

The Afghanistan Engineering Support Program assembled this deliverable. It is an approved, official USAID document. Budget information contained herein is for illustrative purposes. All policy, personal, financial, and procurement sensitive information has been removed. Additional information on the report can be obtained from Firouz Rooyani, Tetra Tech Sr. VP International Operations, (703) 387-2151.

To: ██████████ USAID-OIEE
From: ██████████ Tetra Tech TSM
Date: November 16, 2011
Re: WO-A-0079 Tarakhil O&M Estimate

Executive Summary

Tetra-Tech (TT) was tasked by USAID with assembling an estimate of probable cost to perform operations and maintenance activities at the 100MW Tarakhil Power Plant in Kabul, Afghanistan.

The following general direction and assumptions were provided by USAID in calculating our estimate:

- Develop an estimated cost for a management contract to carry out operations and maintenance at the Tarakhil Power Plant
- Assume term is 3 year period
- Assume that HFO receipt and commissioning is part of this process
- Assume that the plant runs at or near the level that it is currently operating
- Assume start date in mid 2012

TT analyzed operations and maintenance data collected during our “Tarakhil Power Plant Operational Evaluation” report dated August 10, 2011 to determine the quantity of consumables and the number of full-time, expat and third country national staff required to safely staff the plant.

The total estimate for 36 months of operations and maintenance (O&M) is ██████████. The following narrative contains a detailed description of assumptions and methodology. Also please see the attached Excel spreadsheet (with 3 worksheets; “*Cost Sheet*”; “*Historic Operations*”; and “*Multiplier Computation*”) for computational details.

Of note, an industry benchmark for internal combustion engine O&M cost is \$.01/KW-hr. Excluding uplift, the cost closely follows this rule of thumb (assuming the plant is staffed for full rated operation).

Assumptions

The following list of detailed pricing assumptions was used in the attached Excel spreadsheet:

- 2x12-hr shifts, 7 days/week: Shift work will provide the least cost alternative for USAID to fund this task order. This will minimize the number of staff, minimizing salary, mobilization, and R&R coverage costs. Similar expat operating schedules are performed on other base life support type contracts (AFCAP, LOGCAP, etc) to success.
- All preventive and expected corrective maintenance can be completed by the workforce proposed in the staffing plan. (Verified by analysis of Caterpillar's maintenance schedule.)
- R&R or short-term absence can be absorbed by existing workforce due to the 2x12 hr shifts, 7 days/week.
- HFO receipt & HFO plant re-commissioning is included (lump sum).
 - Re-commissioning and HFO receipt includes mechanical and electrical improvements required to receive ambient temperature fuel oil.
- Plant operations level is similar to current (extreme duty cycling, low base load).
 - Current analysis reveals a 4% loading factor based on MWh usage.
- Security and base support are not included in our estimate.
- Contract length July 2012-June 2015 (36 months).
- Local national (LN) salaries are not included in our estimate.
- Fuel cost NIC.
 - Lube oil and maintenance oil/grease are included.

Cost Drivers

Details of specific cost drivers are presented below.

Cost Driver: Staffing

The estimate was based on the following proposed staffing plan (as shown in Figure 1: Proposed Staffing) which includes 20 full-time-equivalent (FTE) employees:

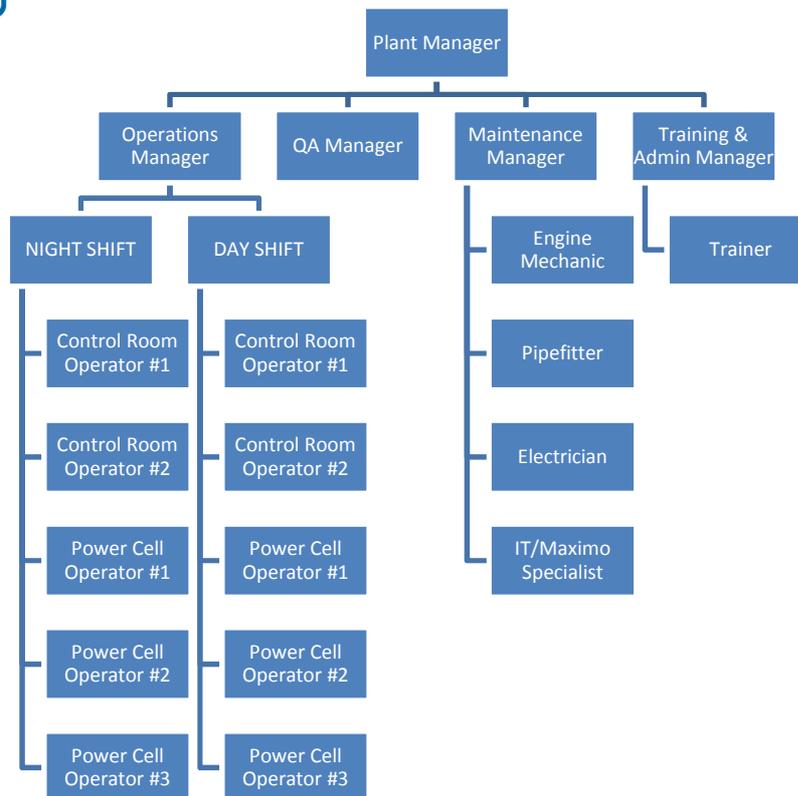


Figure 1: Proposed Staffing

Plant Manager

The Plant Manager oversees all facets of, and is the single person overall responsible for, plant operation, material condition, power production, and training of Afghan nationals. It is understood that there will be organizational tension between Operations (who is responsible for keeping the plant running) and Training (who is responsible for ensuring a successful turnover of the plant to the Afghan government). The Plant Manager is expected to balance these competing requirements and achieve the goal of a turning over a fully operational plant to the Afghan government. The Plant Manager must also ensure the deputy Afghan Plant Manager is fully trained; when on R&R, the Afghan deputy will assume the Plant Manager duties.

QA Manager

The QA Manager is responsible (to the Plant Manager) for Quality Assurance (QA) of both plant maintenance and personnel training. The QA manager must also develop and train the Afghan quality assurance staff. The QA Manager will designate an Afghan deputy who will assume the expat QA Manager's duties during R&R.

Operations Manager

The operations manager is responsible (to the Plant Manager) for producing reliable power and day-to-day operation of the power plant. They oversee both shifts of operators. They are also expected to coordinate with the Training Manager to make their tradesmen available to train Afghan nationals, and to ensure Afghan operators have sufficient opportunity working in the plant to become proficient. The Afghan deputy Operations Manager will assume the duties of the Operations Manager during their absence.

Maintenance Manager

The maintenance manager is responsible (to the Plant Manager) for the material condition of the equipment and facilities, for the IT system, and for the maintenance program. They oversee specific non-shift tradesmen (engine mechanic, pipefitter, and electrician) and the IT/Maximo specialist. The Maintenance Manager is expected to coordinate with the Training Manager to make their tradesmen and IT specialist available to train Afghan nationals, and to ensure Afghan maintainers have sufficient opportunity actually performing maintenance to become proficient. The QA Manager will inspect and assess the quality of maintenance under the Maintenance Manager's purview. The Afghan deputy Maintenance Manager will assume the duties of the Maintenance Manager during their absence.

Training & Admin Manager

The Training and Admin Manager is responsible (to the Plant Manager) for training Afghan nationals in the operation and maintenance of the plant. They are also responsible for miscellaneous administrative matters. The trainer reports to them. The QA Manager will inspect and assess the quality of training under the Training Manager's purview; specifically the capability of Afghan nationals to self-sustain the power plant. The Afghan deputy Training and Admin Manager will assume the duties of the Training and Admin Manager during their absence.

Control Room Operators

Control Room Operators are shift workers, normally standing watch in the control room. They monitor and control the output of the generators and oversee generator light-off and shutdown, as well operation of supporting systems such as the fuel oil transfer system.

Power Cell Operators

Power Cell Operators are shift workers, normally standing watch in the generator spaces. They monitor and maintain the generators while in steady-state operation, and physically align systems and generators for light-off, shutdown, and special evolutions. They also conduct day-to-day housekeeping and minor preventative maintenance on the components of the power plant.

Engine Mechanic

The Engine Mechanic is responsible (to the Maintenance Manager) for the material condition and continued operation of the prime movers. They conduct scheduled and unscheduled preventative and corrective maintenance of the engines, and assists in training Afghan nationals in diesel engine maintenance.

Pipefitter

The Pipefitter is responsible (to the Maintenance Manager) for the material condition and continued operation of all mechanical components (e.g. pipes, pumps, valves, and fittings) in the power plant, with the exception of the prime movers. They conduct scheduled and unscheduled preventative and corrective maintenance of the power plant mechanical system, and assist in training Afghan nationals in mechanical system maintenance.

Electrician

The Electrician is responsible (to the Maintenance Manager) for the material condition and continued operation of all electrical components (e.g. breakers, motors, generators, switches, and cabling) in the power plant. They conduct scheduled and unscheduled preventative and corrective maintenance of the power plant electrical system, and assists in training Afghan nationals in electrical system maintenance.

IT/Maximo Specialist

The IT/Maximo Specialist is responsible (to the Maintenance Manager) for secure and reliable IT operations, including the integrity of the Maximo database. They maintain all computer and communication systems and software, including the Maximo maintenance software. They also assist in training Afghan nationals in IT system management.

Trainer

The Trainer is responsible (to the Training & Admin Manager) for development and execution of an effective training program that will enable Afghan nationals to properly operate and maintain the plant in the absence of non-Afghan operators.

Cost Driver: Salaries

Salaries were estimated at current market rate. An overall uplift multiplier of 95% was applied to include uplift, additional overtime, and housing allowance. The computation of the overall uplift multiplier is detailed on the spreadsheet worksheet "Multiplier Computation". A burdening multiplier of 3.0 was applied to the base salary to reflect fringe benefits and personnel-specific unallocated overhead. Finally, R&R expenses for 1 trip per expat every 90 days were included.

Cost Driver: Materials:

The estimate includes a tool and consumable allowance for rags, drill bits, gaskets, and the like. It also includes a spare part allowance of ██████ per generator, plus ██████ for the electrical system and ██████ for the mechanical system. An additional ██████ is included for IT requirements. Finally, due to the extreme conditions the generators are used in, an annual change of lube oil and turbo oil is included, with a material cost of ██████ Assuming a lube oil cost of ██████ for SAE 40 lube oil, and ██████ for Tellus Oil T 68).

Cost Driver: Facility Maintenance

The estimate assumes a cost of ██████ per square foot to maintain the physical facilities, including roof, HVAC, fire suppression, and other building components.

Cost Driver: Miscellaneous

The estimate also includes a miscellaneous cost of ██████ as a reserve to bring in a Caterpillar factory technician in the event of an equipment failure beyond the capabilities of the contracted maintenance team.

Cost Driver: Overhead, Contingency, Profit, and Inflation

The final cost estimate includes 10% for home office overhead, 7% for contingency, and 5% for profit. Years 2 and 3 were accelerated by 2% to reflect inflation.

Cost Driver: HFO Commissioning

The **first year** contract cost also includes ████████ to cover changeover to Heavy Fuel Oil (HFO) and system re-commissioning for HFO operations. This was a first-year-only cost.

Cost Driver: Mobilization & Deployment Prep

The **first year** contract cost also includes ████████ to cover expat mobilization and pre-deployment preparations. This was a first-year-only cost.

Additional Recommendations:

Based on the Team's previous analysis at the Tarakhil Power Plant, there is a need for successful training to facilitate handover of the plant to the Afghans with no expat operators. To that end, the success of the training program should be an integral part of the performing contractor's measurement for award fee. It is essential to align the contractor's incentive with USAID's desired outcome.

A successful training program has two components: process and results. A contractor should not earn a full award fee for his training process, if there are not results.

Assessment of the training process should be based on an independent audit of the performing contractor's:

- Training records, for completeness and accuracy
- Training material, for breadth, depth, scope and content
- Training plan, for frequency and methodology

Assessment of the training results should be based on an independent audit of the Afghan staff's:

- Knowledge of required skills and plant technical concepts
- Practical ability to maintain and operate the power plant through steady-state and transient operation
- Management ability to forecast, plan, and execute long term operations

This assessment could be carried out on a continuous basis, by a full time assessor; or on a periodic (e.g. quarterly unannounced inspections) basis by an inspection team.

Some options for structuring the contract include:

- Award fee board that analyzes the plant's reliability and operational success as well as training success, and recommends an award fee to the Contracting Officer.

- Creating a financial incentive for the contractor to reduce his expat staff (while still holding him accountable for plant performance); for example:
 - Offer a fixed salary total irrespective of actual expat staffing. This would create an incentive for the contractor to promote utilizing the less-expensive Afghan staff operating the plant as soon as possible.
 - Reduce the amount of salary paid over the life of the contract, effectively phasing out the expat staff by phasing out their funding.
- Offering a bonus award fee based on effectiveness of the training program, with a majority weight on results.
- Including additional costs for innovative training tools like a computer-based simulator.
- Relaxing power plant operating metrics to allow the contractor to focus more on training Afghans and less on 100% reliable power delivery.
- Relaxing power plant operating metrics to allow 1 of the 18 generators to be used as a full-time training aid.

LABOR

Title:	Base salary	% of annual cost:
Plant Manager		
QA Manager		
Operations Manager		
<i>Maintenance, IT, & Training:</i>		
Maintenance Manager		
Engine Mechanic		
Pipefitter		
Electrician		
IT/Maximo Specialist		
Training & Admin Manager		
Trainer		
Non-shift subtotal:		
 <i>DAY SHIFT:</i>		
Day Shift Control Room Operator #1		
Day Shift Control Room Operator #2		
Day Shift Power Cell Operator #1		
Day Shift Power Cell Operator #2		
Day Shift Power Cell Operator #3		
<i>NIGHT SHIFT:</i>		
Night Shift Control Room Operator #1		
Night Shift Control Room Operator #2		
Night Shift Power Cell Operator #1		
Night Shift Power Cell Operator #2		
Night Shift Power Cell Operator #3		
Shift Subtotal:		
 Salary subtotal:		
 Uplift (@ Uplift %):		
Burdened labor (salary x multiplier):		
R&R cost for all expats (1 trip/90d):		
LABOR SUBTOTAL:		
 SECURITY:		
SECURITY SUBTOTAL:		
 BASE LODGING & FOOD:		
BASE LODGING & FOOD SUBTOTAL:		
 MATERIALS		
Tools & consumables		
Spare parts		
IT Allowance		
Lube oil/turbo oil changeout		
MATERIALS SUBTOTAL		
 FACILITY MAINTENANCE		
Assume 75,000 sf facility		
FACILITY MAINTENANCE SUBTOTAL:		
 MISC		
Reserve for Caterpillar tech assist		
MISC SUBTOTAL:		
 SUBTOTAL:		
Overhead		
Contingency		
Profit		
Grand total:		
<i>First year only: HFO changeover & recommissioning</i>		
<i>First year only: Mobilization & deployment prep:</i>		
 Year 1		
Year 2		
Year 3		
3-year price		

Variables:

Uplift %:

Burdening multiplier:

Annual spare part cost/generator

Annual spare part cost for fuel oil system

Annual spare part cost for electrical system

Facility maintenance cost/sf

Food & lodging, per person-day

Home office overhead

Contingency

Profit

of expat personnel (FTE's)

Inflation rate

Afghan personnel

Mobilization/R&R airfare:

Predeployment costs: (Shots, visas, etc.)

