

Nangarhar Electricity Expansion Case Study

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Power Demand and Supply in 2010

31 MW Projected Demand

12 MW Darunta Dam

19 MW Projected Shortfall



Total Cost of Supply for 31MW in 2010

Source	Supply (MW)	Supply costs (\$/kWh)	Transmission costs (\$/kWh)	Distribution costs (\$/kWh)	Weighted avg cost (\$/kWh)
Darunta	11.8	.005	-	.025	
Kabul/Uzbek	19.2	.13	.01	.025	
Total	31				.12
Cash Realized					.04
<i>Loss per unit</i>					.08

Projected cash flow in 2010

Cash revenues	\$11 million
Total costs	\$33 million
Loss	\$22 million !!

DABM/S

- A management contract being considered for DABM/S, similar to that underway for Kabul division of DABM
- But, Nangahar provincial leaders prefer a program of direct TA and capital grants

Assignment. Make recommendations to Mission on how to improve DABM/S's operations to enable the sustainable delivery of services.

NANGARHAR ELECTRICITY EXPANSION INITIATIVE CASE STUDY

(NOTE: THIS CASE IS FOR TRAINING PURPOSES ONLY. IT USES A COMBINATION OF FACTUAL AND NON-FACTUAL DATA.)

Nangarhar Province lies in eastern Afghanistan along the long border with Pakistan. The proximity with Pakistan fosters close ties and migration. It was once a major center of opium poppy production but with the success of poppy eradication programs, production dropped by 95% and poverty among peasant farmers has risen as they seek new livelihoods.

The provincial capital, Jalalabad, is the largest city in eastern Afghanistan, home to 170,000 people and only 90 miles by road from both Kabul and Peshawar, Pakistan. Situated on the main road between Pakistan and Afghanistan, it is a growing city with a relatively strong economic base.

Nangarhar is also important for security reasons. Taliban fighters have been active in the province, and there continues to be an active insurgency outside of Jalalabad, with weapons supplies coming from across the Pakistan border. Although Jalalabad is considered relatively safe due to a large presence of Afghan National Police and Afghan armed forces personnel, areas outside of Jalalabad have seen regular Taliban activity. For strategic reasons, the USG would like to stimulate legitimate economic opportunities and build confidence in government services such as electricity supply.



Map of Afghanistan with Nangarhar highlighted

For this reason, USAID was asked by the National Security Council and Embassy to significantly increase electricity supply to Nangarhar. The target areas initially are Jalalabad and the economic corridor to the Pakistan border and the border crossing point at Torkham. USAID was told to prepare a preliminary plan and budget for a fast-tracked electricity expansion program within 3 months. You are asked by the Front Office to produce a set of preliminary recommendations based only on the information in this case. Tomorrow morning, you meet with the DCM, Mission Director and head of the Office of Infrastructure, Engineering and Environment to outline your recommendations. The focus of this discussion is what to do about the heavy losses that the Nangarhar electricity utility is experiencing, and what should be done to ensure the sustainability of the expansion program.

Electricity Services in Nangarhar

Electricity services in Nangarhar are provided by a division of the Afghan national electricity, DABM Nangarhar (DABM/S). DABM/S is small in terms of customers and electrical load. In 2006, the total number of DABM/S electricity customers was just over 10,000, with Jalalabad as the main load center. In the past few years, households have received energy for a few hours every third day. Business and government customers receive energy most days, but supply is less than 6 hours a day. This unreliable supply of electricity is a major constraint on economic activity.

Electricity Customers in Jalalabad City (2006)	
Consumer Category	No. of Customers
Domestic	8,699
Government/public agencies	231
Commercial	983
Industries (small)	214
Industries (large)	18
Total	10,145
Houses awaiting connections	2,200

Power Demand

Total power demand in Jalalabad is about 16 MW. Once the Darunta Hydroelectric Plant is rehabilitated in late 2009, demand will reach 17 MW. Given that Darunta will have only 11.8 MW of capacity, there will be a shortfall of 4 MW in 2008 and 5 MW in 2009.

Forecast of Power and Energy Demand – Jalalabad City					
	2005	2008	2010	2015	2020
Power Demand (MW)	13.6	15.8	17.3	27.2	41.7
Energy Demand (MWh/Year)	66,245	84,162	99,558	151,106	221,540

In addition to Jalalabad, power demand from the economic corridor stretching along the highway to the Pakistan border is currently estimated to be 14 MW. Assuming no growth in demand along the corridor, total estimated power demand of 31.3 MW is projected for 2010.

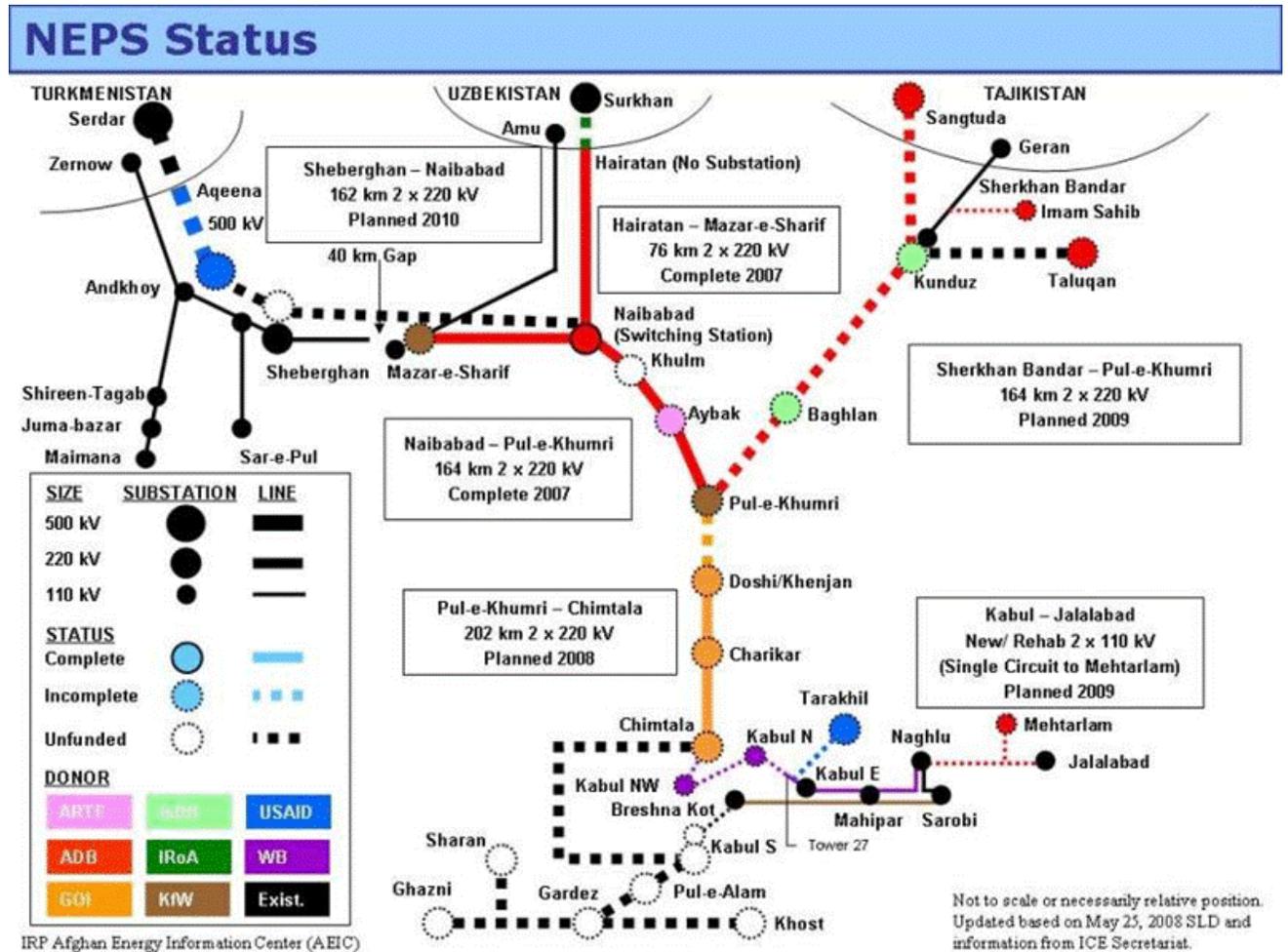
Power supply

The Darunta hydropower plant is the only available source of power supply for Jalalabad other than expensive diesel generators. Darunta is a multi-purpose dam that is also used for irrigation. The plant is more than 40 years old, only two of its three generators were operating in October 2008, and plant maintenance is poor due to lack of available funds within DABM. Its original capacity of 11.5 MW has been reduced to 7.5MW.

USAID is rehabilitating the plant to 11.8 MW capacity by December 2010. As noted, estimated demand by 2010 in Nangarhar (including Jalalabad and the corridor to Pakistan) will be about 31 MW. Therefore, the provincial shortfall will be 19 MW. This is the increase in capacity in the USAID-assisted expansion program.

The corridor from Jalalabad to the Pakistan border is currently supplied by 40 small diesel generation units owned and operated by private businessmen. Rates for this supply are in the 40 to 55 US cent range. This supply is reliable, but is so expensive that it is a constraint to the many roadside businesses, including such energy intensive enterprises as metal workshops, ice manufacturers, car repair shops, and cold stores. Pakistan is short of generating capacity so there is no possibility of providing electric energy from Pakistan imports.

Nangarhar depends on the Darunta Plant and small diesel gensets; it is currently not connected to a larger “Afghan electricity grid.” A new transmission system, the Northeast Power System (NEPS) will transmit energy from Central Asia thru Mazar-e-Sharif to Kabul and eventually Nangarhar and Kandahar. Until NEPS is completed, Nangarhar is its own stand-alone electrical system.



ADB is providing funding for a single circuit 110kV transmission line from Naghlu HPP (100MW - which is connected to the Northeast Power System) to Jalalabad, which will have the capacity to carry 45 MW of Kabul/ Uzbek energy. ADB funds will also support

substation upgrades at Naghlu and Jalalabad, and a 110 kV dual circuit line to Mehtarlam, a town north of Jalalabad.

This new line will begin construction by KEC of India in January 2009 with expected completion in June, 2010. This line could be upgraded quickly and inexpensively to carry 60 MW from Kabul to Jalalabad and beyond. However, all supply coming down this line is at the cost of less supply being available in Kabul. The Kabul/ Uzbek electricity supply to Nangarhar will average 13 US cents / kWh.

From your field assessment, you have concluded that there are six options for providing additional supply:

1. Build a hydro generation plant in the province to the north of Nangarhar, in Kunar, and transmit the power through mountainous areas with relatively high incidences of Taliban activity. This would take 5 years to construct and would require an investment of \$400 million.
2. Install more efficient higher capacity diesel generation at the Jalalabad load center or along the highway.
3. Upgrade the 110 kV line from Kabul to Jalalabad, as described above, to carry 60 MW of power.
4. Institute a demand side management program for government buildings and for high efficiency residential and commercial lighting.
5. Maximize the use of renewable energy where applicable – market center solar street lights, solar water pumping for irrigation, solar lamps – battery charging stations, wind turbines. Each of which has specific O&M support issues that need to be considered.
6. Some combination of the options above.

Electricity Distribution

After years of civil war, the Jalalabad distribution system is in disrepair. The substations and low voltage distribution networks are inadequate, overloaded, and outdated. Although there are 10,000 meters, the number of customers connected to the network is much higher. Afghan law permits metered customers to on-sell



electricity to neighboring households.

Wiring to neighboring households is typically strung using small diameter wires over hundreds of yards, leading to voltage fluctuation and technical losses. Although it is known that illegal connections exist, there is little data on the extent of this problem. An Australian firm, SMEC, estimated in 2006 that rehabilitating the Jalalabad network requires an investment of \$18 million.

Financial viability of DABM/S

Despite cheap electricity from the Darunta Plant, DABM Nangarhar’s cost recovery is low and “aggregate technical and commercial losses” are similar to Kabul – about 60%. DABM/S charges residential customers 10 US cents (5 Afs.) per kWh, while government, commercial and industrial customers pay 20 US cents (10Afs.) per kWh.

An analysis of DABM/S’s commercial accounts in 2007 suggests that **cash realization per kWh in Jalalabad is only 4 cents on the average**. As depicted in the table below, total cost of supply for DABM/S using only energy from Darunta is 3 cents so DABM/S currently has a margin of 1 cent per kWh.

Total Cost of Supply for 31MW in 2010					
Source	Supply (MW)	Supply costs ¹ (\$/kWh)	Transmission costs (\$/kWh)	Distribution costs (\$/kWh)	Weighted Average Cost (\$/kWh)
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Total	31				.12
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Once Kabul/ Uzbek electricity becomes available, DABM/S costs rise significantly. Your best estimate for a blended cost of electricity from Darunta and Kabul/ Uzbek is 12 cents per kWh, when taking into account additional network costs to provide power along the corridor. This indicates that DABM/S will lose 8 cents per kWh once new supply under the program is available. Losses would deepen if supply was augmented by diesel gen-sets. Since DABM Headquarters does not have sufficient funds even to pay fuel for Kabul, it is unlikely that DABM Kabul can provide a subsidy to Nangarhar.

You have estimated that at these prices, 31 MW of supply will result in an annual \$33 million in total costs to DABM/S, annual total cash revenues of \$11 million, with a total cash loss of \$22 million.

The World Bank and USG have developed plans with the Afghan Government to restructure and commercialize DABM. This includes support for a commercialization contract that will put Kabul Electricity Directorate (KED) under the management of a

private firm. Under the management contract, the firm will also provide capital and operating equipment, and rebuild KED's technical and commercial capacity. Similar arrangements are being considered for DABM provincial utilities. However, provincial leaders in Nangarhar said they prefer direct technical assistance and capital grants to implement an intensive loss reduction program, expand energy supplies, and build staff capacity.

What the USG and the Nangarhar Government can agree on is that the local economy urgently needs more electricity. As the Jalalabad mayor told USAID,

“Farmers are no longer growing poppy. Many come to Jalalabad and the highway corridor for work. We must have electricity for factories to create jobs.”

He expressed concern about the corridor that connects Kabul, Jalalabad, and Peshawar and is a growing hub of commercial activity, stating “You see, many small businesses along the road have no access to the grid. They depend instead on expensive power from diesel gensets, costing 45 cents/ kWh. How are we going to grow with rates like that?”

Assignment

Your review indicates that it is possible to expand supply dramatically in the next 18 months. However, your team is concerned about the longer-term financial and technical viability of the system.

The program needs to take into account the dilapidated distribution network, energy supply shortages, high technical and non-technical losses, low cost recovery, lack of qualified DABM/S personnel, on-going dependency on Government and donors for operating and capital expenditures, and a tense security situation.

A budget for these activities has not yet been decided, but, depending on the results of your assessment of a prioritized program design, funding could be up to \$50 million. Tomorrow, you and your team will present the key elements of a new program to the Mission Director and senior USG staff. You know that the Mission Director is frustrated with donor funding that is needed to “prop up” the Kabul electricity system and is looking for a solution in Nangarhar that will deliver strong results in the short term and be sustained in the future.

The main question that you must answer is how to deal with the Nangarhar utility, DABM/S? You should recommend an approach that is likely to result in sustainable services. Please outline your main recommendations in a few (5 – 10) bulleted key points.