Fund	1.00
Knowledge and Support technical assistance: Technical Assistance Special Fund	1.50
Cofinancing	**2.00**
Asian Clean Energy Fund under the Clean Energy Financing Partnership Facility (Full ADB Administration)	1.00
High Level Technology Fund (Full ADB Administration)	1.00
Counterpart	**0.00**
None	0.00
Total	**4.50**

Currency of ADB Financing: USD

I. INTRODUCTION

1. The regional knowledge and support technical assistance (TA) cluster will support an increase in regional power trade among Afghanistan, Kazakhstan, the Kyrgyz Republic, Tajikistan, Uzbekistan, and Turkmenistan by (i) modernizing the Coordinating Dispatch Center (CDC) Energiya, which coordinates power flow between the national electricity grids of the Central Asian power system (CAPS), to enhance its technical capacity; (ii) identifying the technical obstacles to power trade for CAPS, and proposing and coordinating solutions to overcome them for each country; and (iii) supporting the expansion of CAPS membership and seeking new markets.

2. In March 2018, countries at the Energy Sector Coordinating Committee meeting under the Central Asia Regional Economic Cooperation (CAREC) program agreed to request TA from the Asian Development Bank (ADB) to bridge the gap between energy supply and demand by facilitating cross-border trading. The TA is fully aligned with the CAREC 2030 strategy for (i) promoting energy trade and further integrating energy markets in the CAREC region and (ii) connecting Afghanistan with CAPS. The TA also directly supports the CAREC Energy Work Plan, 2016–2020, especially element 2 on promoting regional electricity trade and harmonization. However, it is not included in any of ADB's country operations business plans.[1]

II. ISSUES

3. **Diminished power trade in the region**. Power trade among Central Asian countries has been declining since the collapse of the Soviet Union in 1991. In 1990, 25,413 million kilowatt-hours (kWh) were traded among Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan. By 2010, the energy trade had decreased to 2,256 million kWh following the disconnection of Tajikistan from CAPS in 2009; it bottomed out in 2016 at 2,080 million kWh.[2] The drop in energy trade has caused widespread power outages in Tajikistan in winters and increased fossil fuel use by Kazakhstan, Turkmenistan, and Uzbekistan in summers. While hydropower exports from the Kyrgyz Republic have continued, the lack of hydropower from Tajikistan in summer has forced fossil fuel-rich countries to generate electricity using gas and oil instead of exporting those fuels. Meanwhile, Tajikistan has had to make substantial investments in generating capacity to produce electricity in winter, while being unable to export hydropower in summer. Tajikistan spills large amount of water annually which could have been used to generate about 5 billion–7 billion kWh of energy. Because of the limited electricity trading opportunities within CAPS, the Kyrgyz Republic had to find additional trading partners such as the People's Republic of China and Pakistan.

4. **Technical constraints on capacity to trade power**. During the time of the Soviet Union, the Central Asian energy flow between the electricity grids of southern Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan was regulated by the United Dispatch Administration of Central Asia (based in Tashkent, Uzbekistan), subordinated to the central dispatch and planning institution in Moscow. Following the collapse of the Soviet Union, United Dispatch Administration became nongovernment organization in 1993 and was renamed to CDC. The governance was assigned to the Central Asia United Power System Council (CAUPS), comprising the heads of the national power systems. The council was responsible for the administration and coordination of the parallel operations[3] of CAPS. In 2004, Kazakhstan,

[1] The TA first appeared in the business opportunities section of ADB's website on 29 November 2018.
[2] The actual trade among CAPS members was 579 million kWh. The balance includes bilateral trade with Afghanistan.
[3] Parallel operation of electrical grids refers to a synchronous grid or an 'interconnection', which is a group of areas operating with three phase alternating current frequencies synchronized (so that peaks occur at virtually the same

Tajikistan, the Kyrgyz Republic, and Uzbekistan concluded an intergovernmental agreement on the coordination of electricity grids of Central Asia. CDC was given the status of international organization working under the guidance of the CAUPS. Turkmenistan withdrew from CAPS in 2003 and switched to parallel operations with Iran. The signatories provide the financing for CDC.

5. Unlike the national dispatch centers in the Kazakhstan, Kyrgyz Republic,[4] and Tajikistan,[5] no significant technological modernizations were made at CDC since it was established in the 1960s and converted to a non-governmental organization.[6] CDC relies on outdated technologies to perform its functions, including (i) coordination of the operations of power systems and energy entities within CAPS, (ii) determination of the conditions for the parallel operation of CAPS, (iii) coordination of operation personnel's actions during intersystem emergencies and elimination of intersystem accidents, (iv) coordination of relay protection and automation of circuits and settings, (v) coordination of operation of dispatch data acquisition and transmission systems, and (vi) control over measurements and metering of international power flows within CAPS.

6. CDC's technological limitations, which constrain regional power trade, include the following: (i) power flows within CAPS are forecast 6 months in advance using historical data and cannot be adjusted using real-time figures; accordingly, power flow planning is not optimized because of unnecessarily high safety factors; (ii) in the event of an accident on the grid, the site of the fault can take a day or longer to locate; (iii) the settlement of power flows between countries is unnecessarily long as the actual metered flows and reported flows do not match up because of the quality of CDC's telemetry;[7] and (iv) newly constructed assets cannot be monitored without taking out something else; thus, CDC does not have a full picture of all important sites at once.

7. **Central Asian power system membership expansion**. Afghanistan already trades bilaterally with, Tajikistan, Turkmenistan, and Uzbekistan. In 2017 Afghanistan expressed interest to join CAPS. Substantial assessments of Afghanistan's electricity grid will be needed to ensure its compatibility with CAPS as well as amendment of the CAPS intergovernmental agreement.

8. **Tajikistan reconnection into Central Asian power system.** After almost a decade of disconnection, Tajikistan and Uzbekistan agreed to reconnect their power systems. Tajikistan is working with CDC and Uzbekistan's utility company to address technical constraints to the CAPS reconnection. Tajikistan started to export power to Uzbekistan on islanded mode (nonparallel operation) through two 220-kV lines and one 500-kV line in the second quarter of 2018. As Tajikistan's electricity grid has been modernized, some assessments and works will be required to adjust relay protection systems and ensure synchronous (parallel) operation with CAPS by the end of 2018.[8] Uzbekistan's electricity grid will also require potential adjustments.

---

time). This allows transmission of alternating current throughout the area, connecting large number of electricity generators and consumers and potentially enabling more efficient electricity markets.

[4] ADB. 2010. *Grant Assistance Report: Proposed Loan and Grant to the Kyrgyz Republic for the Power Sector Improvement Project*. Manila (Grant 0218-KGZ financed the installation of supervisory control and data acquisition (SCADA) for National Electric Grid of Kyrgyzstan).

[5] ADB. 2010. *Grant Assistance Report: Proposed Grant to Tajikistan for the Regional Power Transmission Project*. Manila (Grant 0213-TAJ financed the installation of SCADA for the Tajik energy utility Barki Tojik).

[6] CDC was established as the United Dispatch Administration of Central Asia in the 1960s in the Soviet Union.

[7] The automated communications process by which measurements and other data are collected at remote or inaccessible points and transmitted to receiving equipment for monitoring.

[8] On 28 February 2018, Tajikistan requested ADB's support to carry out a relay protection study under ADB. 2014. *Grant Assistance Report: Proposed Grant to Tajikistan for the Wholesale Metering and Transmission Reinforcement Project*. Manila (Grant 0417-TAJ). ADB will finance the necessary works from the *Grant to Tajikistan Reconnection to the Central Asian Power System Project* approved in 2018.

III. JUSTIFICATION FOR CLUSTER MODALITY

9. The cluster will include three subprojects that will aim to support the increase in power trade within CAPS by (i) introducing an energy data management (EDM) system to CDC to enable a safe increase of energy flow within CAPS; (ii) identifying and offering solutions to any technical bottlenecks to regional power trade that may occur in any of the CAPS countries; and (iii) facilitating power trade within CAPS, expanding CAPS membership, and exploring additional potential energy markets to increase potential for power trade.

10. The TA cluster modality is appropriate as each subproject has individually identifiable outputs that contribute to a single outcome. Since the subprojects are strategically linked with the common overall objective, the TA cluster modality will allow them to be flexibly designed and implemented, leading to better sequencing of TA activities than with a stand-alone TA. The cluster TA modality also allows ADB to sequentially commit funds based on the actual progress.

IV. THE TECHNICAL ASSISTANCE CLUSTER

A. Impacts, Outcome, and Outputs

11. The TA cluster is aligned with the following impacts: countries' emission reduction target achieved, CAREC regional cooperation framework accomplished,[9] and energy security in selected CAREC countries enhanced. The TA cluster will have the following outcome: cross-border clean energy trade increased using high-level technology (HLT) by CDC. The HLT will replace manual processes to allow CDC to operate in a real-time regime.[10]

12. **Output 1: CDC Energiya modernized, capacitated and engendered.** This output will be delivered by analyzing the installed SCADA energy management systems in Kazakhstan, the Kyrgyz Republic, and Tajikistan; and by introducing an EDM system for CDC. The EDM system will be procured and integrated into CDC. Measures to incentivize women to join CDC workforce will be explored.

13. The EDM system, which is an HLT, will be deployed to replace all Soviet-era equipment and processes at CDC. The aim will be to maximize the utilization of the CAPS transmission capacity by enabling operation of the regional grid in real time. Introduction of modern systems with greatly increased volumes of telemetry information collected by CDC will also allow centralization of CAPS emergency automation.[11]

14. **Output 2: Solutions to the bottlenecks to the regional power trade provided.** This output will be delivered through an examination of the national grids of all CAPS countries to identify and propose technical solutions to the bottlenecks within each one that constrain electricity flow. The Central Asian Electricity Grid Coordination Board will endorse the final findings for implementation by Kazakhstan, the Kyrgyz Republic, Tajikistan, and Uzbekistan.

15. **Output 3: Membership in CAPS expanded.** This output will be delivered through studies and dialogue to facilitate the admission of new members into CAPS. Countries that are already

---

[9] CAREC. 2015. *Strategy and Work Plan (2016–2020) for Regional Cooperation in the Energy Sector of CAREC Countries.* Ulaanbaatar.

[10] The design and monitoring framework is in Appendix 1.

[11] With the new generation and transmission equipment introduced recently in the CAPS grid, the dynamic analysis task and calculation of emergency automation settings became an increasingly complex task that cannot be handled by CDC's existing capacity and equipment.

trading with CAPS countries are potential candidates for membership. Afghanistan's electricity grid will be assessed for its compatibility with other national grids. The consultant will propose the necessary works on Afghanistan's electricity grid and other national grids to ensure safe parallel operation for consideration by the Central Asian Electricity Grid Coordination Board and implementation by Afghanistan, the Kyrgyz Republic, Tajikistan and Uzbekistan. The consultant will also explore connection options for Turkmenistan, who also trades electricity with Afghanistan, to connect to CAPS. The consultant will also study the alternate energy markets.

B. Cost and Financing

16. The TA cluster is estimated to cost $4.5 million, of which (i) $1,500,000 will be financed on a grant basis by ADB's Technical Assistance Special Fund (TASF-6); (ii) $1 million will be financed on a grant basis by the Regional Cooperation and Integration Fund;[12] (iii) $1 million will be financed on a grant basis by the Asian Clean Energy Fund[13] under the Clean Energy Financing Partnership Facility and administered by ADB; and (iv) $1 million will be financed on a grant basis by the High-Level Technology Fund[14] and administered by ADB. Detailed cost estimates and financing arrangements will be presented in each TA subproject proposal submitted for approval.

17. The government will provide counterpart support in the form of staff, office space and supplies, secretarial assistance, domestic transportation, and other in-kind contributions.

C. Implementation Arrangements

18. ADB will administer the TA cluster. The Energy Division of ADB's Central and West Asia Department will be the executing agency for all subprojects in close coordination with ADB resident missions.[15] Each TA subproject proposal will be submitted for approval to the Director General, Central and West Asia Department, in accordance with the business process for knowledge and support TA cluster processing after consultations with ADB's Office of Cofinancing Operations. Subproject activities will start only after approval.

Table 1: Implementation Arrangements for the Technical Assistance Cluster

Aspects	Arrangements		
Indicative implementation period for the TA cluster	November 2018–December 2021		
Executing agency	ADB (Focal point: Energy Division, Central and West Asia Department)		
Implementing agencies	Coordinating dispatch center Energiya, national utilities, and national dispatch centers		
Consultants	Package title	Selection method	Engaged by
	Firm: Optimization of Central Asia power system	QCBS (90:10)	ADB
	Firm: Energy data management system design and integration	QCBS (90:10)	ADB
	Energy data management system	Goods	SCADA system design and integration consultant

[12] Established by ADB. Financing partner: the Government of Japan.
[13] Financing partner: the Government of Japan.
[14] Financing partner: the Government of Japan.
[15] Afghanistan, Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan.

Aspects	Arrangements		
	Resource persons and individual consultants (power transmission, relay protection, legal expert, energy system communication experts, gender expert)		ADB
Disbursement	The technical assistance resources will be disbursed following ADB's *Technical Assistance Disbursement Handbook* (2010, as amended from time to time).		

ADB = Asian Development Bank, QCBS = quality- and cost-based selection, SCADA = supervisory control and data acquisition.
Source: Asian Development Bank.

19. **Subprojects.** The TA cluster will be implemented through three subprojects (Appendix 2). Each subproject will be designed to support the achievement of the cluster outputs (paras. 12–15) as and when needed during the implementation period.

Table 2: Indicative Implementation Period and Budget Allocation for Subprojects

Item	Subproject Title	Implementation Period	Budget ($'000)
Subproject 1	Modernization of Coordinating Dispatch Center Energiya	November 2018–December 2020	2,500
Subproject 2	Provision of Solutions to Bottlenecks to the Regional Power Trade	November 2018–March 2021	1,500
Subproject 3	Expansion of Central Asian Power System Membership	November 2018–December 2021	500

Source: Asian Development Bank.

20. **Consulting services.** International and national consultants will be recruited individually through framework agreements wherein short-listed consultants may be hired as needed for the duration of the agreement to provide technical expertise and logistical support to ADB and the implementing agencies. Firms will also be recruited using the quality- and cost-based selection with a 90:10 quality-to-cost ratio. The consultants will be engaged in accordance with the ADB Procurement Policy (2017, as amended from time to time) and the associated project administration instructions and/or staff instructions. The estimated cost and requisite fields of expertise are indicative and estimates will be finalized before the approval of each TA subproject in consultation with the implementing agencies.

21. Procurement by the consultant will follow the ADB Procurement Policy and the Procurement Regulations for ADB Borrowers (2017, as amended from time to time).

22. **Cofinancing requirements.** TA implementation will follow the additional monitoring and reporting requirements specific to the Asian Clean Energy Fund under the Clean Energy Financing Partnership Facility, the High-Level Technology Fund, and the Regional Cooperation and Integration Fund.

V. THE PRESIDENT'S DECISION

23. The President, acting under the authority delegated by the Board, has approved (i) the Asian Development Bank (ADB) administering technical assistance not exceeding the equivalent of $1,000,000 to be financed on a grant basis by the Asian Clean Energy Fund under the Clean Energy Financing Partnership Facility; (ii) ADB administering technical assistance not exceeding the equivalent of $1,000,000 to be financed on a grant basis by the High-Level Technology Fund; and (iii) ADB providing the balance not exceeding the equivalent of $2,500,000 on a grant basis for the Regional Cooperation on Increasing Cross-Border Energy Trading within the Central Asian Power System, and hereby reports this action to the Board.

DESIGN AND MONITORING FRAMEWORK

Impacts the TA is Aligned with: CAREC 2030 Program Results Framework Countries' emissions reductions target achieved,[a] regional cooperation framework accomplished,[b] and energy security in selected CAREC countries enhanced			
Results Chain	**Performance Indicators with Targets and Baselines**	**Data Sources and Reporting Mechanisms**	**Risks**
Outcome Cross-border clean energy trade increased using high-level technology by CDC Energiya	By 2021: a. At least 11,000 million kilowatt-hours trade within CAPS annually (2017 baseline: 3,109 million kilowatt-hours) b. At least additional 5,587,560 tCO_2 in emission achieved (2017 baseline: 0) c. CDC Energiya uses high-level technology to replace manual processes and operate in real-time regime	a.–c. CDC and national dispatch report	Change in the geopolitical climate in the region Change in water availability because of climate change Shutdown of 57% efficiency CCGT plants instead of 30% open cycle thermal plants in Uzbekistan in summer
Outputs 1. CDC Energiya modernized, capacitated, and engendered	By 2020: 1a. EDM system installed at CDC Energiya in Uzbekistan to enable CDC's communication with modernized dispatch centers in Kazakhstan, Kyrgyz republic, and Tajikistan (2017 baseline: 0) 1b. Number of women employees in CDC Energiya increased by 10% (2017 baseline: 48 women)	1a.–b. TA Consultant's completion report	Price volatility for equipment
2. Solutions to the bottlenecks to regional power trade provided	2a. By 2021, at least three technical solutions to electricity grids provided to member countries for implementation (2017 baseline: 0)	2a. Annual CAREC Energy Progress Report	Availability of information on the electricity grids
3. Membership in CAPS expanded	3a. By 2019, Afghanistan adopts action plan to join CAPS (2017 baseline: 0) 3b. By 2019, Turkmenistan expresses interest in joining CAPS (2017 baseline: 0)	3a. CDC and Afghan press releases 3b. Annual CAREC Energy Progress Report	Worsening of security situation in Afghanistan

Key Activities with Milestones

1. CDC Energiya modernized, capacitated, and engendered

1.1 Recruit consultant to assess the need and design a state-of-the-art system (Q4 2018)
1.2 Organize regional workshop (with at least of 50% women's participation) (Q2 2019)
1.3 Procure EDM system (Q4 2019)
1.4 Consultant installs EDM system (Q3 2020)
1.5 Train CDC staff (with at least 50% women) in the use of the system (Q4 2020)
1.6 Engage consultant to conduct survey and explore opportunities to engage more women students in relevant universities by creating incentive mechanisms and an enabling environment for women employment (Q4 2019)

2. Solutions to the bottlenecks to regional power trade provided

2.1 Engage consultant (Q4 2018)
2.2 Identify and propose solutions for endorsement by the Central Asia United Power System Council (Q1 2021)
2.3 Organize high- and working-level meetings (Q1 2019–Q1 2021)

3. Membership in CAPS expanded

3.1 Engage consultant (Q4 2018)
3.2 Assess Afghan electricity grid to check compatibility with CAPS (Q2 2019)
3.3 Produce recommendation for endorsement by the Central Asia United Power System Council (Q4 2019)
3.4 Afghanistan adopts action plan for joining CAPS (Q4 2019)
3.5 Consult with Turkmenistan (Q1 2019)
3.6 Turkmenistan expresses interest to join CAPS (Q2 2019)
3.7 Organize high- and working-level meetings (Q1 2019–Q4 2021)

Inputs

Asian Development Bank:

Technical Assistance Special Fund (TASF-6): $1,500,000

Regional Cooperation and Integration Fund: $1,000,000

High-Level Technology Fund: $1,000,000

Asian Clean Energy Fund under the Clean Energy Financing Partnership Facility: $1,000,000

Note: For each TA subproject, the government will provide counterpart support in the form of staff, office space and supplies, secretarial assistance, domestic transportation, and other in-kind contributions.

Assumptions for Partner Financing

Not applicable

CAPS = Central Asian power system, CAREC = Central Asia Regional Economic Cooperation, CCGT = combined cycle gas turbines, CDC = Coordinating Dispatch Center, EDM = energy data management, Q = quarter, TA = technical assistance, tCO_2 = tons of carbon dioxide.

[a] United Nations Framework Convention on Climate Change. 2016. *Paris Agreement–Status of Ratification*. Paris.

[b] CAREC. 2015. *Strategy and Work Plan (2016–2020) for Regional Cooperation in the Energy Sector of CAREC Countries.* Ulaanbaatar.

Source: Asian Development Bank.

SUBPROJECT DESCRIPTIONS

Subproject 1	**Modernization of Coordinating Dispatch Center Energiya**
Indicative outputs and activities	Output: energy data management system installed at coordinating dispatch center (CDC) Energiya. The consultant firm will be engaged to assess and update the needs of CDC Energiya based on the work already performed by other development partners such as the United States Agency for International Development and the World Bank. Based on the installed equipment at the national dispatch centers in Kazakhstan, Kyrgyz Republic, and Tajikistan, the consultant will design the energy data management system to correspond to the state-of-the-art practice at international dispatch centers and prepare the list of necessary hardware and software for procurement. The consultant will prepare a modular modernization plan to enable prioritization based on the urgency for a particular system and the funding availability. The final design of CDC's equipment will also provide requirement into the design of Uzbekistan's supervisory control and data acquisition project for the country's utility. The consultant firm will also procure the selected priority equipment and perform the necessary work to integrate them into CDC Energiya. The consultant firm will then train the CDC staff in operation of the newly installed equipment. The technical assistance (TA) will also finance the institutional capacity building of the Central Asian power system (CAPS) by organizing a regional workshop to be held in one of the CAPS countries with participants from Kazakhstan, the Kyrgyz Republic, Tajikistan, Uzbekistan, and CDC. The workshop will present experiences of other countries with advanced transmission systems and share their experience in system planning, electricity dispatch between regions, and policy setting. Japan's experience in dealing with abrupt power changes caused by natural calamities is of interest and importance as many of the CAPS countries also experience power intermittency. At least four persons from Kazakhstan, the Kyrgyz Republic, Tajikistan, and Uzbekistan, as well as CDC, will be invited with at least half being women. The composition of each delegation should contain one person in charge of technical policy making and one from strategic planning. An international consultant will be engaged to conduct surveys and explore opportunities to engage more women students in universities by creating incentive mechanisms and an enabling environment for women employment. International and national consultants as well as resource persons will be recruited individually to provide technical and logistical support to the Asian Development Bank (ADB) and the implementing agencies.
Indicative implementation arrangements	ADB will be the executing agency. CDC Energiya will be the implementing agency. Subproject 1 is proposed to be financed with $500,000 from ADB's Technical Assistance Special Fund (TASF-6); $1,000,000 from the High-Level

	Technology Fund, and $1,000,000 from the Asian Clean Energy Fund under the Clean Energy Financing Partnership Facility. The Asian Clean Energy Fund[a] will be used to design the energy data management system and finance capacity building in the form of knowledge exchange during the study tours; ADB's Technical Assistance Special Fund (TASF-6) and the High-Level Technology Fund will be used to finance the physical upgrade of CDC.
Implementation schedule	November 2018–December 2020
Subproject 2	**Provision of Solutions to Bottlenecks to Regional Power Trade**
Indicative outputs and activities	Output: At least three technical solutions to electricity grids provided to countries for implementation. A consultant firm will be recruited to assess the electricity grids of Kazakhstan, Kyrgyz Republic, and Uzbekistan in order to determine the technical bottlenecks to energy trade and recommend technical solutions.[b] Examples include substations in any of the CAPs countries and/or transmission lines between two countries that are dilapidated or insufficient capacity, which limits the amount of electricity that can be traded. Another example is the dismantled 500 kilovolt (kV) transmission line between Regar substation (Tajikistan) and Gusar substation (Uzbekistan), which prevents parallel operation of the Tajikistan and Uzbekistan electricity networks. The two countries are working on a technical solution to achieve parallel operation by instead connecting an existing Sughd substation (Tajikistan) to the 500 kV Serdarya–Uzbekiston transmission line in the north of Tajikistan. However, the missing 500 kV in the south of Tajikistan still limits the amount of electricity that can be passed to Uzbekistan in the south of Tajikistan because of the insufficient transmission capacity. The study will update the Power Sector Regional Master Plan of the Central Asia Regional Economic Cooperation (CAREC) Program to take into account recently completed infrastructure projects. The study will also explore alternate energy markets outside of CAPS to increase the import and export of energy. Connecting to other energy markets will require identifying bottlenecks and proposing technical solutions. For example, for Turkmenistan to connect to CAPS in the parallel mode (500 kV) while continuing to trade with Iran (400 kV), a back-to-back substation in Iran (Serax substation) that is connected to Turkmenistan (Mary substation) could be considered. This would also enable the connection of CAPS, through Iran, to Turkey and the Caucasus. These types of solutions will be explored for Russian Federation–Kazakhstan–Central Asia–South Asia energy trade or connection to the People's Republic of China as part of One Belt, One Road Initiative. These solutions will need to be developed in close coordination with each of the national grids and CDC Energiya, and they may require the endorsement of the Central Asia United Power System Council (CAUPSC) for implementation by each country. High- and working-level meetings will be organized through the duration of the regional technical assistance to facilitate (i) decision-making within the CAREC framework and (ii) discussion with prospective countries for trade

	outside of CAPS. International and national consultants, as well as resource persons, will be recruited individually to provide technical and logistical support to ADB and the implementing agencies.
Indicative implementation arrangements	ADB will be the executing agency. Kazakhstan Electricity Grid Operating Company, National Electrical Grid of Kyrgizstan Company, Barki Tojik, and Uzbekenergo will be the implementing agencies. Subproject 2 is proposed to be financed with $500,000 from the Regional Cooperation and Integration Fund and $1,000,000 from ADB's Technical Assistance Special Fund (TASF-6).
Implementation schedule	November 2018–March 2021
Subproject 3	**Expansion of Membership in Central Asian Power System**
Indicative outputs and activities	Output: Afghanistan adopts action plan to join CAPS and Turkmenistan expresses interest in joining CAPS by 2021. The consultant firm from subproject 2 will perform the assessment of the electricity grids of Afghanistan and Turkmenistan to determine their compatibility with CAPS and to recommend modifications, if any. An action plan will be developed for Afghanistan, which will detail the technical modification to the grid and legislative changes necessary for Afghanistan to operate in parallel mode with CAPS. Based on the results from subproject 2, Turkmenistan will be approached with proposals to join CAPS in parallel mode. High- and working-level meetings will be organized through the regional TA to facilitate speedy and positive decision-making on the expansion of CAPS membership. Proposals for amendment of the intergovernmental agreements and the charter of CDC Energiya will be also developed for consideration by the CAPS countries. The CAUPSC, which will make the final decision, will be consulted throughout the process. International and national consultants, as well as resource persons, will be engaged individually, as necessary, to provide technical and logistical support during the consideration and deliberation of the CAUPSC.
Indicative implementation arrangements	ADB will be the executing agency. Da Afghanistan Breshna Sherkat and Turkmenenergo will be the implementing agencies. Subproject 3 is proposed to be financed with $500,000 from the Regional Cooperation and Integration Fund.
Implementation schedule	November 2018–December 2021

[a] Financing partner: the Government of Japan.
[b] The assessment of the Tajikistan's entire grid is proposed to be carried out by the Government of Tajikistan using ADB financing, per a request on 28 February 2018.
Source: Asian Development Bank.