



Office of Inspector General

June 19, 2014

MEMORANDUM

TO: USAID/Afghanistan Mission Director, William Hammink

FROM: OIG/Afghanistan Acting Country Office Director, Randall Ase /s/

SUBJECT: Review of Sustainability of Operations at Afghanistan's Tarakhil Power Plant
(Report No. F-306-14-002-S)

This memorandum transmits our final report on the subject review. In finalizing the report, we considered your comments on the draft review and have included them in Appendix II.

The report contains five recommendations to promote the sustainability of the Tarakhil Power Plant. We acknowledge your management decisions on all of the recommendations. Please provide the Audit Performance and Compliance Division with the necessary documentation, when available, to achieve final action on these recommendations.

Thank you and your staff for the cooperation and courtesies extended to us during this review.

SUMMARY

Increasing access to electrical power has been a top economic priority and key part of Afghanistan's National Development Strategy.¹ In 2006, less than 10 percent of Afghanistan's national population—and one-third of Kabul's population—had access to electricity, according to national utility data. At the time, the country was relying on three old hydropower plants for its energy needs. To increase the power supply, particularly in the Kabul area, in 2007 USAID contracted with the Louis Berger Group/Black & Veatch Joint Venture (LBG/B&V) to build the Tarakhil Power Plant under USAID's Afghanistan Infrastructure and Rehabilitation Program.

Construction, however, fell behind schedule because of deficiencies with the scope of work, difficulties in getting title to the land, subcontractor performance problems, and other challenges, which led to budget overruns. USAID's final cost to build the plant was approximately \$307 million, substantially (144 percent) more than the \$126 million originally budgeted.

In June 2010, USAID transferred ownership of the power plant to the Afghan Government's Ministry of Energy and Water. The ministry, in turn, charged Da Afghanistan Breshna Sherkat (DABS), the national utility company, with operating and maintaining the plant.

Following this transfer, USAID provided operation and maintenance (O&M) support through a \$27.7 million contract with LBG/B&V that continued through June 30, 2012. This assistance included training and mentoring power plant staff. The aim was to build their capacity so that they could operate and maintain the plant on their own in a reliable and sustainable manner.

At the time of the review, in early 2014, USAID was still providing periodic O&M support to the power plant to assist with specific repairs. In February 2014, for example, USAID procured technical services under an existing contract to resolve operational problems in one of the plant's three sections or power blocks. USAID was also in the early stages of implementing a capacity-building project with DABS, funded under USAID's Power Transmission Expansion and Connectivity Project. Activities under this project were expected to include additional technical assistance and training for staff at a number of DABS-operated facilities, including the Tarakhil plant, as well as support to strengthen DABS's capacity in areas such as asset management.

Located on the outskirts of Kabul and covering an area of slightly less than 1 square mile, Tarakhil is a modern power plant. It consists of eighteen 5.8-megawatt diesel engine generators, housed in three power blocks (A, B, and C) containing six generators each, capable of collectively producing 105 megawatts of electricity. The plant is pictured on the next page.

The Office of Inspector General (OIG) conducted this review to determine whether DABS was operating and maintaining the power plant in a sustainable manner to protect USAID's investment in the facility. We determined that the plant was not being operated and maintained in a sustainable manner and was still dependent on external technical assistance to effect needed repairs, with plant staff requiring further training. The plant was also not used regularly, but as an emergency back-up supply, and therefore was not increasing Kabul's power supply to help reduce its energy deficit, particularly during the winter season, as intended.

¹ Afghanistan National Development Strategy, Energy Sector Strategy, February 2008.



The Tarakhil Power Plant, located on the outskirts of Kabul, has 18 diesel generators capable of generating 105 megawatts of electricity. (Photo from mission archives, September 2010)

The review disclosed the following:

- DABS was not using the power plant as intended (page 4). It has been severely underused since its handover, generating only 2.2 percent of the power it was designed to produce.
- Operation and maintenance training did not adequately prepare staff to run the plant (page 7). Staff needed further assistance to fix the plant's malfunctioning computerized control systems. They were also not fully capable of maintaining plant equipment.
- Plant did not track inventory (page 12). Staff did not maintain records of the power plant's large volume of spare parts, consumable supplies, materials, and non-expendable assets.
- DABS did not give the power plant adequate management support (page 14). DABS did not ensure that the Tarakhil plant had ample supplies of spare parts available. The utility company also had not developed a proper operating budget for the plant.

The report recommends that USAID/Afghanistan:

1. Perform and document an analysis to identify a more economical and affordable fuel supply that would allow the Tarakhil Power Plant to increase its operations and generate power on a regular, sustainable basis (page 6).
2. Implement a strategy to strengthen the capacity of Tarakhil Power Plant staff to maintain key control systems. At a minimum, this strategy should include training to help technical staff diagnose and troubleshoot control system malfunctions on their own and steps to be taken, by both USAID and Da Afghanistan Breshna Sherkat, to make a software/systems engineer

available to the power plant to assist with control system malfunctions and follow up on ongoing system-related issues (page 10).

3. Implement a training strategy, which includes milestone dates, for equipping staff at the Tarakhil Power Plant with the skills to operate and maintain the plant sustainably (page 12).
4. Implement a strategy, which includes milestone dates, to (1) repair or replace the Tarakhil Power Plant's maintenance management system, (2) provide plant staff with further training and supervision in the use of this system to enable them to manage Tarakhil's inventory control functions on their own, and (3) facilitate a comprehensive inventory of the plant's spare parts, supplies, and nonexpendable assets (page 14).
5. Ask DABS management to provide a plan, including milestone dates, outlining the steps it will take to strengthen the management support it provides to the Tarakhil Power Plant. At a minimum, this plan should include (1) identification and procurement of needed critical spare parts for the plant's inventory, (2) development of a detailed annual operating budget for the plant, (3) operation of all plant generators for a minimum of 4 hours per month, and (4) review of the staffing patterns at Tarakhil to assess, with input from the plant manager, whether existing staff possess the skills required for their positions and whether additional staff are required in certain areas (page 15).

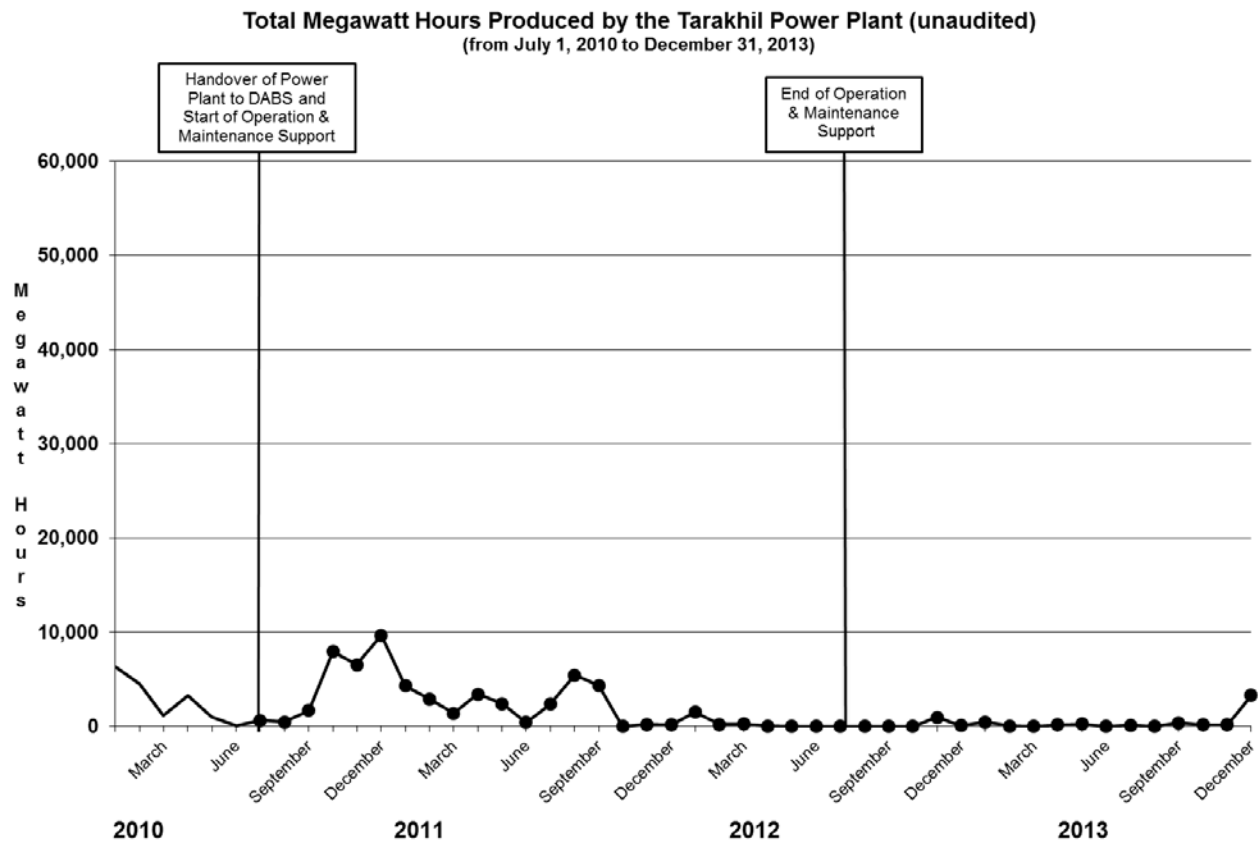
Detailed results appear in the following section. The scope and methodology are described in Appendix I. Management comments on the draft report are included in Appendix II, and our evaluation of these comments is included on page 16.

REVIEW RESULTS

Utility Company Was Not Using the Power Plant as Intended

The power plant was intended, according to mission records, to fill a gap in the available supply of power on Afghanistan’s national power grid “to alleviate the acute electrical power shortage currently being experienced in Kabul.” With this objective in mind, the plant’s engines and support systems were designed and built for base-load operations, meaning the engines would be operating and generating power continuously (i.e., 24 hours per day, 7 days per week) to supplement Kabul’s limited power supply.

Since its handover in June 2010, however, the power plant has been severely underused and operating at a level far below what it was designed for. Had the power plant been operating as designed, at the recommended 90 percent capacity, the plant could have produced more than 2.9 million megawatt-hours of electricity from July 2010 to December 31, 2013. Instead, the plant’s output during this period totaled only about 63,000 megawatt-hours, a small fraction (2.2 percent) of Tarakhil’s potential production capacity. The figure below shows the power plant’s limited activity.



Note: Base-load production at Tarakhil is 68,985 MWh in a month.

Source: Auditor generated based on power production data furnished by contractor and power plant staff.

DABS limited operations because it couldn't afford to operate the power plant at full capacity. Although in 2007 the government committed to paying for the plant's fuel and operating costs starting a year after completion, it later acknowledged it could not afford the fuel and would need assistance with the other operating costs.

The cost of diesel was a big factor. The power plant's generators operate on diesel fuel, which is very expensive in Afghanistan. Operating at full capacity, 24 hours a day, the power plant would consume more than 600,000 liters of diesel fuel daily, which would cost the plant an estimated \$281 million per year to operate, \$245 million for the fuel alone. DABS could not afford this cost. With the power plant currently generating electricity at an average unit cost of \$0.33 per kilowatt-hour and DABS billing its residential and commercial customers at an average rate of \$0.09 per kilowatt-hour, DABS would have incurred a loss of about \$0.24 for each kilowatt-hour it generated at the power plant. For the plant to operate at a profit, DABS would have had to quadruple its rates, a move considered unlikely given political sensitivities.

Another factor contributing to the underuse was imported power. Starting in December 2009, 6 months before the plant's handover, Kabul began receiving imported electricity thanks to the completion of a multi donor project led by the Asian Development Bank. It involved the installation of a transmission line to bring in power from neighboring Uzbekistan and Tajikistan. This line initially gave the city an additional 100 to 110 megawatts of electricity,² helping meet Kabul's energy requirements. While there was still a strong need for Tarakhil's power, to further reduce the energy gap, the imported power became the preferred source of energy since it was much cheaper than that generated by Tarakhil—about \$0.06 versus \$0.33 per kilowatt-hour, respectively.

The circumstances leading to the plant's underuse, however, were rooted in the original decision to construct a power plant in Kabul although it lacked a sustainable fuel supply. According to mission staff, in late 2006 a former U.S. Ambassador pressed USAID to construct a power plant in Kabul to generate 100 megawatts of additional electricity. One mission engineer who was present at the time said media reports of families in Kabul freezing to death prompted the request, which was made out of genuine concern and desire to help the Afghans.

Although USAID claimed to be against building the plant from the very beginning and expressed concerns about the project, the embassy reportedly "instructed" the mission to push forward with the plant's construction. During the design phase, a further concern arose about sustainability: what kind of engines to install given the absence of an affordable fuel supply to operate them. Political pressure, coupled with the urgency to build the plant by the winter of 2008-2009, prevented the mission from performing an in-depth study of the fuel issue and exploring other options.

Because it's expensive to run, the power plant has been operating merely as an emergency power source, standing ready to generate electricity for the grid in critical situations, such as interruptions in the availability of imported power to Kabul due to damaged transmission lines. In this standby mode, the plant's generators sit idle most of the time. As a result, despite USAID's investment of almost \$335 million in its construction and maintenance, the plant is not regularly contributing additional electricity to increase the power supply in the Kabul area as envisioned.

² In September 2011, the imported power received increased to between 240 and 280 megawatts.

This limited activity is also damaging some of the power plant's equipment. Operating on an intermittent—rather than a continuous—basis has resulted in more frequent starts and stops, which place greater wear and tear on the engines and electrical components. An evaluation performed on the power plant's operations in April 2011 reported that a plant the size of Tarakhil should have fewer than 200 starts per year, yet the evaluation team cited one engine at the plant with more than 8,000 starts since its installation a year earlier. This practice, according to the evaluation, has resulted in the premature failure of equipment, which over time will increase O&M costs and could result in "catastrophic failure."

With the city currently facing a growing energy deficit and continuing power outages, Kabul needs additional power. An analysis of the electricity supplied to Kabul from October to December 2013 revealed that the amount of power made available to the city on average was meeting less than 48 percent of its energy needs, contributing to the power outages³ experienced by consumers during these winter (peak demand) months. According to a senior DABS official, the outages in the Kabul area during the winter of 2013-2014 increased by at least 25 percent over the preceding winter.

At the time of the review, DABS and USAID were exploring opportunities for the power plant to serve Kabul's commercial sector. A senior DABS official said the utility had initiated discussions with local private investors in Kabul seeking a reliable and uninterrupted source of power and willing to pay a price that would make it profitable. In DABS officials' initial discussions with prospective investors, however, only about 20 percent of them expressed interest and a willingness to pay the proposed rates.

Meanwhile, USAID was expanding on this effort and planned to have an economic study conducted of viable local options for the power plant. This activity was expected to include a detailed cost analysis as well as efforts to identify prospective customers willing to pay premium rates for power (e.g., industrial parks).

Another idea, offered by a mission engineer, involved the construction of a gas pipeline that would bring natural gas from the Sheberghan area in northern Afghanistan to be used by the power plant. Tapping into these vast natural gas reserves could offer the power plant a much cheaper and sustainable fuel supply, significantly reducing its operating costs. While such a project would likely involve a major investment as well as security risks, it may merit further consideration in light of the continual, long-term demand for energy in Kabul.

Although it is uncertain whether this problem can be resolved, we support the mission's initiative and agree that further efforts are needed to explore alternatives that would increase the power plant's usage. Therefore, we recommend the following.

Recommendation 1. *We recommend that USAID/Afghanistan perform and document an analysis to identify a more economical and affordable fuel supply that would allow the Tarakhil Power Plant to increase its operations and generate power on a regular, sustainable basis.*

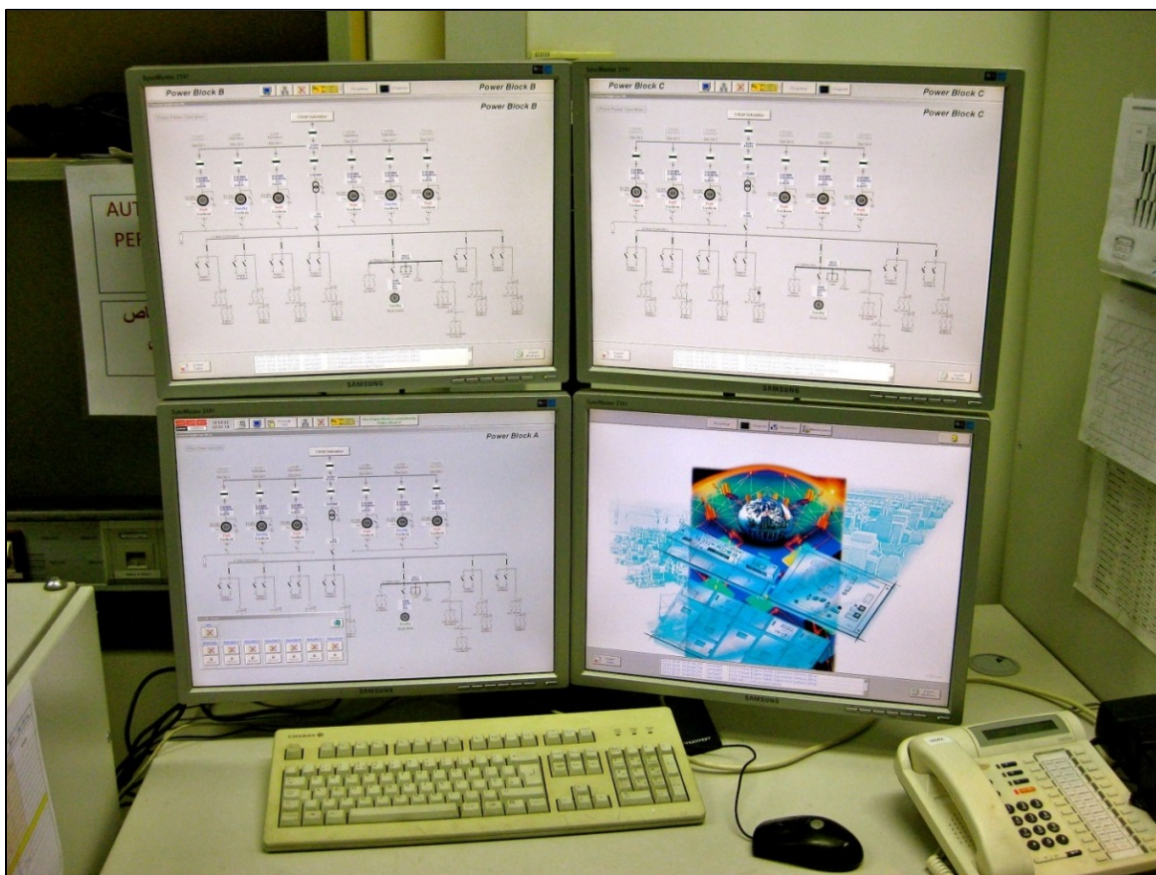
³ Outages occur for a number of reasons, including insufficient power supply, heightened customer demand, or load exceeding the capacity of the transformers, overhead lines, and power cables.

Operation and Maintenance Training Did Not Adequately Prepare Staff to Run the Plant

USAID awarded LBG/B&V a \$27.7 million contract to provide training and mentoring for the power plant staff. The training was to build their capacity so that they could operate and maintain the power plant on their own in a reliable and sustainable manner. However, even after completing the O&M training, staff still were not fully capable of running the power plant on their own and often were in need of external assistance to address problems with the plant's computerized control systems. Staff also were not fully equipped to provide the level of maintenance required to maintain plant equipment.

Troubleshooting Control System Malfunctions

The power plant relies on computerized control systems that help staff operate and monitor the generators, circuit breakers, and other equipment connected with power generation. For example, each of the power plant's 18 generators has its own computer and operating software, which allows plant staff to operate the generators "locally" (i.e., manually) and also sends signals to the Supervisory Control and Data Acquisition (SCADA) or master control system. Using SCADA, operators can monitor and control generator settings—speed, frequency, voltage, and other parameters—from a central control panel (shown below).



The central control panel, in Block B, shows the status of the generators in each of Tarakhil's three power blocks. (Photo by OIG, January 15, 2014)

Operators also rely on another control system to monitor the status of the power plant's circuit breakers, located in the plant's substation (shown below), which connect the power generated at the plant to the grid. Collectively, these control systems work together to automate the myriad processes involved in generating power at the plant and are essential to its operations.



The substation at Tarkhil where circuit breakers and other equipment are used to connect the power generated at the plant to the grid. (Photo by OIG, January 23, 2014)

Unfortunately, since the end of the O&M contract in June 2012, plant staff have had chronic problems with some of its software-based control systems. Following are a few examples.

- Just months after the O&M contract ended, staff reported to USAID that the operating software in five generator units was malfunctioning, temporarily placing them out of service. It was later reported that the software had become corrupted. Although DABS sent information technology staff to the plant to repair the units, they were unable to fix the problem since they did not know how to reinstall the original software. The plant staff eventually managed to load a copy of a working version of the software, taken from one of the operable generators, onto some of the nonworking units. The copy was of low quality, however, so it was not loaded onto all the units.

- In a separate incident, the plant experienced complications with the software that allows generators to communicate with SCADA. The software malfunctioned in November 2012, initially affecting all three power blocks. DABS officials sent two engineers who, after spending over a month at the plant, managed to wipe the program off the system and according to the plant manager, “just made matters worse.” Following this failed attempt, a short-term contractor reinstalled the software, obtained from the manufacturer in Germany. This allowed the power plant to regain operation, but in only two of its power blocks (A and C), with problems continuing in Block B. These problems later triggered a system lockout in June 2013, which prevented staff from being able to run—or even perform routine maintenance on—any of Block B’s six generators. When the review team visited the plant in January 2014, the generators (pictured below) were still out of service.



Generators in Tarakhil’s Block B remain idle because of a control system malfunction. (Photo by OIG, January 23, 2014)

Problems such as these and the inability to fix them quickly stemmed from the sophistication of the power plant, which is the only one of its kind in Afghanistan and uses advanced technology. The evaluation conducted on the plant’s operations in 2011 emphasized that staff needed additional training to operate the equipment and related control systems. It noted that “items such as the SCADA system that controls the power plant are state-of-the-art, anywhere in the world. It takes highly qualified and well-trained personnel to operate and maintain these types of systems.” An engineer in the mission’s infrastructure office commented on the situation and said that a sizeable gap exists between the technology at the power plant and staff members’ skills.

Another factor was the limited training provided on the power plant's control systems. According to the plant manager, the O&M training offered some basic instruction on the operating software but did not cover troubleshooting or how to reinstall software. The training also reportedly did not cover all key control systems. A November 2011 assessment of the O&M training reported that it did not cover the technical aspects of SCADA and some of the other control systems since neither the contractor nor the manufacturer provided the hardware and software required to provide such training. Without training on troubleshooting, plant staff were unprepared to deal with many of the problems that arose. A former member of the O&M team who worked at the plant provided this assessment: "The crew there can start and stop the engines as long as nothing happens; the problem arises when they are faced with a situation that requires problem solving on a unit that won't start."

The problems with the control systems and the power plant workers' inability to repair them in a timely manner have placed plant equipment out of service for extended periods, reducing the power plant's power-generating capacity. The problem involving Block B is a prime example. Because of the malfunction of the block's computerized control system, its generators were inoperable for 7 months, cutting the plant's power-generating capacity by one-third.

In February 2014, USAID sent an engineering team, funded under its Afghanistan Engineering Support Program, to the power plant to address the situation in Block B. After 3 weeks, the team diagnosed the source of the malfunction—a faulty software code—and repaired it. The team, however, reported that other issues remained and required further assistance or spare parts. For example, the team reported that the SCADA software installed at the plant was outdated and would not operate on newer computers. Consequently, when one of the SCADA computers fails and needs to be replaced—which is likely to happen at some point—new SCADA software will be required. New software for the entire plant would cost about \$160,000.

Although the generators in Block B were operable as of March 2014, staff need further training and support so that they will be better equipped to diagnose and handle future problems with the plant's many computerized control systems.

In addition, the power plant will require external technical assistance—in the form of a software or control engineer—from time to time for complex problems. DABS will need to identify a contractor that can send such an expert to the plant quickly to avoid reducing operational capacity for extended periods. USAID can help DABS determine the most appropriate means to acquire such services (e.g., a service contract with the manufacturer for specific control systems). The utility company, meanwhile, should exercise restraint and avoid attempting to fix problems that are beyond its capability; otherwise, it may cause further damage, as DABS engineers did when they attempted to fix the software that malfunctioned in November 2012.

Unless USAID develops a strategy for fixing Tarakhil's control systems, malfunctions like the one involving Block B and the other system glitches Tarakhil has faced will gradually cause the plant to run out of operable generators. Therefore, we make the following recommendation.

Recommendation 2. *We recommend that USAID/Afghanistan implement a strategy to strengthen the capacity of Tarakhil Power Plant staff to maintain key control systems. At a minimum, this strategy should include training to help technical staff diagnose and troubleshoot control system malfunctions on their own and steps to be taken, by both USAID and Da Afghanistan Breshna Sherkat, to make a software/systems engineer available to the power plant to assist with control system malfunctions and follow up on ongoing system-related issues.*

Doing Routine Maintenance

Of Tarakhil's 40 O&M personnel, the plant manager considered only 4 (including him) fully qualified. That is, they had sufficient understanding of the mechanical systems to read the technical manuals, perform troubleshooting, and direct and supervise systems maintenance. The manager felt that at least 12 such staff were needed to operate a plant the size of Tarakhil. He stated further that while his staff could start and shut down the generators, most were not capable of performing troubleshooting when problems arose and often did not know what to do.

In a letter to DABS in August 2012, USAID expressed concerns about staffing at the power plant and asked DABS for assurances that it could acquire, "sufficient technical knowledge and expertise" to maintain the plant. The former member of the O&M contractor's team, who worked at the plant until November 2013, also expressed concerns: "Plant staff does not have the required experience, knowledge level, or corporate support to make a concerted effort of maintaining TPP [the Tarakhil power plant]."

Plant staff lacked the needed skills and needed further training for several reasons. One was the initial training approach used, which was initially ineffective and took time to evolve. The former member of the O&M team said the training offered during construction and the early part of the O&M project consisted of classroom videos and written tests, with too little practical, hands-on application. It also used off-the-shelf materials that lacked relevant content and were not applicable in Afghanistan. While the training improved under the O&M contract, the team member felt there was not enough time remaining under the contract by that point to achieve sustainable success. This shortage of time may explain why the training provided on the plant's control systems focused on basic operation and theory and did not cover troubleshooting.

Further, training was not comprehensive. LBG/B&V, for example, provided no training on certain plant equipment, preventing power plant staff from using it. During a tour of the plant in January 2014, staff pointed out several pieces of equipment, including a large milling machine (shown below) valued at about \$11,000, sitting idle because staff did not know how to use them.



Milling machine (left) and metal lathe (right) provided by USAID sit in a warehouse at the power plant. (Photo by OIG, January 29, 2014)

The departure of a number of trained staff at the end of the O&M contract also contributed to the plant's skill shortage. During the project, the contractor used its local staff for many of the maintenance functions, thinking the locals would continue to work at the power plant after the contract ended, providing continuity and retaining the high level of skill they had developed. Unfortunately, when the O&M contract ended, the local staff elected not to continue working at the plant because the wages DABS offered were much lower than what LBG/B&V paid. Their departure reduced the number of trained, qualified staff on hand at the plant.

With so few fully qualified staff at Tarakhil, maintenance has lapsed. In addition to certain tasks being neglected (e.g., staff were reportedly not testing the quality of the fuel and lubricating oil as prescribed), the shortage has resulted in plant equipment occasionally being damaged. For example, an air compressor for one of the power plant's generators was accidentally damaged when staff did not perform the proper sequence of safety procedures to ensure it was not inadvertently turned on while undergoing maintenance.

The 2011 evaluation of the power plant's operations concluded that "Without a continued dedicated effort in training local personnel, the Tarakhil power plant will quickly fall into a condition where it is unable to run." The evaluation further recommended that O&M training be continued another 3 to 5 years to ensure that staff can keep the plant running.

At the time of the review, the mission was working with DABS to fund further O&M assistance, under USAID's Power Transmission Expansion and Connectivity Project. Activities under this project were expected to include at least 2 years of additional training to help the power plant staff develop the skills needed to maintain the plant.

Training and fully qualifying local personnel to operate and maintain the sophisticated technology at the Tarakhil power plant will take time. While we applaud the mission's continuing training activities, we believe that any further training provided should build on the lessons learned from previous O&M training activities. For instance, USAID and DABS should make greater effort to customize the training by soliciting input from the plant manager and his staff on the specific areas where training is most needed. In addition, the training should emphasize practical, hands-on training over formal classroom presentations and should include all pieces of equipment. Training materials should be in Dari to the extent possible since many staff cannot read English. Lastly, USAID should include a train-the-trainer component to allow DABS or the power plant to continue the training on their own after this activity ends.

Having a fully qualified and adequately trained staff at the power plant will require a long-term commitment but is critical to the successful operation and longevity of the plant. Therefore, we recommend the following.

***Recommendation 3.** We recommend that USAID/Afghanistan implement a training strategy, which includes milestone dates, for equipping staff at the Tarakhil Power Plant with the skills to operate and maintain the plant sustainably.*

Plant Staff Did Not Track Inventory

Under the power plant's formal transfer, the Afghan Government assumed full responsibility for the care and custody of the plant, including its equipment and other property. To help build the power plant staff's capacity to maintain the plant, USAID's O&M support included activities to

assist staff in performing warehousing, inventory, and control using the plant's computerized asset management system. This system was designed to help staff perform a variety of functions, such as exercising inventory control over plant assets, tracking and scheduling routine maintenance, and generating work orders to request needed spare parts and supplies. In addition to providing training on this system, LBG/B&V reported that by the end of the contract in June 2012, it had entered all of the spare parts and tools provided—totaling over 2,000 items—into the system.

Despite the O&M assistance, however, staff were not adequately tracking its inventory. Examples include the following.

- **No inventory records.** Other than LBG/B&V's list of the nonexpendable assets (e.g., furniture, shop equipment, etc.) provided under the contract, the power plant did not maintain inventory records accounting for these assets or the large volume of spare parts and consumable supplies it had in stock. Discussions with staff and an inspection of the storerooms, revealed that the plant's inventory system was sorely deficient. Staff stored spare parts and supplies, mostly leftover items from the plant's construction, under lock and key, either in a storeroom or in one of the 88 shipping containers located on the premises (some pictured below). With no inventory records, the plant's storekeeper relied on his memory to track down specific items. Still, given the large volume of items stored, this was often a difficult and time-consuming task, according to the plant manager.



Shipping containers house spare parts, supplies, and materials, most of which were not inventoried. (Photo by OIG, January 15, 2014)

- **Physical inventory not completed.** After the O&M assistance ended, the mission asked DABS to conduct an inventory of the spare parts, supplies, and assets on hand at the power plant. However, at the time of OIG's visit to the plant in mid-January 2014—19 months later—this inventory was still ongoing and taking an excessively long time to complete.

Part of the problem stemmed from the malfunction of the power plant's asset management system. This system, which staff intended to use to manage inventory, became inoperable 1 month after plant staff took over operations. According to the plant manager, the system's software relied on Internet connectivity. Unfortunately, the plant lost Internet access when the service contract, previously paid for under the O&M contract, ended. When the power plant resumed service, the software failed to function, and technicians found it had become corrupted.

Another factor was the large volume of spare parts and supplies left behind by the contractor, which made the inventory process a massive undertaking. Among the supplies stored at the compound were a large quantity of leftover construction materials—pipe fittings, hoses, etc. filling at least 60 shipping containers. While LBG/B&V attempted to conduct an inventory, coverage focused on the spare parts furnished under the O&M contract and did not include materials left from construction, which represented the bulk of the items to be inventoried, because of time constraints and a lack of labor.

With no records of existing stock, the power plant staff had no idea how many units of spare parts and supplies they had on hand, which had run out, or where certain items were stored. This lack of oversight increased the risk of key spare parts not being available when needed. According to plant staff, items available locally typically took 2 to 3 months to procure, whereas items that had to be ordered from outside the country took much longer. For example, a surge arrester (transformer) the plant requested in October 2012 to replace a burned out unit had not arrived as of January 2014.

In addition to the replacement delays, the lack of inventory records increased the possibility of plant staff requesting spares already in stock. In an interview, the plant manager acknowledged instances in which his staff had ordered spares only to find out that the items were on hand.

With some replacement parts requiring more than a year to procure, the plant must have a proper inventory system in place. Otherwise, equipment may remain out of service for an extended period—possibly causing an interruption in power generation. Therefore, we make the following recommendation.

***Recommendation 4.** We recommend that USAID/Afghanistan implement a strategy, which includes milestone dates, to (1) repair or replace the Tarakhil Power Plant's maintenance management system, (2) provide plant staff with further training and supervision in the use of this system to enable them to manage Tarakhil's inventory control functions on their own, and (3) facilitate a comprehensive inventory of the plant's spare parts, supplies, and nonexpendable assets.*

Utility Company Did Not Give the Power Plant Adequate Management Support

When O&M assistance ended, DABS assumed responsibility for the power plant's operation and maintenance. This included providing complete staffing, spare parts and supplies as required, asset management, budgeting, and procurement. In meetings between DABS and USAID management, before the O&M contract ended, DABS assured USAID that it was prepared to manage the power plant's operation and maintenance.

However, the power plant did not always receive adequate management support from DABS. Several examples follow.

Parts Procured Only as Needed. Since the handover, DABS has procured only a few replacement parts for the power plant and only as needed. DABS has made little effort to ensure that the power plant has an adequate supply of spare parts, particularly critical spares, in its inventory. LBG/B&V reportedly left the power plant with a 1-year supply of spare parts, while also giving DABS a list of recommended spares to be procured to support operations for 5 years. As of the review, however, DABS had not procured any spares from the list. The plant manager offered to develop a shortened version of the list, prioritized to reduce the number of spares to be procured (and the cost), but DABS never responded.

No Operating Budget. Despite the costs involved in operating and maintaining a plant the size of Tarakhil, DABS did not maintain an operating budget specific to the plant. When asked to examine the power plant's budget, DABS could provide only a consolidated budget covering all of its thermal power plants. It presented maintenance costs as one line item, without providing a detailed breakdown or showing how much of the budget had been allocated to the power plant.

Excessive Idle Time. Because of the high cost of fuel, DABS did not authorize the power plant to operate its generators "unless absolutely needed." The plant manager said that as early as July 2012, he had relayed to DABS officials the need to operate the power plant's generators at least 4 hours per month to keep them in good condition, but received no response from DABS.

Insufficient Staff. Some sections at the plant were not adequately staffed. The plant manager said the inventory area, in particular, was extremely understaffed given the large volume of spare parts and supplies. He said that the area should have been staffed by DABS with at least three people—one responsible for equipment, one for consumable supplies, and one for tools. Instead, the plant had only one storekeeper, who was not computer literate and could not have used the power plant's computerized asset management system even if it had been operational.

DABS attributed some of these support issues to a lack of resources. A senior DABS official said DABS did not have sufficient financial resources to provide the level of management support needed. He anticipated that more resources would be available in the near future as the utility company's revenue collection—supported under USAID's Power Transmission Expansion and Connectivity Project—improves.

By not providing sufficient management support, DABS has not met its responsibility of ensuring the power plant's successful operation and maintenance. The power plant's continued operation depends on the support it receives from DABS. Without committed support, the plant will continue to see its equipment fall out of service, jeopardizing the overall sustainability of this facility. Therefore, we make the following recommendation.

Recommendation 5. *We recommend that USAID/Afghanistan ask the utility company's management to provide a plan, including milestone dates, outlining the steps it will take to strengthen the management support it provides to the Tarakhil Power Plant. At a minimum, this plan should include (1) identification and procurement of needed critical spare parts for the plant's inventory, (2) development of a detailed annual operating budget for the plant, (3) operation of all plant generators for a minimum of 4 hours per month, and (4) review of the staffing patterns at Tarakhil to assess, with input from the plant manager, whether existing staff possess the skills required for their positions and whether additional staff are required in certain areas.*

EVALUATION OF MANAGEMENT COMMENTS

The mission provided comments in response to the draft report that are included, without attachments, in Appendix II. Those comments indicate that the mission made management decisions on all five recommendations. Our evaluation of those comments is provided below.

Recommendation 1. The mission agreed and made a management decision to perform an analysis to identify a more economical and affordable fuel supply that will allow the Tarakhil Power Plant to generate power on a regular, sustainable basis. The mission provided a target date of September 30, 2014, to close this recommendation. We acknowledge the mission's management decision.

Recommendation 2. The mission agreed and made a management decision on the actions to be taken. To strengthen the capacity of the Tarakhil Power Plant staff to maintain key control systems, the mission said that it was implementing a strategy through USAID's Power Transmission Expansion and Connectivity Project. One of the contracts awarded under this project included providing guidance and training for power plant staff and oversight of the operation and maintenance of the plant over the contract's 3-year performance period. Concerning Tarakhil's control systems, contracted activities will include helping DABS assess all of the plant's control systems, identifying those that were not fully functional, and assisting with corrective actions. Activities also involved helping DABS identify O&M activities, including repair of the control systems, for which outsourcing would be a more practical and cost-effective solution, while also identifying vendors. The mission set a target date of November 30, 2014 to close this recommendation. We acknowledge the mission's management decision.

Recommendation 3. The mission agreed and made a management decision to train Tarakhil Power Plant staff to operate and maintain the plant in a sustainable manner through activities being carried out under USAID's Power Transmission Expansion and Connectivity Project. Activities under this project include a certification program, involving (a) an assessment of the basic skills needed by O&M staff to perform the tasks associated with their positions and (b) identification of the specific training courses needed to become certified for each position to make sure all O&M positions are staffed with qualified individuals. O&M staff receive training so that they can become fully proficient in performing all tasks required by their position. Staff are also trained to implement and maintain the newly developed Computerized Maintenance Management System, established under the project, which covers all O&M activities. The mission set a target date of November 30, 2014 to close this recommendation. We acknowledge the mission's management decision.

Recommendation 4. The mission agreed and made a management decision to implement a strategy to address this recommendation through USAID's Power Transmission Expansion and Connectivity Project. The project includes the establishment of a comprehensive Computerized Maintenance Management System covering O&M activities at the Tarakhil Power Plant. Use of this new system will require performing an inventory of all plant materials, equipment, and supplies, as well as providing training for O&M staff so that they can independently operate and maintain the system. The mission set a target date of December 31, 2014 to close this recommendation. We acknowledge the mission's management decision.

Recommendation 5. The mission agreed and made a management decision on the actions to be taken. Rather than asking for a plan outlining proposed measures DABS management would take to strengthen the management support it gives to the Tarakhil plant, the mission indicated that steps to improve the management support provided to the power plant were already being taken under USAID's Power Transmission Expansion and Connectivity Project. One of the activities under this project involves training DABS staff to implement and maintain a Computerized Maintenance Management System, which is expected to support O&M activities at the Tarakhil Power Plant by helping staff (1) manage the inventory, including critical spare parts, (2) develop budgets, (3) establish standard operating procedures stipulating the frequency with which generators are operated, (4) develop an annual O&M plan for base- and peak-load operation, and (5) establish a certification program that identifies specific skills needed for staff positions and includes training to make sure all O&M positions are staffed with qualified individuals. The mission set a target date of September 30, 2014 to close this recommendation. We acknowledge the mission's management decision.

SCOPE AND METHODOLOGY

Scope

The Office of Inspector General in Kabul conducted this review in accordance with the Quality Standards for Inspection and Evaluation, as issued in 2012 by the Council of the Inspectors General on Integrity and Efficiency. The purpose of this review was to determine whether DABS was operating and maintaining the power plant in a sustainable manner to protect USAID's investment in this facility.

The construction of the power plant and subsequent O&M assistance provided was carried out under two contract task orders awarded by USAID to LBG/B&V under USAID's Afghanistan Infrastructure and Rehabilitation Program. According to mission records, the final cost of construction totaled approximately \$307 million, and subsequent O&M assistance cost an additional \$27.7 million.

In June 2010, ownership of the power plant formally transferred to the Afghan Government's Ministry of Energy and Water, with DABS, the country's national utility company, operating and maintaining the plant. To help DABS fulfill this role, USAID provided contracted O&M assistance through June 2012, at which time DABS assumed full responsibility for the power plant. This review focused on the operation and maintenance of the power plant from June 2012 through February 28, 2014.

In planning the review, we examined prior audit reports issued by USAID OIG and by the Special Inspector General for Afghanistan Reconstruction on the power plant to identify any information pertinent to our objective. In addition, the review team examined the mission's FY 2013 annual self-assessment of management controls, which missions perform to comply with the Federal Managers' Financial Integrity Act of 1982,⁴ to determine whether the assessment cited any relevant weaknesses. The review team also ascertained the extent of monitoring provided by the mission of the power plant's operations subsequent to the plant's handover to the Afghan Government. The monitoring included periodic site visits to the plant by mission staff to assess operations, correspondence with DABS management to follow up on O&M problems, and contact with DABS and the power plant to coordinate contracted, limited-scope repairs. USAID-funded activities involving the power plant are managed by the mission's Office of Economic Growth and Infrastructure.

Fieldwork took place from December 18, 2013, to April 9, 2014, at the USAID/Afghanistan mission in Kabul. The review team also made three field visits to the power plant, located on the outskirts of Kabul, during which team members interviewed the plant manager and other staff, toured the facility, photographed equipment and other aspects of the plant, and examined part of the plant's inventory of spare parts and supplies. In addition, we visited the Ministry of Energy and Water's main offices in Kabul, where we interviewed a senior planning official.

⁴ Public Law 97-255, codified in 31 U.S. Code 3512.

Methodology

To determine whether DABS was operating and maintaining the power plant sustainably, the review team initially examined mission Implementation Letters outlining the terms under which USAID formally transferred the power plant and related equipment to the Afghan Government. Other relevant background documents reviewed consisted of procurement and financial records relating to the construction and O&M contracts, mission correspondence with DABS management regarding past O&M issues, prior audit reports and congressional hearings relating to the power plant, mission portfolio reviews, evaluation reports, and other pertinent records. In addition, the review team interviewed USAID staff from the mission's acquisition, infrastructure, and director's offices to obtain further background information on the power plant's operations. The team also ascertained the extent of USAID's financial investment in the power plant and involvement in past and ongoing activities.

In addition to the work performed at the USAID mission, the review team made several field visits to the power plant complex, where team members interviewed the plant manager and other relevant staff, toured the facility, inspected the storerooms and other storage areas, examined selected plant equipment, discussed maintenance procedures, and viewed some of the control systems in the central control rooms. During the interviews, the team inquired about the problems and challenges the power plant currently faced, along with the impact of these problems on plant operations.

We also interviewed senior officials with the Ministry of Energy and Water and DABS, as well as members of a technical team hired to address a control system malfunction at the power plant. In addition, we obtained information on the plant's operating problems from a former contractor at the power plant, both under the O&M assistance contract and later under a separate contract.

During fieldwork, we also performed several analyses. For example, we computed the amount of power (in megawatt-hours) that the power plant could have generated during the period from July 1, 2010, to December 31, 2013, with base-load operation. We compared this amount with the total power actually generated during that period to determine the extent to which the plant was being underused. This analysis relied on power production data compiled by LBG/B&V (from July 2010 to April 2012) and DABS (from May 2012 to December 2013).

Another analysis involved computing the average unit cost for the power plant to generate 1 kilowatt-hour of electricity. We compared this with the average rate charged to customers to ascertain the extent to which the power plant operates at a loss.

We performed a third analysis to ascertain the extent to which the power supply in Kabul was meeting demand. This entailed using data furnished by Afghanistan's National Load Control Center to compute the average amount of power (in megawatts) available in Kabul from October 1 to December 31, 2013. We compared this amount with the maximum load capacity in the Kabul area (actual demand reportedly exceeded this amount) to determine the percentage of demand being met.

We established a materiality threshold of 15 percent. For example, if the total power produced by the power plant was less than 85 percent of its recommended operating capacity, we concluded that the plant was not achieving base-load operation.

MANAGEMENT COMMENTS



MEMORANDUM

June 7, 2014

TO: James Charlifue, OIG/Afghanistan Director

FROM: William Hammink, Mission Director /s/

SUBJECT: Draft Report on the Audit of USAID/Afghanistan's Review of Sustainability of Operations at Afghanistan's Tarakhil Power Plant (Report No. F-306-14-00X-P)

REFERENCE: JCharlifue/WHammink memo dated May 8, 2014

Thank you for providing USAID/Afghanistan with the opportunity to respond to the draft audit report on the Review of Sustainability of Operations at Afghanistan's Tarakhil Power Plant.

In 2009, high-voltage transmission lines were completed, delivering low-cost grid power to the North East Power System (NEPS), of which Kabul was the largest NEPS load center. Diversifying a city power source is a common and responsible practice in cities throughout the world, and Kabul needed a source of backup/peaking power generation in case of high demand in winter or failure of transmission lines bringing in electricity from Central Asia. The 105-Megawatt Tarakhil Power Plant (TPP) is a vital component of NEPS and provides Kabul with a reliable power source during winter months, when additional power is needed (peaking load) or during emergencies when imported power to Kabul is interrupted. The purpose of the power plant was to improve the quality of life for those served by Da Afghanistan Breshna Sherkat (DABS), the national electric utility company. The increase in reliable electricity was expected to extend hours of operation for businesses and schools and encourage investment in new industrial and commercial enterprises, creating jobs and economic growth.

The plant was completed in December 2009, and ownership was transferred from USAID to DABS in June 2010.

We believe TPP has served and will continue to serve a critically important role in Kabul electricity security. Nonetheless, we do recognize the Government of the Islamic Republic of Afghanistan needs to improve its management of the power plant, which will require continued USAID technical assistance.

We welcome the audit recommendations on strengthening Afghan capacity to operate and manage this important plant as the government aligns with USAID thinking. Based on work we have already done, we ask that the Office of Inspector General close four of the five recommendations in the report.

COMMENTS ON OIG'S RECOMMENDATIONS

***Recommendation 1.** Perform and document an analysis, exploring possible options available, to identify a more economical and affordable fuel supply that would allow the Tarakhil Power Plant to increase its operations and generate power on a regular, sustainable basis.*

USAID Comments: The Mission concurs with recommendation 1.

Actions Taken/Planned: USAID will perform an analysis for a more-economical and affordable fuel supply that will allow TPP to generate power on a regular, sustainable basis.

Target Closure Date: September 30, 2014.

***Recommendation 2.** Implement a strategy to strengthen the capacity of Tarakhil Power Plant staff to maintain key control systems. At a minimum, this strategy should include training to help technical staff diagnose and troubleshoot control system malfunctions on their own and steps to be taken, by both USAID and Da Afghanistan Breshna Sherkat, to make a software/systems engineer available to the power plant to assist with control system malfunctions and follow up on ongoing system-related issues.*

USAID Comments: The Mission concurs with recommendation 2.

Actions Taken/Planned: USAID has already implemented a strategy to strengthen the capacity of TPP to maintain key control systems through our on-budget project with DABS called PTEC Commercialization Part 2 Contract for Power Generation, which includes providing guidance and training for DABS TPP staff and oversight of operations and maintenance of the plant for the three-year contract period. In addition, USAID, through the off-budget Afghanistan Engineering Support Program, provided a software/systems engineer to identify and fix problems in operations of TPP Block B, and additional information that has been included in the Commercialization Part 2 Contract (see Tab 1, page 1).

Closure Request:

Based on the above, we request OIG concurrence to close Recommendation 2.

***Recommendation 3.** Implement a training strategy, which includes milestone dates, for equipping staff at the Tarakhil Power Plant with the skills to operate and maintain the plant sustainably.*

USAID Comments: The Mission concurs with recommendation 3.

Actions Taken/Planned: Under DABS PTEC Commercialization Part 2 Contract for Power Generation project, a training strategy for TPP staff to operate and maintain the plain sustainably has already begun. The project includes a Certification Program, a Computerized Maintenance Management System (CMMS), and specific training for plant staff (see Tab 1, page 1).

Closure Request:

Based on the above, we request OIG concurrence to close Recommendation 3.

***Recommendation 4.** Implement a strategy, which includes milestone dates, to (1) repair or replace the Tarakhil Power Plant's maintenance management system, (2) provide plant staff with further training and supervision in the use of this system to enable them to manage Tarakhil's inventory control functions on their own, and (3) facilitate a comprehensive inventory of the plant's spare parts, supplies, and nonexpendable assets*

USAID Comments: The Mission concurs with recommendation 4.

Actions Taken/Planned: USAID has already implemented a strategy, in cooperation with DABS and with milestone dates to (1) repair or replace the

Tarakhil Power Plant maintenance management system, (2) provide plant employees with further training and supervision in the use of this system to enable them to manage Tarakhil inventory-control functions on their own, and (3) facilitate a comprehensive inventory of the plant spare parts, supplies, and nonexpendable assets through the PTEC Commercialization Part 2 Contract for Generation, which includes establishing a comprehensive CMMS. The CMMS includes inventory of the plants spare parts, supplies, and non-expendable assets, and training for DABS staff to maintain the CMMS on their own (see Tab 1, page 1).

Closure Request:

Based on the above, we request OIG concurrence to close Recommendation 4.

***Recommendation 5.** Ask DABS management to provide a plan, including milestone dates, outlining the steps it will take to strengthen the management support it provides to the Tarakhil Power Plant. At a minimum, this plan should include (1) identification and procurement of needed critical spare parts for the plant's inventory, (2) development of a detailed annual operating budget for the plant, (3) operation of all plant generators a minimum of 4 hours per month, and (4) review of the staffing patterns at Tarakhil to assess, with input from the plant manager, whether existing staff possess the skills required for their positions and whether additional staff are required in certain areas.*

USAID Comments: The Mission concurs with recommendation 5.

Actions Taken/Planned: The PTEC Commercialization Part 2 Contract for Power Generation, already being implemented by DABS, includes the CMMS at TPP for 1) inventory and critical spare parts; costs and budgets; 2) establishing Standard Operating Procedures and Annual O&M Plan for base and peak load, including the frequency that generators are operated; 3) and a Certification Program that identifies specific skills needed for staff positions and recommends positions requiring qualified individuals. Furthermore, per Section III.D.5 of PTEC Implementation Letter 22-7, DABS expected contribution to the PTEC Program includes providing qualified staff in a timely manner (see Tab 1, page 1 and Tab 2).

Closure Request:

Based on the above, we request OIG concurrence to close Recommendation 5.

Attachments:

Tab 1: Excerpt from Description of Services for Contract # DABS-91-ICB-038, Consulting Services: DABS Commercialization Program Part 2 for Generation and Transmission

Tab 2: PTEC Implementation Letter 22-7

cc: OAPA Afghanistan Audit

Clearance Page: Mission Response to OIG Draft Report on the Review of Sustainability of Operations at Afghanistan's Tarakhil Power Plan (Report No. F-306-14-00X-P)

Drafters:

OEGI:	JGordon	Date: <u>05/22/2014</u>
	GLin	Date: <u>05/22/2014</u>
	RWardak	Date: <u>05/22/2014</u>

Clearances:

OEGI:	CDrilling	via tracker	Date: <u>05/22/2014</u>
OAA:	KBryant	via tracker	Date: <u>06/05/2014</u>
OFM:	KFall	via tracker	Date: <u>05/22/2014</u>
RLO:	JSouthfield	via tracker	Date: <u>06/05/2014</u>
Exec. Asst.:	PClark	via tracker	Date: <u>06/05/2014</u>
DMD:	CBryan	via tracker	Date: <u>06/07/2014</u>

OAPA:	NRuzika	via email	Date: <u>06/03/2014</u>
	GS, SRAP	via email	Date: <u>06/04/2014</u>

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