

# **Why Building Power and Water Utilities is Like Building a National Army; And Why It is Not**

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**Note: This paper reflects the views of the author; it does not reflect the official views or position of the U.S. Agency for International Development.**

This paper has three main points:

1. Rebuilding electricity and water services requires rebuilding the commercial and institutional capacity of utilities, not just investment in physical infrastructure. In fact, strategies that concentrate principally on rebuilding physical infrastructure for deeply troubled electricity and water utilities usually fail.
2. Rebuilding critical utility services also requires rebuilding a viable commercial relationship between the utility and its customers; we refer to this as “commercialization.” If the commercial side of the electricity or water service remains “broken,” it is unlikely that the services will be sustainable.
3. Centralization of services in the form of networked, large scale utilities is often critical to rebuilding affordable, high quality water, sanitation and electricity services. Strategies that concentrate on highly decentralized services through small-scale service providers generally face problems associated with high costs, insufficient capital and unsustainability.

Electricity, water and sanitation are essential services positively associated with stabilization and economic growth. Electricity is particularly important because of electricity’s direct contribution to security, economic growth, health, education, and governance. The cost, quality, and reliability of electricity supply is particularly important; high cost, unpredictable supply does little to promote stability or economic growth. This latter assertion is supported in numerous public surveys conducted in Afghanistan, Iraq, Liberia, and other conflict and reconstruction situations in recent years.

This paper concentrates on rebuilding electricity services, but we acknowledge that issues facing the water and sanitation sector have similarities with the power sector. We will refer to parallels between the electricity and water sector when appropriate.

## **Why Building Power and Water Utilities is Like Building a National Army**

According to the Washington Post, in 2010, the US Government spent \$9.2 billion on Afghan security forces, and the administration requested another \$11.6 billion for 2011. About a third of the FY2010 budget is for equipment, “about 80,000 vehicles, 175,000 radios and technical equipment, about

400,000 weapons and 146 different aircraft,” according to John Ferrari, deputy commander for programs for the NATO training mission in Afghanistan.<sup>1</sup> The remaining two-thirds is presumably for salaries, benefits, facilities, and operating costs for the security forces.

If I were to ask a group of military experts “Can you build a durable and effective security force in an unstable environment just by supplying equipment and other physical facilities?” I expect the answer to be a resounding “No!”

I admit that I have no military training, but I assume that my colleagues in the military view other investments as critical to the success of a security force. These would include salaries, benefits, personnel, logistics, communications and intelligence systems, and so forth. Without these critical organizational capacities, I doubt my colleagues would consider handing over equipment and buildings to be an adequate strategy to stand up a national security force.

In USAID’s work in Afghanistan, Iraq, Liberia, and Pakistan, I have often observed a significant number of experts engaged in electricity and water system reconstruction who believe that building physical infrastructure is sufficient to “stand up” these services. I have also encountered situations such as Afghanistan in 2004 to 2007 and Iraq in 2010 where large sums of USG and host government funds have been spent on physical reconstruction, with primary indicators of service quality pointing to unsustainable services, unhappy customers, and continuing physical decapitalization. I have worked alongside colleagues, both in the military and civilian agencies, who suggest that investment in the “soft” side of utilities is unnecessary. I was perhaps most surprised in 2009 when during a presentation that I gave on Afghan electricity reconstruction at the National War College, another expert stated that it is not necessary to invest in the institutional rebuilding because the Afghans will do this, and corruption is not a problem to be addressed, but rather a fact of life that we must live with as we concentrate on physical rebuilding.

Evidence suggests that strategies focused on physical rebuilding, without also rebuilding utility institutions, are generally not effective. This is particularly true when there is widespread social disruption, corruption, and poor civil governance. Examples are abundant, and would include:

- The US Government invested \$5 billion<sup>2</sup> in the Iraq electricity sector since 2003. This was complemented by almost \$1 billion in annual investments by the Government of Iraq (GOI). These investments were primarily for physical infrastructure. Yet, in 2010, the sector recovered only 2% to 4% of its costs,<sup>3</sup> services continued to be so unpredictable and intermittent that electricity remains a serious public complaint, and the electricity system suffers crippling maintenance problems.<sup>4</sup>

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<sup>1</sup> “Gauging the price tag for Afghanistan’s security,” Walter Pincus, Washington Post, December 21, 2010.

<sup>2</sup> “A Benchmark of Progress, Electrical Grid Fails Iraqis,” Steven Lee Myers, New York Times, August 1, 2010.

<sup>3</sup> Estimated by Parsons Brinkerhoff, contractor to the Iraq Strategic Programs Office, U.S. Embassy, Baghdad, personal conversations, November 2010.

<sup>4</sup> For example, Iraq Strategic Programs Office staff estimate that 55% of Iraqi generation capacity sits idle due to a combination of poor maintenance, lack of spare parts, and fuel logistics issues.

- Analysis conducted in 2007 showed that the electricity sector in Afghanistan had cash losses increasing from \$50 million to \$250 million between 2007 and 2012. The sector generated little cash for maintenance, and was almost completely reliant on donors to pay major maintenance and capital replacement expenses. The system remained solvent by eliminating maintenance expenditure, freezing salaries below the cost of living, and obtaining capital funds from donors.

Empirical evidence shows that an electricity sector that runs large cash losses, has no funds for maintenance or capital expenditure, and pays wages that require employees to steal to survive cannot operate for long unless the central government has the resources to subsidize the sector on a large scale.<sup>5</sup> Even Iraq has shown that government subsidies do not solve the problems of poor maintenance, widespread theft and unpaid bills.<sup>6</sup>

So, how is building an electricity utility like building an army? Here are some possible similarities:

What makes a large organization successful is not just its physical facilities. People, their incentives, effective communications, IT and management infrastructure matters as much as the physical facilities.

In fact, there are many examples of newly rebuilt and refurbished capital facilities falling into disrepair during conflicts due to the commercial and financial decline of the utility that operates the facilities.<sup>7</sup>

Utility staff, presumably like soldiers, must be trained and motivated within a larger organizational framework that defines a mission, strategies, organizational objectives, roles and operational rules. If an organization does not have funds to pay personnel, maintenance and operating costs, it probably will not sustain services. Salaries and benefits must be enough to attract and retain motivated personnel. Critical systems, including human resource, logistics, materials and inventory, maintenance, financial management are needed. In conflict environments, these institutional features generally must be “hardened” to compensate for the pressures for factionalism, corruption and poor civil governance. Hardening organizations to resist revenue losses and corruption is an art and science in itself.<sup>8</sup>

In sum, rebuilding critical utility services is similar to building a national security force in the sense that the human resources and institutions matter just as much as the physical equipment and facilities. Empirical evidence shows that in most countries and most conflict situations, we will not accomplish our objectives if we concentrate only on the physical infrastructure. Worse, the price of failure – associated with, and branded as, US Assistance – will be high.

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<sup>5</sup> There are many studies of deeply troubled power and water systems, including some that have been turned around. Examples are included in the bibliography.

<sup>6</sup> Many news articles and Special Inspector General for Iraq Reconstruction reports document the poor maintenance, low cost recovery, and bad service in Iraq’s electricity system.

<sup>7</sup> Kajaki Dam in Afghanistan is a good example of this; so are distribution transformers and substations in both Iraq and Afghanistan during recent years. In both countries, distribution utilities have almost no cash for maintenance, and have let their facilities deteriorate steadily.

<sup>8</sup> See for example, PA Consulting’s Kabul Electricity Services Improvement Program MOU Review, July 2010.

## **Why Building Power and Water Utilities is Unlike Building a National Army**

Unlike military systems, most utility systems are businesses that obtain a large share of their income from customers. A viable commercial relationship between the utility and its customers is critical for the sustainability of the utility. Typically, utilities earn their income because they deliver valuable services to customers. Subsidies alone do not solve the problem: many countries have tried to provide heavily subsidized utility services, and in almost all cases, this has led to serious financial and operational difficulties.<sup>9</sup> Even in countries with the resources to subsidize services, like Iraq, Qatar, Saudi Arabia and United Arab Emirates, governments have found that subsidies alone do not create viable utilities; effective relationships with customers and adequate cost recovery are essential.

Experience has shown that when consumers do not pay for their services – for water or electricity – services are rarely sustained or expanded. Decapitalizing, money losing systems tend to provide less service as donor funding declines. This situation has been observed in conflict settings, as well as in situations with poor civil governance. It was widespread after the fall of the Soviet Union, and has been observed in Haiti, Liberia, Iraq and Afghanistan.<sup>10</sup>

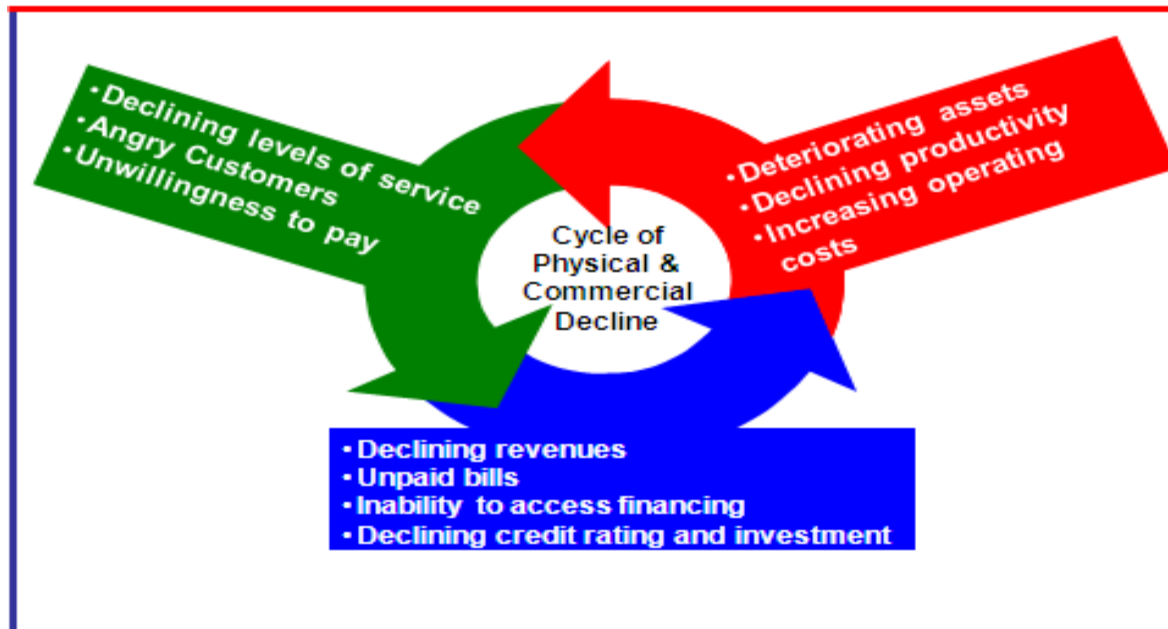
Common features in these situations include: breakdown of the commercial side of the business, inadequate revenues, declining customer service, and subsequent physical decline of the systems. We sometimes refer to this as the “downward spiral” of utilities: as the utility loses its relationship with customers, revenues decline, funds for motivating staff and maintaining equipment become scarce, services deteriorate, and customers become increasingly angry and unwilling to pay for services. This common situation is depicted in the graphic below:

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<sup>9</sup> Asian Water Supplies: Reaching the Urban Poor, Arthur C. McIntosh, published by Asian Development Bank and International Water Association in 2003 provides a good overview of the importance of customer revenues in sustaining urban water utilities. The Georgia UEDS and Pamir Power cases in USAID’s “Operating Contracts for Managing Critical Infrastructure in Difficult Conditions” explain the importance of rebuilding customer relationships and revenues for power utilities.

<sup>10</sup> For example, aggregate electricity losses is very high in most Afghan load centers. In Jalalabad, losses are over 85% of total electricity delivered to the network, and in Kabul, losses are approximately 60% of electricity delivered. Much of this loss is due to systematic underreporting of consumption, unregistered and illegal connections, tampered meters, and customers who are not billed. In most load centers with this level of losses, there are almost no funds for maintenance and repair.

## TYPICAL SITUATION WITH TROUBLED UTILITIES



Interestingly, even in the Middle East, where many governments have the capacity to subsidize electricity and water services, governments have found that when the commercial side of the business – especially the critical commercial linkage between the utility and customers – is weak, demand grows at unmanageable rates, peak demand spikes to levels that cause serious operational problems, and services are negatively impacted. The solution implemented in Egypt, Iran, Jordan, Morocco, Qatar, Saudi Arabia, Tunisia, Turkey and United Arab Emirates has included commercialization of the national utilities. Some countries retain heavy subsidies, but they all meter, bill and collect from customers. This is the “business backbone” of a viable utility, even in heavily subsidized countries.

In these situations, a power or water utility is not like a national army due to the fact that if customers do not pay, the institution will not survive as services degrade. The customer connection is critical to success.

### **Rebuilding the Commercial Side of a Utility**

A common feature of conflict situations is collapse of the commercial side of a utility, whether water or power. As the commercial side of the business collapses, revenues collapse, with the result that funds for maintenance, replacement of equipment and operations, and services collapse. Typical to this cycle of decline are two features: angry customers increasingly unwilling to pay bills, and small scale service providers – neighborhood diesel generator business and individual “captive” electricity generators, and water vendors.

Critical features of rebuilding the commercial side of utilities include:

- Identification and enumeration of customers,

- Installation of tamper-resistant meters and service connections,
- Accurate and prompt billing and collection,
- Improvement in fault response and customer service,
- Disconnection of customers who illegally connect or do not pay their bills.

What is the proof that rebuilding the commercial side of the business is a critical success factor in establishing sustainable, high quality utility services? We have many examples where the commercial side of the business has broken down, and services are unacceptably poor. We find this in Afghanistan, Haiti, Iraq, Liberia, and Pakistan, among others. It is well established that utilities in this condition have serious difficulties with maintenance and replacement of equipment as it wears out.

We also have cases where the focus of donors has been principally on physical reconstruction where services have not improved significantly. As noted above, in Iraq, billions invested by the GoI and USG in the electricity sector has been associated with limited improvement in service. While Iraq faces serious generation shortages, there are also signs of rapid deterioration of generation and distribution facilities.

A similar pattern occurred in Pakistan, where Independent Power Producers built new generation capacity, but due to the commercial failure of the distribution sector, services declined steadily in quality and reliability since the late 1990s, with heavy load shedding and frequent outages in recent years. In Afghanistan, several audits of urban water investments focused almost entirely on physical capacity found that systems were not working less than a year after completion of the physical reconstruction programs.<sup>11</sup>

We have examples of successful rebuilding of the institutional and commercial capacity of utilities from many countries. These examples clearly indicate that as the institutional and commercial capacity improves, services improve. This is the situation currently with Afghanistan's electricity sector, where the combination of large scale network investments such as NEPS and distribution rehabilitation are being combined with distribution commercialization. Because of the success of the "centralized" solution (NEPS), the challenge is now meeting the rapid demand growth in northern and eastern Afghanistan. Other examples of improved electricity and water services that resulted from rebuilding commercial capacity in non-conflict situations are abundant.<sup>12</sup>

### **Centralized versus Decentralized Approaches**

When faced with the challenge of rebuilding critical networked services, there are important choices to be made related to centralization or decentralization of services. Dr. Carl's Schramm's paper "Expeditionary Economics"<sup>13</sup> advocates a "bottom-up approach emphasizing the critical role entrepreneurs play in reconstruction," and he discourages "central planning mindset that currently prevails in the international development community."

<sup>11</sup> One example is "Audit of USAID/Afghanistan's Urban Water and Sanitation Program," Office of the Inspector General, Audit Report No. 5-306-07-006-P

<sup>12</sup> The author has a substantial library of utility turnaround success stories. For specific references, contact the author at [aeisendrath@usaid.gov](mailto:aeisendrath@usaid.gov).

<sup>13</sup> Foreign Affairs, May/June 2010.

While there are many situations where a decentralized approach to providing electricity and water may be effective, there are also many situations where a centralized approach may be advisable, and it would be poor doctrine to reject centralized approaches without careful analysis.

Take the example of electricity in Afghanistan. The initial focus of USG rebuilding effort emphasized installing and operating decentralized diesel generation capacity, completion of the Kajaki Dam and generation facilities, rehabilitation of small hydro facilities, and rehabilitation of distribution in selected load centers, including Mazar-i-Sharif, Aybak, Qalat, and a section of Kabul's distribution grid.

The Afghan national electricity utility, DABS, and the Ministry of Finance have repeatedly stated that decentralized diesel is too expensive for DABS to operate and maintain, and therefore, they will not operate most of these facilities if the USG does not pay the operating costs. The Ministry of Energy has urged donors to build large hydro electricity facilities, including large dams, because large hydro facilities provide reliable electricity that is affordable to Afghan consumers.<sup>14</sup> These hydro facilities need to be connected to a transmission grid to get the power to major load centers. As proposed by the Ministry, they would be far too large to serve just the local market.

Efforts to rehabilitate and complete several hydro electricity projects were broadly successful in adding generation capacity, but the added capacity was still far below demand for electricity in the communities served. In addition, the fact that the Kajaki Dam was located at the far end of the Sangin Valley, an area with high security risks, led this project to install only one of two new turbines that were planned. Therefore, Kajaki, which serves Kandahar City, as well as communities in Helmand and Kandahar Provinces, failed to produce enough power to meet more than 25% of Kandahar City's demand.<sup>15</sup>

As an alternative to obtain low cost electricity, major donors, including the USG, agreed in 2005 to construct a transmission system running from Central Asia through north and eastern Afghanistan to the Kabul load center. The resulting North East Power System (NEPS) was commissioned in 2008, and since then has carried an increasing amount of low cost electricity to load centers along the line, including Kabul. This is an example of where a centralized solution is working.

In fact, many communities in Iraq and Afghanistan that have power have it because they have networks linked to more stable neighboring countries' electricity grids. Afghanistan has fifteen transmission lines that link regional grids to much larger electricity grids in neighboring countries. These interconnections supply nearly continuous power to many load centers in Afghanistan, including large load centers like Mazar-i-Sharif and Herat, two cities with relatively good power supply.

In the case of the NEPS, this transmission grid will supply wholesale electricity to northern and eastern Afghanistan at 3.5 cents per kWh from Tajikistan and at 6 cents per kWh from Uzbekistan, prices far

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<sup>14</sup> There is an added advantage of hydro facilities: if a donor builds the facilities, the operating and maintenance cost is very low, and tariffs can be held at very low rates as well.

<sup>15</sup> Kandahar City's peak demand is estimated to be nearly 50 MW, while only 12 MW of Kajaki's total of 31.5 MW of generation capacity is available to serve Kandahar; the remaining Kajaki output goes to other load centers in Helmand and Kandahar Provinces.

lower than power produced from diesel fuel.<sup>16</sup> A general point here is that if one of the objectives of a rebuilding program is to provide continuous electricity to run modern equipment and facilities, it is often necessary to support a network that includes large-scale, least-cost generation. Without access to least-cost generation, the public may be saddled with expensive wholesale generation and potentially also with intermittent supply.<sup>17</sup>

In general, while there are situations where decentralized approaches may be desirable, it may also be advisable to consider the option of rebuilding larger national or regional networks, as these larger networks often make it possible to access low cost generation sources, to diversify supply, and to benefit from the economies of scale that modern utilities achieve.

In conclusion, rebuilding power and water utilities is like building a national army in that sufficient investment in rebuilding the institution and its critical systems is critical for success. It is unlike building an army because rebuilding the utility generally must include rebuilding the critical commercial relationship between customers and the utility. In addition, the choice between large scale networked systems and small scale decentralized systems is a complex one, depending in part on medium and long term objectives, and available resources.

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<sup>16</sup> It is also interesting to consider how much it would cost to build 250 MW of photovoltaic capacity to provide the same amount of power as can be obtained via NEPS from Central Asia. A recent prefeasibility study examining a possible PV plant for Kandahar estimated that the capital cost of a complete PV plant would be \$7 million per MW, and so the equivalent PV capacity for northern and eastern Afghanistan would be \$1.75 billion, compared to the approximately \$500 million that has been spent on NEPS.

<sup>17</sup> Examples of intermittent supply would include PV and wind without battery storage, and run of river hydro plants in locations that have low fall and winter river flows.

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