



# Technical Assistance Report

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Project Number: 52079-001  
Knowledge and Support Technical Assistance (KSTA)  
August 2018

## Floating Solar Energy Development

This document is being disclosed to the public in accordance with ADB's Public Communications Policy 2011.

Asian Development Bank

## ABBREVIATIONS

AC	–	alternating current
ADB	–	Asian Development Bank
CAREC	–	Central Asia Regional Economic Cooperation
DABS	–	Da Afghanistan Breshna Sherkat
DBO	–	design–build–operate
EPP	–	OJSC Electric Power Plants
ESCC	–	Energy Sector Coordinating Committee
FPV	–	floating solar photovoltaic
GHG	–	greenhouse gas
km	–	kilometer
kW	–	kilowatt
MW	–	megawatt
PMU	–	project management unit
TA	–	technical assistance

## NOTE

In this report, “\$” refers to United States dollars.

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## KNOWLEDGE AND SUPPORT TECHNICAL ASSISTANCE AT A GLANCE

<b>1. Basic Data</b>		<b>Project Number:</b> 52079-001
<b>Project Name</b>	Floating Solar Energy Development	<b>Department/Division</b> CWRD/CWEN
<b>Nature of Activity Modality</b>	Capacity Development Regular	<b>Executing Agency</b> Asian Development Bank
<b>Country</b>	AFG, AZE, KGZ	
<b>2. Sector</b>	<b>Subsector(s)</b>	<b>ADB Financing (\$ million)</b>
		<b>Total</b> 0.00
<b>3. Strategic Agenda</b>	<b>Subcomponents</b>	<b>Climate Change Information</b>
Inclusive economic growth (IEG) Environmentally sustainable growth (ESG)	Pillar 1: Economic opportunities, including jobs, created and expanded Eco-efficiency	CO <sub>2</sub> reduction (tons per annum) 140 Climate Change impact on the Project Low
<b>4. Drivers of Change</b>	<b>Components</b>	<b>Gender Equity and Mainstreaming</b>
Governance and capacity development (GCD) Knowledge solutions (KNS)  Partnerships (PAR)  Private sector development (PSD)	Institutional development  Application and use of new knowledge solutions in key operational areas Knowledge sharing activities Pilot-testing innovation and learning Bilateral institutions (not client government) Official cofinancing Regional organizations Promotion of private sector investment	No gender elements (NGE) ✓
<b>5. Poverty and SDG Targeting</b>		<b>Location Impact</b>
Geographic Targeting Household Targeting SDG Targeting SDG Goals	No No Yes SDG7, SDG8, SDG9, SDG13	Not Applicable
<b>6. Risk Categorization</b>	Complex	
<b>7. Safeguard Categorization</b>	Safeguard Policy Statement does not apply	
<b>8. Financing</b>		
<b>Modality and Sources</b>		<b>Amount (\$ million)</b>
<b>ADB</b>		<b>0.00</b>
None		0.00
<b>Cofinancing</b>		<b>3.00</b>
Clean Energy Fund under the Clean Energy Financing Partnership Facility (Full ADB Administration)		3.00
<b>Counterpart</b>		<b>0.00</b>
None		0.00
<b>Total</b>		<b>3.00</b>

## I. INTRODUCTION

1. Central and West Asian countries are heavily reliant on either fossil fuels, hydropower, or imported fuels and power, which make them carbon-intensive, energy-insecure, and vulnerable to climate and external supply shocks. The knowledge and support technical assistance (TA) aims to pilot test and build expertise on the emerging floating solar photovoltaic (FPV)<sup>1</sup> technology to diversify the energy mix, increase energy security, and reduce greenhouse gas (GHG) emissions.<sup>2</sup> Afghanistan, Azerbaijan, and the Kyrgyz Republic represent these critical vulnerabilities of Central and West Asian countries and are the targeted beneficiaries.<sup>3</sup>

2. The TA is aligned with the Energy Policy 2009; the energy sector group work plan, 2018–2019; and the Central Asia Regional Economic Cooperation (CAREC) Strategy 2030 and Work Plan, 2016–2020.<sup>4</sup> The TA outcome will contribute to the Asian Development Bank (ADB) target of providing at least \$6 billion in climate financing annually from 2020. The countries requested the TA and agreed with the scope during reconnaissance missions in November 2017 and January 2018.<sup>5</sup> All member countries concurred with the TA concept at the CAREC Energy Sector Coordinating Committee (ESCC) meeting in Ashgabat, Turkmenistan in March 2018. The TA is not included in ADB's country operations business plans and regional cooperation operations business plan.<sup>6</sup> The concept clearance was obtained on 6 June 2018.

## II. ISSUES

3. Power supply in Afghanistan is 80% imported, while 85% of power in Azerbaijan is supplied from fossil fuel-based plants. In the Kyrgyz Republic, 90% of power is from hydropower plants (Table 1a).<sup>7</sup> All countries have little or no installed solar capacity despite rapid cost reductions in the last 5 years and supporting policies. This is due to lack of awareness, and insufficient technical skills and knowledge on the costs, benefits, and financing options.

4. The availability, suitability, and cost of land for solar energy are additional constraints to its development. Land with competing uses, such as agriculture and housing, is expensive, and hilly terrains are costly to develop and prepare for land-based solar projects. However, the

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<sup>1</sup> A photovoltaic cell is a specialized semiconductor diode that converts light (photons) to electricity (voltage).

<sup>2</sup> Compared with about 400 gigawatts of installed land-based photovoltaic capacity worldwide, only 106 FPV plants totaling 211 megawatts (MW) were in operation by the end of 2017. Japan has the most number of plants. The People's Republic of China has the largest, at 40 MW, and is constructing 150 MW and 70 MW plants. Several plants are in operation in 17 countries, such as Italy, the Republic of Korea, the United Kingdom, and the United States.

<sup>3</sup> The TA first appeared in the business opportunities section of the Asian Development Bank (ADB) website on 22 March 2018.

<sup>4</sup> ADB. 2009. *Energy Policy 2009*. Manila.; ADB. 2018. *Energy Sector Group Work Plan 2018–2019*. Manila; ADB. 2017. *CAREC 2030 Connecting the Region for Shared and Sustainable Development*. <https://www.adb.org/documents/carec-2030-connecting-region-sustainable-development>; CAREC. 2015. *Strategy and Work Plan (2016–2020) for Regional Cooperation in the Energy Sector of CAREC Countries*. <https://policy.asiapacificenergy.org/sites/default/files/2015-SOM-September-Energy-Strategy-Draft.pdf>.

<sup>5</sup> The CAREC Energy Sector Coordinating Committee (ESCC) visited the 2 MW Boryeong FPV plant at the April 2017 meeting in the Republic of Korea, drawing interest from the CAREC member countries given their solar and water resource potential, and push for renewable energy and private sector participation in the renewable energy sector.

<sup>6</sup> The TA complements ongoing CAREC TA projects: ADB. 2017. *Regional Cooperation on Renewable Energy Integration to the Grid*. <https://www.adb.org/projects/documents/reg-51148-001-tar>. (TA-9365-REG).; ADB. 2016. *Access to Electricity with New Off-Grid Solar Technology in Central Asia*. <https://www.adb.org/projects/documents/access-to-electricity-new-off-grid-solar-technology-central-asia-tar>. (TA-9168-REG).; and ADB. 2017. *Leapfrogging of Clean Technology in CAREC Countries through Market Transformation*. <https://www.adb.org/projects/documents/reg-49413-001-tar>. (TA-9299-REG).

<sup>7</sup> Other Central and West Asian countries are less energy insecure, have a relatively diversified energy mix which includes solar, adequate institutional capacity and have promoted private sector participation in renewable energy.

countries have large lakes and reservoirs with perennially sunlit surfaces. The installation of FPV on these water bodies optimizes the use of water and solar resources, diversifies the energy mix, enhances energy security, and avoids emissions. The total installed generation capacity of the region is only a fraction of the potential FPV capacity on the region's hydropower reservoirs alone. With the existing grid infrastructure for hydropower, the cost of installing FPV is reduced while the power density in megawatts (MW) per flooded area is significantly increased.<sup>8</sup> The FPV output also allows time-shifting of hydropower output, creating a virtual pumped storage capability.<sup>9</sup> Moreover, FPV installed in reservoirs used for drinking water, fishing, irrigation, and hydropower has added environmental benefits. It reduces evaporative losses (water conservation) and algal growth, increasing water clarity and resulting in plant growth, increased oxygen, and fish growth.

**Table 1: Installed Generation Capacity, Solar Potential and NDC Targets**

Aspects		Afghanistan	Azerbaijan	Kyrgyz Republic
	Total	520	7,905	3,786
1a. Power generation capacity (MW, share %)	Thermal	200 (38.5%)	6,764 (85.5%)	716 (18.9%)
	Hydro	254 (48.9%)	1,105 (14.0%)	3,070 (81.1%)
	Wind	0	0	0
	Others	65 (12.5%)	35 (0.5%)	0
1b. Potential and installed photovoltaic capacity	Unconstrained potential	220,000 MW	115,200 MW	267,000 MW
	Installed capacity	A 20 MW ADB-financed project is being tendered	About 35 MW	None
1c. CO <sub>2</sub> emissions (2015) and NDC targets	CO <sub>2</sub> (million tons) <sup>a</sup>	8.66	32.73	7.05
	Tons of CO <sub>2</sub> /capita <sup>a</sup>	0.27	3.36	1.19
	NDC <sup>b</sup>	(13.6)% by 2030	(35)% by 2030	(11.49)% to (13.75)% by 2030

ADB = Asian Development Bank, CO<sub>2</sub> = carbon dioxide, MW = megawatt, NDC = nationally determined contributions.

<sup>a</sup> European Commission Emissions Database for Global Atmospheric Research. [http://edgar.jrc.ec.europa.eu/overview.php?v=CO2ts\\_pc1990-2015](http://edgar.jrc.ec.europa.eu/overview.php?v=CO2ts_pc1990-2015) (accessed 12 July 2018).

<sup>b</sup> Nationally Determined Contribution. Submission to the United Nations Framework Convention on Climate Change. Sources: Asian Development Bank and United Nations Development Programme.

5. Solar energy is inexhaustible and available year-round, and photovoltaic cost-effectiveness is proven globally. Land-based and floating photovoltaic are sustainable options, given that (i) the countries have adequate solar resources (Table 1b), (ii) photovoltaic is becoming even more cost-effective, (iii) photovoltaic is quick to install, and (iv) photovoltaic mitigates climate change while enhancing energy security. Photovoltaic development also supports the countries' nationally determined contributions targets to reduce GHG emissions by 2030 (Table 1c).

6. The TA will pilot test high technology, enabling the countries to leapfrog in knowledge and capacity and increase readiness for private sector participation in large-scale, land-based, and floating solar development. The TA will also address critical challenges and vulnerabilities such as (i) insufficient technical and institutional capacity, (ii) limited financial resources, (iii) tariffs below cost recovery, and (iv) energy insecurity due to reliance on a single type of energy source.

7. Afghanistan remains in the lowest 5% of electricity use globally, with only 30% of the population connected to the grid. Domestic capacity is only 520 megawatts (MW); and imports from Iran, Tajikistan, Turkmenistan, and Uzbekistan account for 80% of the power supply.<sup>10</sup>

<sup>8</sup> The added cost of the floating structure could be compensated through savings from land acquisition and preparation.

<sup>9</sup> FPV helps to meet demand surges during the day and save water for hydropower plant operation at night.

<sup>10</sup> The cost of energy imports increased 14 times from \$16 million in 2007 to \$224 million in 2016.

Unreliable supply and lack of grid connection have caused reliance on expensive (about \$0.50 per kilowatt-hour) and carbon-intensive diesel generation. The country aims to diversify into renewable energy and encourage private sector participation, but its inaccessible and insecure land, and limited baseload generation and grid capacity, have hindered solar development.

8. In Azerbaijan, oil and gas supply over 90% of power while hydro accounts for 7%. The government aims to diversify its energy mix and improve sector efficiency, but the low user tariffs hinder investments in renewable energy. A 2016 Presidential decree mandated reforms to develop non-oil sectors, increase the use of domestic resources to free up oil and gas for additional export revenues, and incentivize private sector entry into renewable energy.<sup>11</sup> The high-cost, limited availability, and competing uses of land have stalled photovoltaic development.

9. The Kyrgyz Republic relies heavily on hydropower, which represents 80% of capacity and 90% of supply. It is a net electricity exporter, but a net importer of fossil fuels to feed cogeneration plants in winter when reservoir water is low. Excess water is spilled without generating electricity in the summer, while coal-based plants supply the winter electricity shortage. The country needs to diversify to clean year-round power generation sources as the seasonality of hydropower threatens its energy security and increases emissions. The country's rugged terrain and low user tariffs have contributed to the lack of investments in solar and other clean technologies.

10. While FPV requires stricter standards, given the exposure to water, it has advantages over land-based photovoltaic, as it (i) frees up land for other uses and saves on land acquisition and preparation costs, (ii) allows higher yields because of the cooling effect of water, (iii) conserves water through reduced evaporation, (iv) has readily available water for module cleaning, and (v) is quick to install. FPV systems have been largely installed on lakes, irrigation ponds, and reservoirs. Some plants have been built and tested in marine environments, and pile- or stilt-mounted plants have been installed over aquaculture farms, canals, and wetlands.

### III. THE TECHNICAL ASSISTANCE

#### A. Impacts and Outcome

11. The TA is aligned with the following impacts: (i) selected countries' energy security enhanced;<sup>12</sup> and (ii) GHG emissions reduced.<sup>13</sup> The TA will have the following outcome: utility-scale floating solar projects in selected countries initiated.

#### B. Outputs, Methods, and Activities

12. The TA will have the following outputs: (i) pilot-scale floating solar plants installed and scaled up plants assessed in selected countries; (ii) business models with private sector participation developed; and (iii) institutional capacity in designing, constructing, and operating floating solar photovoltaic systems enhanced.

<sup>11</sup> Government of Azerbaijan. 2016. *Strategic Roadmap for Development of Utilities Services (electricity, heating, water and gas)*. Baku. Presidential decree of the Azerbaijan Republic of December 6, 2016 No. 1138 about approval of strategic road maps on national economy and the main sectors of economy. Baku.

<sup>12</sup> CAREC. 2015. *Strategy and Work Plan (2016–2020) for Regional Cooperation in the Energy Sector of CAREC Countries*. <https://policy.asiapacificenergy.org/sites/default/files/2015-SOM-September-Energy-Strategy-Draft.pdf>.

<sup>13</sup> United Nations Framework Convention on Climate Change. 2016. *Paris Agreement-Status of Ratification*. Bonn. <https://unfccc.int/process/the-paris-agreement/status-of-ratification>.

13. **Output 1: Pilot-scale floating solar plants installed and scaled-up plants assessed in selected countries.** Output 1 will be delivered by installing three pilot FPV systems of up to 100 kilowatts (kW) AC (alternating current) each.<sup>14</sup> The systems will comprise photovoltaic panels, a floating platform, an anchoring or mooring system, an inverter and power conditioner station (land-based or above the water), cables, grid connection infrastructure (including a battery energy storage system as appropriate), and auxiliary facilities. Ground-mounted photovoltaic systems of up to 5 kW AC each will be installed next to the FPV systems to enable performance comparison and facilitate hands-on technical training. Photovoltaic is a proven technology, but the floating and mooring systems associated with FPV are new, high-level technologies. The physical activities on the selected pilot plant sites must have minimal or no environmental impacts. Three design–build–operate (DBO) contracts will be procured under the TA. The three 105 kW AC pilot projects are expected to avoid about 140 tons of carbon dioxide equivalent emissions per year in total.<sup>15</sup> Based on the findings of the pilot projects, the TA will develop feasibility studies for utility-scale floating solar plants in the same sites using the business models formulated under the TA. Potential for scale-up and replication in other water bodies will also be assessed. Safeguards assessments will be done on the scaled-up projects and an environmental assessment and review framework will be prepared to guide these future projects and ensure compliance with ADB's Safeguard Policy Statement (2009).

14. **Output 2: Business models developed with private sector participation.** Output 2 will be delivered by (i) assessing current policy, laws, regulations, and tariff structures; and identifying gaps or shortcomings that hinder the development of solar and renewable energy; (ii) formulating financing plans after market analyses; (iii) identifying and assessing suitable business models for the selected countries—public, public–private partnerships, independent power producers, and other suitable modalities—with several different ownership and operational options, while ensuring adequate balancing of risk and benefits; (iv) recommending the most appropriate business model for each target country; describing the stakeholders' roles, responsibilities, and risks; and incorporating findings in the feasibility studies; and (v) recommending action plans to promote solar photovoltaic, and creating an enabling environment for private sector participation.

15. **Output 3: Institutional capacity in designing, constructing, and operating floating solar photovoltaic systems enhanced.** Output 3 will be delivered through intensive capacity building of stakeholders. The pilot projects will serve as platforms for hands-on technical training on both land-based and floating photovoltaic to build local expertise in designing, constructing, integrating, operating, and maintaining photovoltaic systems. Regional conferences and study tours to leading FPV countries will be also be conducted.<sup>16</sup> Government and local experts will work with and learn from international experts, owners, operators, suppliers, and manufacturers of floating photovoltaic. International consultants will support and train the implementing agencies and project management units (PMUs) in supervising and managing contractors.

16. Output deliverables will be disseminated in digital publication format to the countries at workshops, trainings, and meetings through ADB, implementing agencies, and the CAREC ESCC.

17. The following project sites, identified and agreed with the countries during the fact-finding missions, have diverse water characteristics and uses and therefore allow different designs, components, and configurations to be assessed and pilot tested for optimum learning:

<sup>14</sup> The FPV plant capacity and configuration depend on the site and are limited by the TA pilot-testing budget.

<sup>15</sup> ADB. 2017. *Guidelines for Estimating Greenhouse Gas Emissions of Asian Development Bank Projects*. Manila.

<sup>16</sup> The TA consultant will organize study tours to FPV plants in different stages of development in leading FPV countries (e.g., Japan, the People's Republic of China, and the Republic of Korea) to ensure a deep understanding of FPV.



- (i) **Afghanistan.** The Qargha dam and reservoir in Kabul is a 50-hectare recreational area planned to be developed for trout fishing and hatchery. It is also planned to supply additional drinking water to Kabul, provide irrigation to expand horticulture, and feed a hydropower plant. FPV on Qargha lake contributes to water conservation for more drinking and irrigation water while providing much needed electricity to the grid. Increasing the supply of reliable energy to facilities around the lake could contribute to increases in tourist numbers and revenues. The Naghlu reservoir 40 kilometers (km) east of Kabul will also be assessed for suitability. It has electrical and grid infrastructure via the 100 MW Naghlu Hydropower Plant, the country's largest. A 20 MW land-based photovoltaic plant is expected to be built 2 km from the reservoir under an approved ADB grant tranche, and an additional 20 MW is planned under a future tranche.<sup>17</sup> Qargha lake could fit up to 25 MW, while the Naghlu reservoir could fit over 200 MW of FPV.<sup>18</sup>
- (ii) **Azerbaijan.** Lake Boyukshor, the largest of 9 lakes in Azerbaijan's Absheron peninsula, is saline and was used as a dumping site for sewage and oil effluents. A 2012–2015 lake remediation program cleaned 300 out of the 1,100 hectares and built a promenade and park on its bank fronting the Baku Olympic stadium. Remediation of the remaining 800 hectares is ongoing and tourism is expected to increase with this program. FPV installation could demonstrate climate-resilient lake restoration while displacing fossil-fuel-based power in the distribution network. The lake could theoretically fit at least 500 MW of FPV.
- (iii) **Kyrgyz Republic.** The 284 km<sup>2</sup> Toktogul reservoir feeds a 1,200 MW hydropower plant and provides 40% of power supply in the Kyrgyz Republic.<sup>19</sup> FPV could balance the seasonality of the hydropower plant with a year-round solar generation. Providing frequency regulation of the 500-kilovolt transmission system, the Toktogul hydropower plant exports power and provides irrigation water to Uzbekistan. The lake could theoretically fit over 20 gigawatts of FPV.

### C. Cost and Financing

18. The TA is estimated to cost \$3,000,000, financed on a grant basis by the Clean Energy Fund<sup>20</sup> under the Clean Energy Financing Partnership Facility and administered by ADB. Eligible expenditures include consulting services, training and workshops, and equipment. Pilot equipment costs shall not exceed 30% of the ADB-administered financing amount. The key expenditure items are listed in Appendix 2.

19. The governments of Afghanistan, Azerbaijan, and the Kyrgyz Republic will provide counterpart support in the form of data, counterpart staff, offices, and office supplies; and allocate pilot project water surface and land sites, permits and licenses, and other in-kind contributions.

### D. Implementation Arrangements

20. ADB will administer the TA with the country implementing agencies:<sup>21</sup> Da Afghanistan Breshna Sherkat (DABS), the Ministry of Energy of Azerbaijan, and OJSC Electric Power Plants

<sup>17</sup> ADB. 2016. *Report and Recommendation of the President to the Board of Directors: Afghanistan: Energy Supply Improvement Investment Program (Formerly Multitranchise Financing Facility II: Energy Development 2014–2023)*. Manila.

<sup>18</sup> Further due diligence and environmental sensitivity will be considered in the final site selection for Afghanistan.

<sup>19</sup> ADB is funding the rehabilitation of turbine-generator sets and electrical equipment of Toktogul hydropower plant.

<sup>20</sup> Financing partners: the governments of Australia, Norway, Spain, Sweden, and the United Kingdom.

<sup>21</sup> ADB and the TA consultants will also coordinate with ESCC focal persons on the regional capacity building events.

(EPP) of the Kyrgyz Republic.<sup>22</sup> TA consultants will (i) support TA administration, working closely with, assisting, and training the PMUs in DABS, EPP, and OJSC Temiz Shahar of Azerbaijan;<sup>23</sup> and (ii) coordinate with relevant ADB resident missions and other consultants on capacity building events and to incorporate relevant findings and recommendations.<sup>24</sup> The implementing agencies and PMUs will provide data, office space, staff, assistance in data collection, and logistics; and provide pilot project sites, permits and licenses. ADB will own the pilot projects over the 33-month implementation period, then hand them over for the implementing agencies to own and operate upon TA completion. The on-grid pilot plants will supply power to grid-connected consumers.

21. The implementation arrangements are summarized in Table 2.

**Table 2: Implementation Arrangements**

Aspects	Arrangements		
Indicative implementation period	August 2018–March 2021		
Executing agency	Asian Development Bank		
Implementing agencies	ADB will be the TA executing agency working with the country implementing agencies: Da Afghanistan Breshna Sherkat, Afghanistan Ministry of Energy, Azerbaijan OJSC Electric Power Plants, Kyrgyz Republic		
Consultants	To be selected and engaged by ADB		
	QCBS (90:10)	Consultant	\$2,900,000
	Individual consultants selection and resource person recruitment	International experts and resource persons (5 person-months aggregate)	\$160,000
Procurement	To be procured by consultants		
	Open competitive bidding	3 contracts	\$300,000 each
Advance contracting	ADB will apply advance action on consultant recruitment for timely implementation of the TA.		
Disbursement	TA resources will be disbursed following ADB's <i>Technical Assistance Disbursement Handbook</i> (2010, as amended from time to time).		
Asset turnover	Pilot plants procured under the TA will be transferred to the respective governments upon TA completion following ADB's PAI 5.09 para. 68. <sup>a</sup>		

ADB = Asian Development Bank, OJSC = Open joint-stock company, PAI = project administration instruction, QCBS = quality- and cost-based selection, TA = technical assistance.

<sup>a</sup> ADB. 2013. Administering Grant-Financed Technical Assistance. *Project Administration Instructions*. PAI 5.09. Manila (para. 68).

Source: Asian Development Bank.

<sup>22</sup> DABS, Afghanistan's national power utility corporatized in 2008, is 100% government-owned. It operates and manages all electric power generation, import, transmission, and distribution throughout Afghanistan. Established in 2001, Kyrgyz Republic's EPP generates 98% of electricity for domestic and foreign consumers and regulates the frequency in the Central Asian United Energy System. EPP owns seven hydropower plants and two thermal power stations with a total generation capacity of 3.7 million kilowatt-hours per year, of which 81% is hydropower. Integrity due diligence was conducted on DABS and EPP. No significant or potentially significant integrity risks were identified.

<sup>23</sup> Temiz Shahar, a 100% state-owned entity, is mandated to bring sustainable waste management systems in Baku and is overseeing the Lake Boyukshor remediation project. It operates a waste-to-energy plant near the lake, generating 230 million kilowatt-hours/year. The Ministry of Energy and Water, Afghanistan; the State Committee for Industry, Energy and Subsoil Use and National Energy Holding Company, Kyrgyz Republic; and the State Agency for Alternative and Renewable Energy Sources, and the Energy Sector Regulatory Agency, Azerbaijan, will also be consulted during due diligence and data gathering, and will be requested to nominate participants to training events.

<sup>24</sup> Includes ADB. 2014. *Azerbaijan: Preparing an Enabling Environment for Private Sector Participation in the Power Sector*. <https://www.adb.org/projects/48200-001/main>. (TA 8730-REG); and ADB. 2016. *Azerbaijan: Preparing a Power Sector Financial Recovery Plan*. <https://www.adb.org/projects/50079-001/main>. (TA 9151-AZE), and CAREC TA projects (footnote 6).

22. **Consulting services.** ADB will engage consultants following ADB's Procurement Policy (2017, as amended from time to time) and its associated project administration instructions and/or staff instructions.<sup>25</sup> An international consulting firm, with 127 person-months of international and national consultants over 30 months, will be selected through the quality- and cost-based selection method using full technical proposal. The ratio of quality against cost will be 90:10 given the relatively new technology. Individual consultants and resource persons (5 person-months of total inputs) engaged will be considered for lump sum and/or output-based contracts.

23. **Pilot testing of project approach.** DBO contractors will deliver three pilot projects of up to 105 kW AC each. Pilot plants procured under the TA will be transferred to the respective governments upon TA completion following ADB's PAI 5.09 para. 68.<sup>26</sup> ADB will own the pilot projects during TA implementation, then hand them over for the implementing agencies to own and operate from TA completion. The TA consultant will develop feasibility studies of scaled up plants on the same sites based on the findings of the pilot projects. For the scaled-up projects, safeguards due diligence will be conducted following ADB's Safeguard Policy Statement; and related reports, plans, and monitoring and management plans will be developed and incorporated into the tender documents. Counterpart in-kind contribution, including allocation of project sites and permits or clearances, and implementation arrangements were agreed with the beneficiary countries during the fact-finding missions in November 2017 and January 2018. The TA meets all criteria for pilot testing of a project approach.<sup>27</sup>

24. **ADB's procurement.** All procurement, including the three DBO contracts for the pilot projects of up to 105 kW AC, will be done by the TA consultant on behalf of ADB, following ADB's Procurement Policy and the associated PAIs and TA staff Instructions, and Procurement Regulations for ADB Borrowers (2017, as amended from time to time), in collaboration with the implementing agencies and PMUs. ADB will sign the contracts. The size and cost of each pilot project will be confirmed pending required due diligence during TA implementation to determine the optimum configuration, design, and components for each pilot plant. Pilot project costs will not exceed 30% of the ADB-administered financing amount.

25. **Cofinancier requirements.** The TA implementation will follow the additional monitoring and reporting requirements specific to the Clean Energy Fund under the Clean Energy Financing Partnership Facility (footnote 20).<sup>28</sup>

#### IV. THE PRESIDENT'S DECISION

26. The President, acting under the authority delegated by the Board, has approved the Asian Development Bank administering technical assistance not exceeding the equivalent of \$3,000,000 to be financed on a grant basis by the Clean Energy Fund under the Clean Energy Financing Partnership Facility for Floating Solar Energy Development, and hereby reports this action to the Board.

<sup>25</sup> Terms of Reference for Consultants (accessible from the list of linked documents in Appendix 3).

<sup>26</sup> ADB. 2013. Administering Grant-Financed Technical Assistance. *Project Administration Instructions*. PAI 5.09. Manila (para. 68).

<sup>27</sup> Following ADB. 2013. Safeguard Policy Statement. *Operations Manual*. OM F1/OP. Manila (para. 6); ADB. 2017. Technical Assistance. *Operations Manual*. OM D12. Manila (para. 77). ADB. 2018. *Staff instruction on business processes for knowledge and support technical assistance*. Manila (Attachment 1 (Optional Provisions) para. 14(ii)).

<sup>28</sup> ADB. 2013. *Clean Energy Financing Partnership Facility Implementation Guidelines for the Clean Energy Fund*. Manila.

## DESIGN AND MONITORING FRAMEWORK

<b>Impacts the TA is Aligned with</b> Selected countries' energy security enhanced (CAREC Energy Strategy and Work Plan, 2016–2020) <sup>a</sup> Greenhouse gas emissions reduced (United Nations Framework Convention on Climate Change) <sup>b</sup>			
<b>Results Chain</b>	<b>Performance Indicators with Targets and Baselines</b>	<b>Data Sources and Reporting Mechanisms</b>	<b>Risks</b>
<b>Outcome</b> Utility-scale floating solar projects in selected countries initiated	a. At least 10 megawatts aggregated FPV projects initiated in CAREC member countries by 2022 (2018 baseline: 0)	a. CAREC Energy Sector Coordinating Committee annual work plan and meeting minutes	Changing government priorities may delay or hinder project development
<b>Outputs</b> 1. Pilot-scale floating solar plants installed and scaled up plants assessed in selected countries  2. Business models with private sector participation developed  3. Institutional capacity in designing, constructing, and operating FSP systems enhanced	By 2021: 1a. At least three FPV pilot projects, of up to 100 kilowatts AC each, in operation (2018 baseline: 0)  1b. At least three feasibility studies for scaled up plants based on the pilot projects developed in the same sites (2018 baseline: 0)  2. At least three business models and draft requests for proposals completed (2018 baseline: 0)  3a. At least 30 trained technicians, including at least six women, applied their knowledge and skills on solar photovoltaic and floating photovoltaic design and operation (2018 baseline: 0)  3b. At least 60 stakeholders, including 10 women, from at least 10 countries, gained knowledge on FPV technology, through three national workshops, two international conferences, and study tours to at least three countries (2018 baseline: 0)	1a. TA consultants' final report  1b. TA consultants' final report  2. TA consultants' final report  3. TA consultants' final report (including training reports and conference proceedings)	Limited contractors and equipment suppliers operating in the country

<p><b>Key Activities with Milestones</b></p> <p><b>1. Pilot-scale floating solar plants installed and scaled up plants assessed in selected countries</b></p> <p>1.1 Identify and assess pilot project sites, technologies, capacities, and configurations (Q3 2018).</p> <p>1.2 Complete pilot project feasibility studies and tender documents (Q3–Q4 2018).</p> <p>1.3 Issue bidding documents for the pilot-scale floating solar plants (Q1 2019).</p> <p>1.4 Award three design–build–operate contracts (Q2 2019).</p> <p>1.5 Complete installation of three pilot FPV systems (Q3 2019).</p> <p>1.6 Operate and maintain pilot projects (Q4 2019–Q3 2020).</p> <p>1.7 Complete feasibility studies for scaled up projects (Q3 2019–Q4 2020).</p> <p><b>2. Business models with private sector participation developed</b></p> <p>2.1 Review policies and identify gaps (Q3 2018).</p> <p>2.2 Complete and disseminate tariff and policy study report (Q3 2018–Q1 2019).</p> <p>2.3 Develop and apply business models (Q3 2018–Q2 2019).</p> <p>2.4 Prepare model tender documents and request for proposals (Q3 2018–Q3 2019).</p> <p><b>3. Institutional capacity in designing, constructing, and operating floating solar photovoltaic systems enhanced</b></p> <p>3.1 Identify current condition of technical expertise in and familiarity with photovoltaic technology (Q3–Q4 2018).</p> <p>3.2 Assess capacity needs and design appropriate training program, including study tours with relevant use of regional platforms, such as CAREC, for sharing lessons learned among the countries (Q4 2018–Q1 2019).</p> <p>3.3 Organize and conduct workshops, training, study tours, and/or conferences (Q4 2018–Q1 2021).</p> <p><b>TA Management Activities</b></p> <p>Engage consultant.</p> <p>Hold kick-off meeting and inception mission.</p> <p>Conduct country and regional consultations.</p>
<p><b>Inputs</b></p> <p>Clean Energy Fund under the Clean Energy Financing Partnership Facility: \$3,000,000</p> <p>Note: The governments of Afghanistan, Azerbaijan, and the Kyrgyz Republic will each provide counterpart support in the form of data, counterpart staff, office, and office supplies; and allocate pilot project water surface and land sites, permits and licenses, and other in-kind contribution, the total value of which is estimated to be equal to 30% of the TA cost.</p>
<p><b>Assumptions for Partner Financing</b></p> <p>Not applicable</p>

AC = alternating current, CAREC = Central Asia Regional Economic Cooperation, FPV = floating solar photovoltaic, Q = quarter, TA = technical assistance.

<sup>a</sup> CAREC. 2015. *Strategy and Work Plan (2016–2020) for Regional Cooperation in the Energy Sector of CAREC Countries*. <https://policy.asiapacificenergy.org/sites/default/files/2015-SOM-September-Energy-Strategy-Draft.pdf>.

<sup>b</sup> United Nations Framework Convention on Climate Change. 2016. *Paris Agreement-Status of Ratification*. Bonn. <https://unfccc.int/process/the-paris-agreement/status-of-ratification>

Source: Asian Development Bank.

**COST ESTIMATES AND FINANCING PLAN**  
(\$'000)

Item	Amount
<b>Clean Energy Fund<sup>a</sup> under the Clean Energy Financing Partnership Facility</b>	
1. Consultants	
a. Remuneration and per diem	
i. International consultants	860.0
ii. National consultants	393.0
b. International and local travel	197.0
c. Reports and communications	10.0
2. Equipment <sup>b</sup>	
a. Pilot project equipment and operations services	900.0
b. Computer, printer, and other necessary supplies	24.0
3. Training, seminars, workshops, and conferences <sup>c</sup>	
a. Individual consultants and resource persons	160.0
b. Training seminars, workshops, conferences, and study tours	200.0
4. Miscellaneous administration and support costs for consultants <sup>d</sup>	36.0
5. Vehicles <sup>e</sup>	10.0
6. Surveys <sup>f</sup>	20.0
7. Contingencies	190.0
<b>Total</b>	<b>3,000.0</b>

Note: The technical assistance (TA) is estimated to cost \$3,000,000, of which contributions from the Clean Energy Fund under the Clean Energy Financing Partnership Facility are presented in the table above. The governments of Afghanistan, Azerbaijan, and the Kyrgyz Republic will each provide counterpart support in the form of data, counterpart staff, office, and office supplies; and allocate pilot project water surface and land sites, permits and licenses, and other in-kind contribution, the total value of which is estimated to be equal to 30% of the TA cost.

<sup>a</sup> Financing partners: the governments of Australia, Norway, Spain, Sweden, and the United Kingdom. Administered by the Asian Development Bank.

<sup>b</sup> All equipment and pilot plants shall be transferred to respective governments upon TA completion following Asian Development Bank. 2013. Administering Grant-Financed Technical Assistance. *Project Administration Instructions*. PAI 5.09. Manila (para. 68).

<sup>c</sup> At least nine training or workshops (three per country), three study tours, and two international conferences. At least eight resource persons and individual consultants totaling about 5 person-months will be engaged.

<sup>d</sup> Includes local office and secretarial support for the three countries.

<sup>e</sup> For rental vehicles required during fieldwork for site and safeguards surveys.

<sup>f</sup> Including socioeconomic study and census of affected persons (as needed).

Source: Asian Development Bank.

**LIST OF LINKED DOCUMENTS**

<http://www.adb.org/Documents/LinkedDocs/?id=52079-001-TARreport>

1. Terms of Reference for Consultants