Completion Report

Project Number: 45120-001
Technical Assistance Number: 8008
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Uzbekistan: Solar Energy Development

Asian Development Bank

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TA Number, Country, and Name: TA 8008-UZB: Solar Energy Development			Amount Approved: $1,500,000 Revised Amount: $2,250,000 TASF-IV $1,750,000 TASF-Others $500,000	
Executing Agency: Ministry of Finance	Source of Funding: TASF		Amount Undisbursed: $34,701	Amount Utilized: $2,215,299
TA Approval Date: 16 December 2011	TA Signing Date: 11 January 2012	Fielding of First Consultants: 27 January 2012	TA Completion Date Original: 30 September 2013 Actual: 30 June 2016 Account Closing Date Original: 30 September 2013 Actual: 16 September 2016	

Description. Limited exposure to modern solar technology impeded Uzbekistan from effectively harnessing its huge solar resources. Uzbekistan did not have sufficient reliable solar irradiance data or an enabling environment for solar energy development. Building on the gains from *S-CDTA 7846: Design and Strengthening of the Solar Energy Institute*,[1] which established the International Solar Energy Institute (ISEI), the TA brought international attention to solar in Uzbekistan, and boosted the country's efforts to become the solar technology and knowledge hub of Central Asia.

Expected impact, outcomes, and outputs. The achieved outcome was enhanced readiness for solar application in Uzbekistan. The TA outputs, which were all achieved, were (i) an enabling environment for solar power development and investments; (ii) a national solar energy development road map; (iii) solar irradiance data; (iv) 6 feasibility studies, including for the 100 megawatt (MW) photovoltaic power plant under *Loan 3058/3059-UZB: Samarkand Solar Power Project,*[2] with carbon financing applications called Nationally Appropriate Mitigation Actions (NAMA)*;* and (v) through increased TA financing, highly-specialized solar research and testing equipment.[3] All 6 feasibility studies were approved and prioritized in the roadmap.

The TA's expected impact is increased environmentally sustainable and efficient power generation, with installed capacity of renewable energy increasing by 100 megawatts (MW) within 5 years of TA completion. This will likely be achieved with the Loan 3058/3059, and preparation for a new 100 MW photovoltaic power project, which is scheduled for ADB approval in 2017.

Delivery of inputs, and conduct of activities. The TA maximized inputs from the government, consultants, and ADB staff. The government, through the Ministry of Finance as executing agency (EA), and ISEI and Physics Sun as implementing agencies (IAs), performed satisfactorily, providing timely data and endorsements. The Ministry of Economy and UzHydromet committed to implementing the roadmap and NAMA. The handover of 5 meteorological stations, which collected the required 12-months of onsite solar resource data, to UzHydromet at TA completion enables centralized solar, weather and meteorological data collection for future research and project development.

The consultant was highly satisfactory, delivering quality inputs on time; and adapting to changes in the TA (footnote 3), including the 33-month TA extension. Originally contracted for 81.55 person-months over 21 months to help the government prepare the solar energy development road map, procure and install the six meteorological stations, and prepare the feasibility studies, the consultant rendered 129.93 person-months to also help procure the solar equipment. The consultant proactively pursued the NAMA, and published the roadmap in peer-reviewed scientific journals.

The government is highly satisfied with ADB and the TA. The supplementary financing demonstrated ADB's strong client orientation and commitment to building the IAs' research capacity. Regular missions,[4] presentations in 5 Asia Solar Energy Forum (ASEF) meetings (4^{th}, 6^{th}–9^{th}),[5] 5 workshops, 6 hands-on technical trainings, and day-to-day coordination with the EA and IAs, through the consultant and URM, helped solve implementation issues, built institutional capacity, and sustained local and international interest in Uzbekistan solar initiatives. In turn, government extended full cooperation through counterpart funding ($1.14 million) and in-kind support.

A key implementation challenge was procuring the meteorological stations and solar equipment. The IAs, with the consultant's assistance, needed time to finalize the specifications and packaging of the 31 types (2,000 units) of highly specialized equipment produced, sometimes individually, by only one or a few manufacturers.

Much staff and consultant time were then spent after two rounds of shopping failed mainly due to the suppliers' failure to submit the required financial forms. The third and last round of shopping also required considerable coordination between ADB and the consultant; and among CWEN, CTL, and OSFMD to clarify contractual arrangements for the suppliers.[6] From contract award in May 2015 to January 2016, the equipment arrived in 12 lots in Tashkent and then verified. But, customs

[1] Approved for $225,000 in August 2011, TA 7846 was completed in November 2012 with a highly successful rating.
[2] Approved for $101.1 million and $8.9 million equivalent in November 2013, for which procurement is ongoing.
[3] In November 2012, the TA amount was increased by $750,000 to allow ISEI and Physics Sun to modernize their solar technology testing and research facilities. In May 2014, another change in scope was approved to redefine the composition of the 6 feasibility studies: 1 demonstration and 5 commercial projects. The following 6 studies were approved by 2015: 100 MW PV projects in (i) Samarkand, (ii) Sherabad, (iii) Namangan, and (iv) Guzar, and (v) 130 MW concentrating solar power (CSP) plant in Karmana, and (vi) 10 MW CSP demonstration plant in Kibray.
[4] Sixteen missions were fielded, most of which were back-to-back with review missions for Loan 3058/3059.
[5] The TA jointly organized and funded the 6th ASEF in Tashkent in 2013 which coincided with the loan signing for L3058/3059.
[6] Two consultant contract variations allocated the supply, installation and training costs totaling $328,055.

clearance is processed only after all equipment are verified, causing delays and unforeseen storage fees. The IAs and consultant, worked with the customs office to obtain clearance and allow the delivery to IAs premises, installation and operators' training before TA completion date.

Evaluation of outputs, and achievement of outcome. All envisaged TA outputs were delivered, though with delay. The expected outcome of enhanced readiness for solar technology in Uzbekistan was clearly achieved as best demonstrated by Loan 3058/3059's approval, and the proposed second solar power project. The government's endorsement of the solar road map in June 2015 triggered the NAMA, which were registered with the United Nations in February 2016. With their modernized solar facilities, and knowledge gained from the international consultants, the IAs are more capable of boosting Uzbekistan's solar investments. Already, Physics Sun and ISEI obtained further government grant funds to optimize the use of equipment purchased under the TA. The sector now attracts private and bilateral financing, even for projects not in the roadmap.[7] Construction of ISEI's 50-hectare solar research and demonstration complex commenced in 2015.

Overall assessment and rating. The TA is rated highly successful─highly relevant, highly effective, efficient, and likely sustainable.[8]

The TA has been highly relevant with its continued linkage to Uzbekistan's country partnership strategy.[9] The TA design adequately built on the results of TA 7846, enabled accurate data collection, and pushed solar policy and project development. The equipment, training, and experience provided by the TA have transformational effects for the IAs, scientific institutions, industries and JSC Uzbekenergo, the EA for ADB's energy loans.

The TA was highly effective, achieving the intended outcome and all outputs (footnote 3).

The TA was evaluated as efficient due to the positive ripple effects and sector-wide benefits such as increased capacities, advanced research through modern equipment, enforceable road map with committed frameworks and timeline for policy actions, stakeholder engagement, and infrastructure investments. The first large solar plant is poised for turnkey contract award in 2016 and the second one is under processing. TA funds were also optimized, with only $34,701 undisbursed.

With the solar road map, the IAs' upgraded solar facilities and experts, and the latest CPS for 2016–2018 prioritizing solar power generation, it is clear that the TA benefits are likely to be sustained.

Major lessons. Multi-layer government approvals and agency interactions remain key factors in project implementation, particularly procurement. For the TA, equipment delivery was delayed by prolonged government approvals and customs clearance. Proactive engagement of all concerned parties in the early stage of procurement, and maximizing possibility of flexible approaches in using selection method, contract type and conditions suitable for the required goods and services could have been done better. The TA is well justified given that the entire sector and numerous entities benefited and it built the client's and ADB's knowledge and capacity. The TA is ADB's first solar intervention in Central and West Asia and is the first for Uzbekistan.

Recommendations, and follow-up actions. Planning procurement for TAs, as for loans, require thorough consideration of external factors (e.g. government processes, and market conditions), and timely coordination among CWEN, OSFMD, and URM to come up with a realistic schedule, and appropriate bidding package.

For the proposed second solar power project, the strengths and relationship among the IAs and Uzbekenergo need to be carefully assessed to enable optimal project implementation arrangements. Advanced technologies and approaches must also be demonstrated to keep abreast with the fast-changing solar industry.

ADB = Asian Development Bank; ASEF = Asia Solar Energy Forum, COBP = country operations business plan; CPS = country partnership strategy; CTL = Controller; CWEN=Energy Division, Central and West Asia Department; EA = executing agency; ISEI = International Solar Energy Institute; JSC = Joint Stock Company; NAMA = Nationally Appropriate Mitigation Actions; OSFMD = Operations Services and Financial Management Department; Physics Sun = Scientific Production Association on Solar Physics; PPTA = project preparatory technical assistance; S-CDTA = small-scale capacity development technical assistance, TA = technical assistance; URM = Uzbekistan Resident Mission.

Prepared by: Cindy Tiangco Designation and Division: Energy Specialist, CWEN

[7] Including the (i) 130 kilowatt Namangan test-bed facility completed in 2015 funded by the Government of the Republic of Korea, and planned construction of ISEI's 10 MW CSP demonstration plant, which were both designed under the TA; (ii) 20 MW plant in Khorezm; and (iii) 1.2 MW plant in Bukhara.

[8] The assessments were made following the *Guidelines for the Evaluation of Public Sector Operations* (April 2016), available in www.adb.org/sites/default/files/institutional-document/32516/guidelines-evaluation-public-sector.pdf.

[9] The TA was in the COBP 2011–2013, and the TA additional financing was in the CPS 2012–2016. COBP 2016–2018 includes solar power generation as a key area of assistance, with the PPTA and loan for the second solar power project in the pipeline.