



USAID
FROM THE AMERICAN PEOPLE



AFGHANISTAN EXECUTIVES EXAMINE STRATEGIES FOR CLEAN ENERGY INTEGRATION

EXECUTIVE EXCHANGE FOR DA AFGHANISTAN BRESHNA SHERKAT (DABS) & THE MINISTRY OF ENERGY & WATER (MEW) TO INDIA

NOVEMBER 2014 - NEW DELHI, INDIA - Supported by the U.S. Agency for International Development (USAID), senior officials from Afghanistan's national electric utility, Da Afghanistan Breshna Sherkat (DABS), and the Ministry of Energy & Water (MEW) recently participated in an executive exchange with their counterparts in New Delhi, India to review best practices in the renewable energy integration process. During the exchange, conducted by the U.S. Energy Association (USEA) as part of the U.S. - Afghanistan Utility Partnership, the delegation gained exposure to the technical, financial, policy and regulatory considerations for clean energy integration. The 10-member Afghan delegation met with key institutions involved in the Indian clean energy sector, including the NTPC Vidyut Vyapar Nigam Ltd (NVVN), Azure Power, the Solar Energy Company of India (SECI), the Indian Renewable Energy Agency (IREDA), Tata Power Delhi Distribution Limited (TPDDL), Power Grid Corporation of India Ltd, the Central Electricity Regulatory Authority (CERC) and the Indian Wind Energy Association (InWEA).



Over the course of the weeklong executive exchange, the 10 member delegation from Da Afghanistan Breshna Sherkat (DABS) and the Ministry of Energy and Water (MEW) had the opportunity to visit the key institutions involved in deploying renewable energy in India. (Above) The delegation toured NTPC's Dadri 5MW solar PV plant.

BACKGROUND: THE U.S. – AFGHANISTAN UTILITY PARTNERSHIP PROGRAM

The U.S. – Afghanistan Utility Partnership is part of USEA’s Energy Utility Partnership Program (EUPP), which is aimed at increasing sustainable modern energy services and clean energy production in developing countries through volunteer-driven partnerships. The aim of these partnerships is to mobilize overseas utilities to better address energy service priorities, while improving productivity and quality of service. Extended in late 2014, the U.S. – Afghanistan Utility Partnership Program supports the objectives of USAID/Afghanistan, Da Afghanistan Breshna Sherkat (DABS) and the Afghanistan Ministry of Energy and Water (MEW) through the establishment of international partnerships with other national utility companies and ministries. Through these partnerships, DABS and MEW will be exposed to best practices in the integration of renewable energy into the power sector. The executive exchange to India was the first activity under this new program extension, with three executive exchanges planned during 2015-16.

RENEWABLE ENERGY DEPLOYMENT: THE AFGHANISTAN PERSPECTIVE

Currently, Afghanistan does not possess any grid-scale renewable energy assets. While gifted with solar and wind resource potential, the country relies primarily on power imports, followed by hydro and thermal plants, and finally diesel generation. Da Afghanistan Breshna Sherkat (DABS) is the state-owned provider of electrical power in Afghanistan. Of the estimated 5 million MWh of electricity consumed in Afghanistan in 2013, 78% was imported from neighboring countries and 19% was generated in Afghanistan with hydroelectric sources. Given this supply scenario, Afghanistan is currently embarking on ways to attract clean energy developers and interested renewable Independent Power Producers (IPPs). At the time of the executive exchange to India, DABS was exploring options to establish Afghanistan’s first ever solar reverse auction, with the goal of bringing online between 5-10 MW of grid-connected solar power, slated for the province of Kandahar.



Delegates had the opportunity to tour TATA Power Delhi Distribution Ltd.’s CENSTORE 1 MW rooftop solar installation, which sits atop the distribution utility’s district equipment warehouse.

PRIMARY EXCHANGE OBJECTIVES

As Afghanistan prepares for the future deployment of grid-scale renewable energy technology, with particular focus on the initial 5-10 MW solar plant, the primary objectives of this executive exchange were for DABS and MEW officials to:

- Learn best practices of renewable energy procurement, specifically through the reverse auction mechanism and PPAs
- Gain exposure to best practices in clean energy project development, investment and financing
- Understand the renewable energy integration process, including the challenges, barriers and opportunities of integrating intermittent and variable resources into the grid
- Learn about policy, regulatory and incentive best practices for encouraging renewable energy

IMPLEMENTING REVERSE SOLAR AUCTIONS

The Afghanistan delegation began the executive exchange by meeting with NTPC Vidyut Vyapur Nigam Ltd (NVVN), the power trading subsidiary of India’s National Thermal Power Corporation (NTPC). The Ministry of New and

Renewable Energy (MNRE) implements the National Solar Mission, which has the overall objective of creating policy conditions that enable an environment conducive to solar technology deployment. Divided into three phases, the mission aims to bring online 20,000 MW of solar capacity by the year 2022, with NVVN acting as the nodal agency in phase 1 and facilitating the reverse auction mechanism. NVVN outlined the solar auction for the Afghanistan delegation, which allows certain credible solar developers to enter non-negotiable kWh bids in the auction. The buyer (NVVN) then signs contracts with the lowest bidding developers to purchase solar power at the kWh price they submitted. Acting solely as a power trading entity, NVVN then sells the purchased solar power via separate agreements to state distribution companies, who often must meet state renewable energy purchasing obligations (RPO's).

The Afghanistan delegation was keen to know how NVVN managed to overcome one of the most common market barriers to clean energy deployment – high initial costs. To address this, NVVN implements a bundling scheme, in which for each megawatt of solar power purchased by state distribution utilities, NVVN provides a megawatt of coal power, which is cheaper. Supported by the Ministry of Power, this purchasing scheme levels out the cost of power for distribution companies in meeting their renewable purchasing obligations. NVVN showcased the falling rates of PV prices after the roll out of the reverse auction, with kWh prices falling from Rs. 12.12/kWh to Rs. 8.77/kWh – 43% lower than the Central Electricity Regulatory Agency's benchmark tariff. With the bundled scheme, the price fell to Rs. 4.5/kWh. At the time of the executive exchange, 27 solar PV projects had been selected through NVVN's Phase-1 reverse auction, with over 600 MW of solar capacity commissioned.

NVVN shared their lessons learned with the delegation, including signing long term PPA's at the outset (25 years), ensuring right of way issues for transmission lines are understood and addressed prior to PPA signing, staggering of capacity purchased for quicker financial closure and tariff reduction, advocating for state policies that are favorable to solar deployment to spread out project site locations, relying on authentic data related to solar radiation, properly vetting technical aspects of proposals and regular monitoring and reporting of solar power plants during the tenure of PPAs.

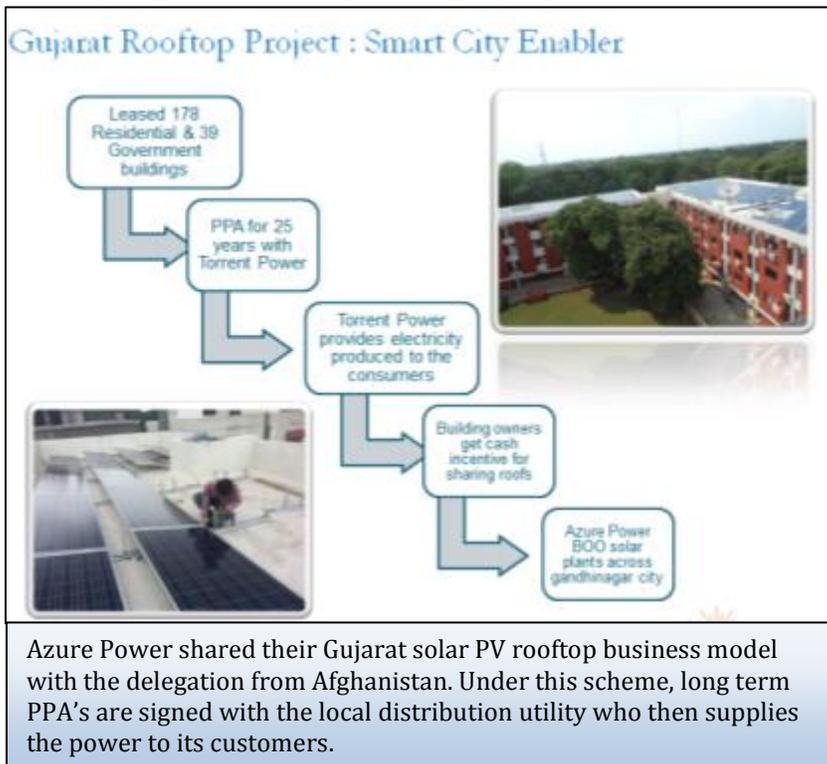


DABS & MEW delegates met with the Solar Energy Corporation of India (SECI) and NTPC Vidyut Vyapur Nigam Ltd (NVVN) to learn about their experiences in facilitating reverse auctions for solar power, and the key challenges and opportunities encountered along the way.

Following the meeting with NVVN, the delegation met with the Solar Energy Corporation of India (SECI), an organization under MNRE with the mandate of developing, deploying and promoting solar power across India. SECI also implements the solar reverse auction under Phase-2 of the National Solar Mission, by signing PPA's with credible developers and back-to-back Power Supply Agreements (PSA's) with interested distribution companies. The delegation from Afghanistan was interested in reviewing SECI's technical requirements for projects, which included, among others, only using commercially established technology, solar cells and modules sourced only from India for up to 375 MW of commissioned projects, a minimum project capacity of 10 MW and max of 50 MW, no more than 5 separate project bids by developers (cumulative capacity of 100 MW), an interconnection with the

nearest grid substation at the 33kV level or above, and bidders submitting a letter to the state and central transmission utility confirming technical feasibility. As of November 2014, SECI had signed a total of 41 PPA's with developers under the solar auction, with a net capacity of 610 MW. Under its mission of deploying solar power across India, SECI also facilitates the implementation of several other schemes. Among these are the solar parks and ultra-mega solar power projects (UMSPP) of capacity greater than 500 MW, CSP pilot projects of up to 100 MW and rooftop solar PV schemes.

SOLAR DEPLOYMENT: THE PRIVATE DEVELOPER'S PERSPECTIVE



Following meetings with NVVN and SECI, the delegates from DABS and MEW had the opportunity to meet with Azure Power to discuss challenges and opportunities for private sector clean energy deployment. Azure Power, who commissioned India's first private megawatt scale utility solar PV plant in 2009, has the longest operating history of private sector solar power plants in India. The company explained that the levelized cost of solar power over the course of a 25 year PPA is what makes it more attractive than other forms of generation. At a certain point during the life of a PPA, the investments have been earned back, creating a highly profitable generation asset. Outlining their rooftop solar PV business, Azure Power explained that building owners are paid for leasing their roof space, and since the modules are situated close to the load, losses are low. Added benefits of this scheme include needing few additional upgrades to the distribution system since the modules are situated close to the load, and generation that

peaks at the same time as demand peaks during hot months. Azure Power went on to high the enabling policy conditions that have helped solar technology in India, such as the mandated state RPO's and the National Solar Mission. Several challenges remain, however, such as an unpredictable solar policy outlook, acquiring the necessary land for projects, and ensuring transmission capacity exists in the project areas.

DEVELOPING, APPRAISING & FINANCING CLEAN ENERGY PROJECTS

Acquiring adequate financing remains one of the greatest challenges in deploying clean energy technology in most countries. To assist in confronting this challenge, the MNRE created the Indian Renewable Energy Development Agency (IREDA), which extends financing to renewable energy and energy efficiency projects, along with loans for equipment and manufacturing. In these schemes, IREDA provides lines of credit to non-banking financial companies, short term loan assistance to clean energy developers, suppliers and contractors, bridge loans against capital subsidies, and underwrites debt. DABS and MEW delegates were specifically interested in how IREDA goes about the project appraisal phase, which begins entity appraisal (net-worth, annual reports, past performance, credit rating from external agency), to the technical appraisal (requisite approvals, applicable central/state policies, resource assessment, power evacuation facilities, plant load factor, implementation schedule), to the financial appraisal (project cost estimates, means of finance, sources of promoter funds, power sale tariff and mechanism, projected cash flows, payback period, cost of generation and sensitivity analysis), to the evaluation of project risks (completion, price, fuel/resource, off-take, regulatory/policy, technology, fund, operational). IREDA also shared best practices of project monitoring, including compulsory site inspections during the pre-commissioning phase, and monitoring of generation data and continued site inspections during the post-commissioning phase.

CLEAN ENERGY INTEGRATION: TRANSMISSION CONSIDERATIONS

To better understand the grid impacts of large-scale renewable energy integration, the delegation from Afghanistan met with India's central transmission utility, PowerGrid, who maintains the interstate transmission system. With about 33 GW of solar and wind capacity expected to be added in the next 5 years, India undertook the "Green Energy Corridors" report, which plans for transmission strengthening, dynamic reactive compensation, energy storage, smart grid applications and a renewable energy management center with real time generation monitoring. Given the report's findings, PowerGrid is currently planning high capacity transmission corridors to reliably evacuate power from where renewable resources are situated to distant load centers, without creating potential transmission bottlenecks. While multiple grid-scale renewable generation assets will not appear in Afghanistan for several years, the delegation was keen to understand the major challenges for grid planning and operation when integrating renewables. PowerGrid outlined many of these for the delegation, including new patterns of flow of power, generation variability, large distances between generation plants and load centers and limited ancillary services like ramp up/down capabilities. In order to mitigate these issues, PowerGrid explained several measures that assist in integrating renewables, such as strong grid interconnections to enlarge balancing areas, demand side management and demand response for load balancing, and grid-scale energy storage for supply side balancing.

SITE VISITS: GRID-SCALE SOLAR PV PLANTS

Delegates had the opportunity to visit two solar PV plants – a 5 MW plant owned by NTPC located in Dadri, and a 1 MW plant owned by TATA Power DDL. Taking up 27.4 acres, NTPC explained that the Dadri plant generates an annual average of 5.38 kWh/meter squared/day with a plant load factor of 16.6% and an approved tariff of Rs. 15.39/kWh. Commissioned in 2013, the plant uses polycrystalline in its 20,856 modules. Furthermore, Dadri has ten (10) 500 kW inverters along with two (2) 33 kV transformers and one (1) 220 kV transformer.



(Left) DABS Chief Operations Officer, Mr. Mirwais Alami, learns about PV conversion and module layout. (Right) MEW Renewable Energy Director, Mr. Aman Ghalib, discusses the plant's inverter technology.

EXPOSURE TO BEST PRACTICES

Over the course of the executive exchange, the Indian energy entities presented numerous best practices in clean energy integration, including:

Solar Reverse Auctions & PPA's:

- Identify project capacities and announce total capacity to be allotted to solar projects
- Prepare clear and transparent Request for Quotations/Proposals (RFQ's/RFP's) and minimum eligibility requirements
- Stagger capacity additions in auctions to help reduce tariffs and speed up financial closure
- Design long-term PPA's from the outset – generally 25 years for grid-scale solar PV plants

- Ensure right of way issues are examined and planned for prior to signing PPA's
- Require that projects are signed with a creditworthy off-taker
- Implement a one or two part tariff
- Specify the billing systems or billing cycles to be used in the PPA
- Outline penalties for delays in payment in the PPA
- Include a clear exit clause in the PPA
- Use a "bundling scheme" in initial auction(s) in order to overcome high cost of renewable power for the purchasing electricity utility/supplier
- Require that projects are only using commercially proven technology
- Require that a certain percentage of project equipment is manufactured domestically
- Set a minimum and maximum megawatt capacity that developers can submit bids for
- Set a maximum number of projects a single developer may bid on
- Require developers interconnect at the nearest grid substation at a specific voltage level (33 kV in India)
- Require developers to acquire or prove the ability to acquire specific land for project sites prior to PPA signing

Clean Energy Project Financing, Appraisal & Development

- Project promoters contributions come through fresh equity, internal accruals or debentures
- Long term debt from a single bank or consortium financing should have a repayment period of 10-15 years, a floating interest rate (or fixed with a periodic reset), flexible and structured repayment and a moratorium period
- Assess investor background, net worth, annual reports, past experiences, key personnel and credit rating
- Evaluate the approvals, clearances, resources, technology, equipment, power evacuation facilities, plant load factor, and implementation schedule during the technical appraisal
- Assess the project cost estimate, means of finance, sources of funds, power sale tariff, projected cash flows, payback period, cost of generation and sensitivity analysis during the financial appraisal
- Include compulsory site inspections during the pre and post-commissioning stages in project monitoring

Technical Considerations for Clean Energy Integration

- Incorporate transmission planning into renewable generation planning to ensure adequate transmission capacity and limit bottlenecks
- Utilize reliable data when examining renewable generation potential
- Understand and maintain clean energy forecasting prior to developing of renewable energy projects
- In an advanced grid, flexibility should be the goal – incorporating balancing mechanisms like storage, demand side management and demand response technologies
- Rolling out rooftop solar PV systems can cut down on losses over the distribution system as the generation generally sits close to the load
- Seek strong grid interconnections in order to enlarge balancing areas

RESULTS

- **Implementing Solar Auctions:** DABS plans to begin with competitive, transparent bidding through the reverse auction mechanism for between 5-10 MW of solar PV capacity in Kandahar
- **Standardizing PPA's:** DABS intends to set long-term PPA's for solar power, with specific requirements like project delay penalties, interconnection feasibilities and land availability
- **Enabling Policy:** MEW will look at new policy structures for making clean energy development more attractive as Afghanistan prepares to create a market conducive to renewable deployment
- **Transmission Planning:** DABS will continue to work with experts as they plan the high voltage transmission system, taking into account long distances between clean energy resources and load centers
- **Project Appraisal:** DABS plans to properly assess the developer, investors and technical aspects of their future grid-scale renewable IPP's
- **Site Inspection:** DABS will incorporate pre and post-commissioning site inspections to ensure renewable projects are being built and operating to a high standard

EXECUTIVE EXCHANGE PROGRAM PARTICIPANTS

DABS

1. Mr. Ahmad Sahil, Chief Financial Officer
2. Mr. Mirwais Alami, Chief Commercial Officer
3. Mr. Nangialai Miakhail, Head of Planning & Engineering
4. Mr. Muhammad Anwari, Contracts Manager
5. Mr. Mohammad Rafi, Manager of Reporting & Banks Reconciliation

MEW

6. Mr. Aman Ghalib, Renewable Energy Acting Director
7. Mr. Mohammad Arif, Senior Energy Advisor
8. Mr. Rameen Kakar, Head of Finance Department
9. Mr. Masood Amanzai, Assistant to the Energy Programming Department
10. Mr. Mohammad Raza, Assistant to the Supervision & Implementation of Electricity Department

USAID/Afghanistan

Mr. Kevin Pieters, Deputy Division Chief – Energy & Water (OEGI)

Mr. Abdul Rasool Ward, Senior Engineer – Power & Energy (OEGI)



For additional information, please contact Mr. Chris Marshall at cmarshall@usea.org or +1-202-312-1257