AYBAK CITY (SAMANGAN PROVINCE) DISTRIBUTION SYSTEM

CLOSE-OUT REPORT

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1.0 Project Strategic Impact

The Aybak (Samangan) Distribution Project is one component of the implementation of the strategy directing the development of the North East Power System) ("NEPS"). (Formerly called the North East Transmission System (NETS).

The NEPS incorporates Donor actions encompassing activity of USAID, the World Bank ("WB"), the Asian Development Bank ("ADB"), Kreditanstalt fur Wiederaufban (KfW), the Government of India ("GoI") and potentially other Donors. The direct purpose of the NEPS is to build the transmission capability of Afghanistan to take competitive advantage of lower cost imported power from the Central Asian Republics ("CAR's") of Tajikistan, Uzbekistan and Turkmenistan, located on Afghanistan's northern border. Within the NEPS activity dual circuit 220 kV transmission lines will be built from each of the CAR countries indicated over the period from 2005 to 2008. The NEPS development has the potential to expand available electric capacity to Afghanistan from its current level of approximately 250 MW to a total available operating capacity of over 1000 MW within 4 years. NEPS represents a relatively quick solution to the electric generating capacity shortage which is inhibiting Afghanistan's economic development.

The indirect and broader purpose of the NEPS is to also exhibit to the world community that a commercially self-sustaining transmission entity which integrates commercially viable generation and distribution components along a socio-politically stable energy corridor can be developed in Afghanistan.

There are multiple actions, both on-going and dormant, but required, as well as outstanding issues that must still be resolved to make the NEPS a successful development. These actions and issues range from purely technical considerations, to commercial, financial, legal and socio-political concerns. The Ministry of Energy and Water ("MEW"), in cooperation with the Donors, continues to address, discuss and focus their actions in coordination meetings to resolve required actions and outstanding issues of concern. The purpose of noting these issues and the broader strategy directing the development of the NEPS is to put in context why the Aybak Distribution Project was initiated.

The basic strategy driving the Aybak (also called Samangan City) Distribution Rehabilitation Project was three-fold: first, engender local support for the transmission line being built under NEPS by providing local benefit in those provinces through which the transmission line is being built; second, prepare the local systems to expand their distribution networks by upgrading the systems to a standardized 20 kV/400 volt system, and third, provide a starting self-sustaining "seed system" which would then be expanded by local resources over time. Concomitant with the third component was to develop the initial framework for a self-sustaining Rural Electric Association ("REA") which would oversee further system development at the local level.

The expectation, when Aybak was selected as the first USAID distribution rehabilitation project, was that the NEPS development would include provision of a substation off the 220 kV transmission line to service lower cost power to Samangan Province. This is one of the issues that remain outstanding at the time of this report.

Without local support of the right of way (ROW) and building of the transmission line within NEPS the critical need for the development of a safe energy corridor may be lost. The fundamental strategic impact of the Aybak Project is directed to engender this local support.

2.0 Project Description and Objectives

2.1 Project Description

The City of Aybak is the Provincial Capitol of Samangan Province. Samangan Province has a population of 378,000 people (Central Statistics Office) and encompasses an area of 11,262 square kilometers. As indicated on the map below, Samangan Province is located in the north-east central area of Afghanistan.

The Project is best described by incorporation of the background information which directed and impacted its development. This includes the following:

- Aybak City is one of eighteen Provincial Cities/Towns designated by Donors as requiring rehabilitation of their distribution systems (Please reference **Attachment 1: Donor Distribution System Rehabilitation/Development List**).

- Aybak is one of eight cities which received a diesel generator from the World Bank. However the existing 6 kV distribution system was dilapidated and unreliable due to years of neglect and insufficient funds for repair as a result of conflict within Afghanistan. The value added by the generation provided could not be accessed fully. The existing generation unit is one caterpillar generator and a very aged Russian generator. The caterpillar generator has a capacity of 1100 KVA, 400V, 50 Hz. The Russian generator has a capacity of 120KVA, 400V, 50 Hz.

- The USAID Aybak Project was directed to rehabilitate and upgrade the 6 kV system to a nationally “informally” adopted standard of medium voltage service at 20 kV and low voltage at 400/230 volts. (**Please reference Attachment 2: Distribution System Specifications**)

- The Distribution System Specifications are taken from DECON specifications as applied to Kabul. The lack of an official national standard led to the adoption of the DECON specification as an informal standard.

- The scope of the work was the installation of a 20 kV overhead distribution system within an area of 2 kilometers by 3 kilometers inside the city of Aybak

- The Aybak Distribution rehabilitation project was tendered on behalf of AEAI by Fluor, AEAI's approved sub-contractor. ZMD from Turkey was selected as the construction entity under Fluor management reporting to AEAI. AEAI was responsible for system design and for materials acceptance. Fluor was responsible for construction management and Quality Control/Quality Assurance.

- The system rehabilitation was to replace 3000 customer connections within Aybak. This rate of replacement was based upon indications from DABM Aybak that there were 2400 customer connections.

- The Project as initiated was to rehabilitate the electric services of all customers and add an additional 600 connections to the system. The 3000 connections as a target number was based upon available data indicating each customer connection required a maximum of 300 watts.

- All system components were to be replaced and upgraded. This included new transformers, switchgear and Medium and Low voltage circuits. Replacement would include new fuse box services into the individual customer locations. (**NOTE**: DABM does not provide the service laterals beyond the meter box into customer premises and considers such provision, including the meter, to be the responsibility of the customer.)

- Aybak's exiting power distribution system is operated by DABM under the direction of DABM's Aybak manager, Mr. Shakoor. Almost 2400 consumers were connected to the two generators via the aged and dilapidated 6 kV system. The existing distribution line that served customers is not commercially viable. The system could not produce revenue requirements to properly tool DABM to (1) maintain the system nor (2) could the system be expanded.

- The proposed new "seed" distribution system with 3000 consumer connections consists of 4MV primary circuit distribution lines, open secondary and direct burial secondary lines. Four consumers will share a meter box that will consist of four digital meters which will be connected to each customer service fuse box.

- A new 5MVA, 400V/20KV transformer and 4MV circuit's switchgear will be installed at the heart of Aybak city. The existing 6KV distribution voltage will be retired and new 20KV is the replacement. There are 14 new distribution transformers (50KVA & 100KVA) to be installed with a rating of 20KV/0.4KV.

- The overhead distribution lines will consist of concrete poles, steel cross arms and ACSR wire. Open secondary wire shall be bundled insulated conductors. The underground cable was specified to be suitable for direct burial.

2.2 Project Objectives

The strategic objectives of undertaking the Aybak Distribution Project are as noted above. In implementing the project the specific project objectives were as follows:

- Replace the dilapidated 6 kV system and prepare Aybak to the extent feasible for utilizing the additional capacity which would come available with NEPS.

- The present 6kV distribution system is very old and the wires are undersized causing excessive voltage drop. Many of the power poles are rotted and in places DABM had jury-rigged the use of short wood poles and spliced them to another wood pole just to raise the lines above ground with insufficient clearances. Undersized and untreated wood pole are commonly used.

- The existing system losses were high and the system could not self-sustain to the extent of allowing capital accumulation to upgrade and expand. The objective was to replace the system and provide the requirements to allow the system to self-sustain and grow. Inclusive in this was the objective of providing training in basic technical and commercial management of the system under a Rural Electric Association.

2.3.0 Progress to Date: The Aybak distribution project was released following USAID approval and Consent to proceed on September 1, 2005. The scheduled date of completion was December 14, 2005. Following release the following actions were accomplished.

- ZMD mobilized to Aybak relatively slowly. Complete mobilization did not occur until late October, 2005. Upon mobilization ZMD:

  - Prepared town mapping and determined consumer loads.
  - Designed 20KV primary distribution lines, location of distribution transformer 20KV/240V, overhead secondary lines and underground cables installations.
  - Designed the 5MVA substation outdoor type installation and 20KV Switchgear complete with one main breaker and four branches of circuit breakers.
  - Designed sizes of primary and secondary wires.
  - Designed sizes of substation and distribution transformer and protection devices.
  - Performed a voltage drop calculation and sectionalizing study of the whole system.

- All designs were reviewed and approved by AEAI personnel assigned to Aybak. Following design and materials approval per the specifications ZMD initiated construction. During the period from mid-October onward material delivery delays and fundamentally poor planning and delay in design by ZMD led to project scheduled completion delays. Initially the announced delay was until January 2006 which continued to slip until final completion of the original contract on April 21, 2006. (Please reference **Attachment 3: Handover Documentation of the Aybak Distribution System**). ZMD accomplished the following over the extended period:

  - Prepared staking sheets to record height of poles, type of pole assembly, primary and secondary assemblies, wire sizes to be installed, distance from pole to pole, guy wire and anchor assemblies and proposed transformer pole location.
  - Prepared pole hole digging, pole erection, installation of primary & secondary assemblies, guy wire & anchor log assemblies' installations, stringing of wires, application of armor rod and tie wire.
  - There were a total of fourteen (14) pole platform mounted distribution transformers rated at 50 KVA and 100 KVA. Each distribution transformer included a distribution panel with a power meter to record total power output at the low voltage side of the transformer.
  - Prepare trench excavation & backfilling, lay of cables, meter and fuse box installation. Each meter box contained as many as four (4) meters with service then fed to molded case circuit breaker boxes ("fuse boxes") located in each customers premise.
  - Testing and commissioning acceptance of the 20 kV distribution system rehabilitation carried out by ZMD/Fluor.
  - The turn over of an agreed list of system spare parts from ZMD/Fluor to AEAI to DABM.

- ZMD provided a week long hands-on basic operations and maintenance training program for linemen and for the operation of switchgear.
- DABM Aybak was provided a basic set of system maintenance tools by ZMD. AEAI has provided additional tools to complete requirements for system maintenance including a bucket truck.

- A copy of the Aybak City Electrical Map is provided below (please reference Attachment 4: Aybak City Electrical Map for more clarity)

- The city of Aybak is cut in two by the Aybak River indicated in green. The new 20 KV system is placed in the western side (bottom half of the map) of the city. The eastern side of the city (upper half of the map) will remain with the 6 kV system to be upgraded and expanded by DABM using portions of the 6 kV system removed from the western side of the city when the 20 kV system is again energized for operations.

- During system installation it was found that shop areas on the western side of the city were master metered. For example, one building with a nominal thirty-five shops had only one meter. The decision was taken to meter all shops individually both to promote knowledge of and more efficient use of electric energy and to insure better revenue collection.

- The contract of ZMD called for 3000 connections. As individual meters were installed it was determined that and additional 330 connections would be required. The price proposal provided by ZMD/Fluor was determined to be too costly based on available alternatives determined from bids for system development in Qalat and Tirin Kot.

- Part of the lump-sum fixed price contract of Fluor/ZMD was the removal of the 6 kV system being rehabilitated. During the construction process ZMD wished to remove the 6 kV system. This would have resulted in cutting service to much of Aybak which was politically and socially unacceptable. ZMD/Fluor was directed to work around the 6kV system and leave it operational.

- The requirement to add 330 connections and continue to maintain service to the remaining 6 kV system necessitated the following:

    - Development of the engineering and design to incorporate the additional 330 connections. In this process an additional 220 connections were identified which DABM will undertake to incorporate into the system
    - Contracting with Afghan Electric Power Corporation (AEPC) following Consent from USAID to provide the additional 330 connections. (These connections included government facilities and Mosques by-passed by ZMD on the basis that the service required exceeded the specifications.)
    - Contracting, following USAID Consent to proceed, for the procurement of two (2) 500 KVA generators to supply the eastern part of the city's 6 kV system which will remain operational following completion of the 20 kV system. (NOTE: An additional 300 kwh in available electric energy enables USD $ 1000 in Gross Domestic Product addition)
    - Procurement of two (2) 40,000 liter fuel tanks for the generators and required transformers for the interconnection of the generators to the system. DABM provided the circuit breakers required to complete the interconnection and one (1) fuel tank at the DABM switchgear station yard.
    - Contracting with AEPC to remove the 6 kV system in that portion of Aybak where the 20 kV system will serve once the extension of the system is completed and energized and the remaining portion of the 6 kV system is prepared for energization.
    - The materials required for the additional customer expansion were by agreement with USAID taken from materials ordered for Qalat and Tirin Kot. (Please reference **Attachment 4: List of Materials for the Additional 330 Connections**,)
    - The target date of system completion and turnover to DABM is June 15, 2006.

- The commercial and managerial development directed to achieving self-sustainability of the Aybak system has and is occurring at the same time as the technical development. The actions taken include:

    - The development of a Rural Electric Association (REA) was initiated. An interim Board of Commissioners was appointed following discussions with civic leaders and the Governor of the province. (The Board will be elected by electric consumers in the future).
    - A one week training session on REA concepts and management was provided to the Board in Kabul. (Please reference the **REA Close out Report** available at the Afghanistan Energy Information Center for details)

- A one week training session on basic accounting and management was provided to REA and DABM Aybak management in Kabul.
- An AEAI computer trainer from Mazar-e-Sharif was moved to Aybak with all equipment to provide a month long training session on basic computer use including MS Office tools to DABM Aybak administrative staff.
- An AEAI Billing and Collections expert will provide a simple computer based accounting and billing and collections system and training in its use to DABM Aybak administrative staff,
- DABM Aybak was provided additional low cost office space needed for its administrative staff.

3.0 Issues to Consider in Distribution System Rehabilitation/Development

- Various events lead to public relations problems that required rapid adjustment of activity in Aybak. These events provide some guidance on what needs to be actioned and avoided in distribution system development projects.

    - Expectations need to be managed from the very start of a project. This cannot be done through the local Governor alone. The formation of the local Board of Commissioners at the start of the project and detailed briefings to them proved beneficial in controlling perceptions and rapidly hearing of and quelling local concerns.
    - Construction contractors and their field staff need to be well versed (1) in local custom and (2) the place a particular project has in overall development of the electric system in order to better inform the public as they are working. A day spent on local and project orientation should be built into all mobilization actions.
    - For contractual reasons the system materials supply and construction was separated from system design and materials approval which was again separated from construction contract management and QA/QC. This proved extremely cumbersome in management and added cost and should be avoided.
    - ZMD had the experience to construct the system but the experience was not in Afghanistan. They underestimated materials delivery and logistical issues which ultimately caused delay. They did not provide the appropriate tooling due to the belief that the tooling could be found in Afghanistan, which it cannot. For example, line swivels and Kellum grips for properly pulling, laying and sagging lines.
    - ZMD was not aware of local customs and cultural requirements. This lead to incidents of protest to local authorities that had to be managed but which could have been avoided.

- As initially conceived and directed by USAID the intent of the Distribution System Development Project was to provide “seed” systems by new system development or old system rehabilitation and provide institutional development assistance in the form of REA’s that would then be capable of growing the seed.

    - The Aybak “seed” was based on 300 watts per customer with an indication form DABM that there were 2600 customers. Ultimately it was found that there are closer to 3500 customers with an expected load of approximately 1000 watts per customer. This required adjustment in new connections and additional generation.
    - A more detailed customer survey should be taken prior to system design. DABM does not know its full customer base and customer end usage.
    - In order for REA development to be successful a minimum of one year of assistance in development needs to be provided.
    - Afghanistan is, as is known, a community based culture. It is an error to provide only part of a city or town with a rehabilitated distribution system.

This action divides the community and leads to issues of social inequity. In addressing other cities and towns it is recommended that USAID should either build/rehabilitate the entire city/town area or avoid going into the area.

ATTACHMENT 1

DONOR DISTRIBUTION SYSTEM REHABILITATION DEVELOPMENT LIST

ATTACHMENT 2

DISTRIBUTION SYSTEM SPECIFICATIONS

ATTACHMENT 3

HANDOVER DOCUMENTATION OF THE AYBAK DISTRIBUTION SYSTEM

(TABLE OF CONTENTS OF THE HANDOVER DOCUMENTATION. THE COMPLETE DOCUMENTATION IS INCLUDED HEREIN BY REFERENCE AND IS ATTACHED TO THE ELECTRONIC COPY OF THIS CLOSE OUT REPORT IN WHOLE. A HARD COPY OF THE TWO (2) VOLUMES OF THE HANDOVER DOCUMENTATION IS AVAILABLE IN THE AFGHANISTAN ENERGY INFORMATION CENTER (AEIC))

ATTACHMENT 4

AYBAK CITY ELECTRICAL MAP

ATTACHMENT 5

LIST OF MATERIALS FOR THE ADDITIONAL 330 CONNECTIONS IN AYBAK