TURNING THE LIGHTS BACK ON:

STRATEGIES FOR PRIVATE PARTICIPATION IN ELECTRICITY INFRASTRUCTURE IN POST-CONFLICT STATES

Master of Arts in Law and Diplomacy Capstone Project

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Strategies for Private Participation in Electricity Infrastructure in Post-Conflict States

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Chapter One: Introduction

Keeping the Lights On in Berbera, Somaliland

In Berbera, Somaliland, a small port town on the Gulf of Aden, a young entrepreneur named Abdirizak decides to start up a small ice-making factory. He acquires the shop space (a converted bank from the colonial era), and imports the ice-making machine from China. He hooks up the water and electricity connections, virtually the sole inputs that the venture requires, and is ready to open for business. After a one-day promotion during which he gives away free ice, his market is locked in. Word spreads throughout town and on the first day that he is officially open, ice is "flying off the shelves." In a town known for its notoriously sweltering conditions, fishermen, shopkeepers, and little boys from households nearby flock to the store to fill their plastic bags and buckets with ice. Abdirizak keeps his ice-making machine running for eight hours a day, every day, and is able to sell everything he produces. His business investment would be an overwhelming success, were it not for one mitigating factor: the electricity costs required to run the machine. All of the electrical power in the town is provided by diesel-fueled generators, mostly less than one megawatt in capacity, run and distributed by local entrepreneurial businessmen. Abdirizak pays one U.S. dollar per kilowatt hour for his electricity, over ten times what an equivalent businessman would pay in the U.S. Given the amount of electricity that he must consume to run his ice-making machine, this cost alone significantly eats into his profits.

The Nature of the Problem

This story is a familiar one across many developing countries of all types and characteristics – post-conflict or non-post conflict, African or Asian. From an ice-making business in the Horn of Africa, to a brick production machine in Afghanistan, the damage caused to small and medium-sized businesses in emerging markets by infrastructure gaps, in particular in the electricity sector, is a critical stumbling block. Although infrastructure investment gaps are huge in developing countries as a whole, these problems are even further exacerbated in such countries when they are emerging from conflict. These challenges are perhaps most pronounced in the electricity sector.

Virtually all post-conflict countries face massive infrastructure gaps, particularly in the energy sector, and filling these gaps is critical for economic recovery and growth. Governments of post-conflict states have very limited public funding to draw on, and donor funding is in short supply as foreign

development assistance budgets shrink ever smaller in the wake of the global recession. As a result, many post-conflict governments, from Afghanistan to Sierra Leone, have declared their intentions to attract investment into their electricity sectors through the private sector. However, the inherent characteristics of many post-conflict countries make this extremely difficult.

This thesis seeks to answer a central question: how can post-conflict countries successfully promote private participation in electricity infrastructure? Are there any "success stories" of existing strategies that have effectively attracted private investment into electricity sectors in post-conflict contexts? Can such approaches be applied to a specific post-conflict context, to develop new and innovative models for electrification?

As a first step, the study examines the case literature for examples of success stories of countries that have effectively attracted private investment into the electricity sectors of post-conflict countries. While the older literature focuses on the more "traditional" model of public-private partnerships (PPPs), the most recent literature is beginning to point toward a new model of alternate supply of power by small, entirely-private companies (independent power providers, or IPPs). In its second half, the study examines evidence from a real-world context: the electricity sector of Somaliland. In addition to a qualitative analysis of the sector's economic, political, and sociocultural characteristics, the study builds a financial model of the country's energy sector and conducts a sensitivity analysis of the effects of various sizes and types of generation/distribution capital expenditures.

Findings

Preliminary evidence from the literature suggest that in regions emerging from conflict, independent local power providers can be a viable option for sustainable, long-term investment in electricity systems. They are in the country for the long term, understand the local context, and have relatively greater tolerance for risks such as exchange rate risk (whereas internationally-funded infrastructure projects typically face currency mismatches between debt in hard currency and revenues in local currency). Yet these providers face a fundamental problem: they lack access to large amounts of capital and generally also the technical expertise to execute a modern, efficient electricity system.

In the primary research section, this study analyzes data from Somaliland, a post-conflict country representative of the critical demand constraints facing the electricity sectors of many other countries emerging from conflict. Somaliland presents a quintessential example of the model identified variously in the literature as "alternative private supply of power" (APS), "small power producers" (SPPs), "community-level mini-utilities," or "isolated mini-grids." Small private companies provide virtually all of the country's electricity supply through small-scale diesel generation. Although the achievements of the system are impressive given the complete lack of external financing, it faces major constraints to expansion and efficiency due to a variety of factors including fragmentation and lack of access to capital.

Based on an in-depth analysis of the Somaliland electricity sector, the study finds that investments by small private providers in diesel generation expansion can be profitable above a scale of approximately 2,000 connections. Further, the study finds that at certain scales (approximately 17,000 connections, or 6 MW), investment can become profitable for technologies such as solar photovoltaics (PV), which are

more efficient but comparatively more expensive in initial costs (solar PV generation costs a minimum of USD 6.8 per watt installed, in a country where the average formal GDP per capita is estimated to be USD 347). However, for solar PV to become profitable, private providers must be willing to extend their investment horizons to a minimum of ten years. For the sector as a whole, profitability is highly sensitive to several variables, including the number of households connected, the energy tariff charged, the price paid for diesel fuel, the collection rate of tariffs, generator efficiency (number of kilowatt-hours which can be generated from one liter of diesel), and total number of utilization hours per year. Moreover, generation and distribution capital expenditures on almost any scale require access to much larger pools of capital, and greater technical expertise, than are currently available in Somaliland.

Where small, local IPPs already exist in post-conflict countries, they may present the most viable solution to address critical electricity sector deficits (at least in the near term), particularly in the absence of forthcoming foreign investment. Yet to achieve any significant long-term capacity and/or efficiency upgrades, these companies need to consolidate, in order to attain the economies of scale and risk-pooling these investments necessitate. To this end, there is a useful role to play for international actors and stakeholders, both lending institutions such as the World Bank and Asian and African Development Banks, as well as contractors such as Development Alternatives Inc. (DAI) and AECOM who are responsible for carrying out the projects on the ground. These actors must focus on developing the capacity of IPPs and supporting them to make necessary reforms.

Recommendations

Based on the results of the analysis, the study makes the following recommendations:

1) Raise awareness among the local investment community about basic financial concepts such as the need for payback periods of a minimum of ten years for large capital investments
    - Post-conflict investment climates are inherently extremely unpredictable, and local investors are aware of the high risk of failure[1]
    - A number of NGOs are already involved in arranging PPPs in post-conflict countries (UNICEF in water, FAO, UNDP, UN Habitat, etc., as well as for-profit contractors including DAI)
    - These implementing agencies should focus efforts on supporting already-existing IPPs, and conduct targeted workshops or training sessions for IPPs to raise awareness about basic financial concepts (i.e. appropriate payback periods for large capital investments in generation and distribution), and possibly intermediate concepts such as discounting of future cash flows

2) Demystify technologies such as solar PV
    - Many private energy producers in fragile environments invest only in what they know and are comfortable with, i.e. diesel generators; there is a perception that these are the most profitable investments because they can begin delivering power and generating revenues quickly
    - In most fragile and developing countries, technologies such as solar PV are poorly understood

[1] Somaliland's National Industry Association reported that 39 out of the 54 small and medium industries registered with them had failed (USAID/DAI 2011).

- In addition to basic training in financial concepts, implementing agencies (UNICEF, FAO, UNDP, DAI etc.) should conduct information sessions for IPPs on alternative technologies such as solar PV and their potential for long-term cost savings[2]

3) Provide guidance in the value of consolidation and economies of scale
   - IPPs need to achieve certain scales of generation capacity and/or a critical mass of household connections to ensure long-term financial sustainability; an externally-financed market assessment can identify the correct economies of scale for a given context
   - In Somaliland, the present study finds that a scale of approximately 17,000 connections, or approximately 6 MW, is the correct order of magnitude to generate the economies of scale required for necessary grid expansion and/or efficiency upgrades (in comparison, large "traditional" PPP generation projects in the region, such as the Bujagali dam, are on the scale of 250 MW in installed capacity)

4) Raise awareness about the value of investing in improved tariff collection
   - This study finds that increasing tariff collection rates to as much as 80% or 90% of total connections has the capacity to substantially improve power providers' profitability
   - Awareness campaigns for power providers and/or the general public would promote understanding and acceptance of these "soft-side" skills

5) Focus attention on shifting local investor attitudes and the broader investment climate
   - Although pools of investment tend to be small in post-conflict countries, evidence from Somaliland and other post-conflict countries shows that IPPs typically access up to 50-100% of their financing from family borrowing and/or informal debt
   - The private power industry typically has very low margins, (in Somaliland, depending on the scale of the project, an increase in diesel price of USD 0.20 can decrease project revenues by a factor of four), and a high risk of failure
   - As a result, the IPP sector of many post-conflict countries can be fiercely competitive; any threat of new entrants or shift in market share can be viewed as a direct threat, which can be particularly dangerous in contexts without formally installed contract enforcement mechanisms
   - In many post-conflict contexts, IPPs also have strong sectarian affiliations (in the case of Somaliland, through the country's extensive lineage group/clan system); these affiliations underlie many business decisions
   - In addition to conducting a capacity building program for IPPs, NGOs and contractors should begin by convening an open dialogue between all IPPs, to reduce the climate of competition and perceptions that the sector is a "zero-sum game," where winners gain at everyone else's loss, and promote the importance of consolidation

[2] As opposed to diesel generation; for example, the present study finds that based on assumptions of load utilization hours, generator efficiency, and current diesel prices of USD 1.00 per liter, IPPs spend USD 26,000 on diesel fuel for as little as 20 kW in capacity, and as much as USD 26.25 million for the capital city of Hargeisa

6) Facilitate financial institution buy-in
   - In post-conflict countries, when financial institutions do exist in some form (whether commercial banks regulated by a central bank, or non-regulated banks), they are extremely risk-averse and unwilling to provide financing either in the volume required or in unproven technologies such as solar power
   - Evidence from innovative new groups such as the Small-Scale Sustainable Infrastructure Fund (S3IDF)[3] has shown that externally-backed full or partial loan guarantees (from as little as USD 1,000 to USD 40,000) to local financial institutions can play a catalyzing role in encouraging them to lend to local electricity projects; however, activities at this scale tend to be extremely time and energy intensive and typically require at least partial grant subsidization
   - Traditional donors such as USAID and DFID can better target their lending dollars by subsidizing initial loan guarantees to local financial institutions; evidence has shown that these can leverage two to four times this amount in capital injected by local entrepreneurs and banks
   - These projects can play a "demonstration effect" role as a result of which domestic institutions ultimately feel more confident lending on their own

These recommendations are relevant to many states and regions emerging from conflict. In such contexts, independent local power providers already in operation can be a viable option for sustainable, long-term investment in electricity systems. Yet evidence from countries such as Cambodia and Liberia has shown that small local independent power providers, which spring up to fill the deficit immediately after and even during a conflict, are often displaced when relative stability has returned and foreign donor funding begins to flow in, which underprices domestic competitors because of its concessional rate loans and economies of scale. This thesis therefore develops a model to demonstrate how these companies can reach the level of scale they need to achieve efficiency, through which they can deliver power affordably and sustainably and play a critical role in filling this critical infrastructure gap.

Methodology and Structure

A desk review was conducted of the current scholarship on infrastructure investment in post-conflict settings, as well as the existing evidence from the case literature. These cases are drawn from countries across a range of regions and levels of development, and serve to illustrate the models discussed in the academic literature. Models include the public sector-led or public/private partnership approach (Afghanistan, Sierra Leone, and Pakistan); the cooperative approach to rural electrification (Costa Rica and rural United States); and the entirely private supply approach (Lebanon and Cambodia).

Primary research was conducted on the ground in the autonomous region of Somaliland, in the towns of Hargeisa, Gabiley and Wajaale. The author interviewed key informants as well as technical experts and experts familiar with the Somaliland energy sector.

[3] http://s3idf.org/

The thesis is organized as follows: Chapter One provides an overview of the existing state of infrastructure in post-conflict countries and the challenges for infrastructure investment in these contexts. Chapter Two presents the existing body of academic scholarship, and Chapter Three presents relevant examples from the case literature. Chapter Four delves into the details of the specific context of Somaliland, and builds a real-world model of the region's energy sector using existing data. Chapter Five provides recommendations for relevant external interventions.

The Existing Investment Gap in Infrastructure in Post-Conflict Countries

Gaps in infrastructure investment in developing countries overall

The infrastructure investment gap in emerging markets, and the resultant toll on their economies, has been widely documented.[4] It is estimated that developing countries will need to invest an additional USD one trillion per year in infrastructure until 2020, equal to approximately 6-8% of their GDPs, just to keep pace with their own growth. A country such as Kenya is indicative; in 2010 Kenya was estimated to have an infrastructure deficit of USD four billion, equivalent to 20% of its GDP,[5] despite the fact that Kenya has one of the highest shares of power spending as a percentage of GDP according to World Bank data. [6] Evidence varies by country, but the largest investment gaps tend to be in the electricity, water, and transport sectors. These infrastructure shortages represent a critical unmet need for the millions of people who do not have access to clean water or electricity. They also represent a major stumbling block holding back the growth and competitiveness of businesses, both large corporations and small and medium enterprises. Access to reliable and relatively affordable power can be one of the deciding factors between businesses succeeding or failing in emerging economies.

The electricity infrastructure gap is particularly acute, and nowhere is it more acute than in sub-Saharan Africa. A key 2011 study on the continent's power infrastructure by the World Bank found that sub-Saharan African countries need an estimated USD 40.8 billion per year to meet their power sector needs, or an estimated 6.35% of the continent's GDP, a need greater than that of any other infrastructure sector including telecommunications, transport, and even water and sanitation.[7] Of this amount, two-thirds is needed to fund new capital expenditures, and one third is needed for operation and maintenance of existing systems. Seventeen countries face major funding gaps, led by Ethiopia and the Democratic Republic of the Congo, which will need to spend the equivalent of 23% and 18% of their respective GDPs to address these shortages. [8]

[4] See for example Fiona Stewart, "Practical Solutions and Models for Addressing Obstacles to Institutional Investment in Infrastructure in Developing Countries" (Concept Note, 2013).
[5] Ibid.
[6] Anton Eberhard et al., *Africa's Power Infrastructure: Investment, Integration, Efficiency* (Washington DC: The World Bank,[2011]).
[7] Ibid.
[8] Ibid.

Contrastingly, Sub-Saharan Africa is currently spending only USD 11.6 billion per year to meet its power sector needs, equivalent to only 1.8% of the continental GDP. The lion's share of current spending to address these challenges comes from domestic sources (80% from sources such as taxes or user charges), of which the majority goes to simply maintaining and operating existing systems. What limited domestic private sector funding there is often channels into the telecommunications sector. [9]

Two major factors affecting Africa's energy gap are system inefficiencies and uneconomic tariffs. Sub-Saharan Africa reportedly loses the equivalent of 1.28% of its GDP to technical and "non-technical" system losses such as theft, undercollection of revenues, and overstaffing.[10] The largest of these inefficiencies is below-cost power pricing, reported to account for 44% of all losses due to inefficiency. As in many developing regions, tariffs in sub-Saharan Africa are often set at an unsustainably low rate, even though the region still has an average power tariff more than twice that of other developing regions such as South Asia. Reasons that power costs are so high in Africa include a lack of economies of scale through regional integration, high fossil fuel prices, low water levels for hydroelectricity, and unstable political environments. The region's mispriced tariffs often do not cover costs, for example due to inefficiently targeted tariff structures that decrease with increased consumption (in effect cross-subsidizing the rich). In addition, it is estimated that the largest potential gains from reducing inefficiencies would be by simply increasing tariff collection rates from the current average of 88.4% to 100%.[11]

While the extent of the continent's energy gap is understood, the key question remaining is how to finance it. State budgets are cash-strapped, so a deciding factor will be the role that private participation will play in the sector in the future. There are signs that private capital flows to power sectors in Africa may be increasing. However, in most countries, domestic borrowing is limited and extremely expensive. There is a possibility that local capital markets will play a role a role in equity financing in the medium term, at least in the most stable low-income countries and those that are resource-rich. Yet the most likely source of capital at least in the near term is financing from non-OECD countries, most notably India, China, and the Middle East, in decreasing order of costs of capital. Non-OECD financing has accounted for an estimated USD 1.1 billion per year of investments in the African power sector. The Chinese in particular have led, though they have focused on large hydropower schemes and the projects they select tend to align with their business interests, often in the natural resource extraction sector.[12]

In a region already suffering from an acute energy sector funding deficit, a further contrast emerges: the lag between stable countries and those recovering from recent conflict. According to data gathered on sub-Saharan Africa through the World Development Indicators, the contrast is stark: in the electricity sector, conflict-affected states in sub-Saharan Africa average only 96 kWh per capita, as compared to over three times more (384 kWh per capita) in non-conflict-affected countries.[13] The results are similar

[9] Ibid.
[10] Ibid.
[11] Ibid.
[12] Ibid.
[13] Jordan Schwartz, Shelly Hahn and Ian Bannon, *The Private Sector's Role in the Provision of Infrastructure in Post-Conflict Countries: Patterns and Policy Options* (Washington DC: The World Bank,[2004]).

in other sectors; in telecommunications, the number of fixed and mobile lines per 1000 people is 19 in conflict-affected states versus 67 in non-conflict-affected states, while in the transport sector the respective percentages of roads that are paved are 13% versus 27%. [14] By their very nature, conflicts damage or destroy infrastructure. A dearth of infrastructure, in particular roads, can in some cases even increase countries' vulnerability to conflict. Rebuilding infrastructure is one of the first steps governments can take to restore confidence and project stability. Yet conflict also makes it even more difficult for already-weak states to attract the financing that they so desperately need.

The developmental benefits of infrastructure

There are significant data which demonstrate the link between improved infrastructure and economic growth through a number of direct and indirect channels, including increased employment, reduced trade barriers, and improved health. For example, in Africa, one econometric study found that if all countries were able to increase their infrastructure stock to the level of Mauritius, the regional leader in infrastructure, their GDPs would be an average of 2.2 percent higher per year.[15] The potential GDP growth improvement for a country such as the Democratic Republic of the Congo, which has one of the largest deficits in Africa, could be as high as 3.3 percent.[16] Another study showed that around the world, improved infrastructure has been associated with decreased inequality.[17] Studies have shown that USD 100 million in infrastructure investment can generate up to 50,000 direct and indirect jobs, and investment in transport such as roads reduces the logistical costs of trade, which are often higher than the costs of trade policies, while also indirectly addressing problems like maternal mortality.[18]

On the other hand, when countries are unable to invest in their infrastructure sectors, the costs for their economies are great. According to development economist Paul Collier, formal sectors are unable to develop in the absence of a reliable power system.[19] In post-conflict Uganda, companies reported that lack of power was the most important impediment to private investment.[20] Deficits in roads and the transport sector can also be a major bottleneck which constrains economic development.[21] On the other hand, investments in roads can potentially have a role to play in reducing inequality by integrating the rural economy into the urban market; for example, post-conflict Uganda prioritized rural roads, and the World Bank found the return on this investment to be up to 40%.[22] Developing countries, both post-conflict and not, have much to gain from investing in infrastructure and much to lose if they do not.

The challenge of infrastructure investment in post-conflict countries

[14] Ibid.
[15] Cesar Calderon, *Infrastructure and Growth in Africa* (Washington DC: The World Bank,[2009]).
[16] Ibid.
[17] Cesar Calderon and Luis Serven in Stephen Jones and Simon Howarth, *Supporting Infrastructure Development in Fragile and Conflict-Affected States: Learning from Experience* (London: UKAid,[2012]).
[18] Amar Bhattacharya, Mattia Romani and Nicholas Stern (2012) in Stewart 2013.
[19] Paul Collier, *Post-Conflict Recovery: How should Policies be Distinctive?* (Oxford University: Centre for the Study of African Economies, Department of Economics,[2007]).
[20] Ibid.
[21] Jones and Howarth, *Supporting Infrastructure Development in Fragile and Conflict-Affected States: Learning from Experience*
[22] Collier ibid.

Many policymakers, in both developed and developing countries, have made the promotion of private sector participation in infrastructure a top agenda priority.[23] This is unfortunately more realistic in some countries than others. Many fragile and post-conflict states release national strategies calling for the rapid attraction of private participation in infrastructure. Yet in these countries, the constraint on international investors is not a shortage of funds, but a lack of projects with an acceptable degree of risk.[24] In the African Development Bank's 2011 report on Sierra Leone's infrastructure sector, it is recommended that private participation in infrastructure "be encouraged because it will generally accelerate the time-frame on which such investment can be realized."[25] Even the government of Somaliland, the autonomous region of Somalia which is not internationally recognized, has issued a Somaliland National Public-Private Partnership (PPP) Policy. The policy document, recognizing "PPP as an important approach for development," states the government's intent to leverage "private sector resources from local and international markets to accelerate needed investments in infrastructure and services."[26] While lofty in ambition, these policies are often unrealistic for governments of countries which have so recently emerged from conflict. Infrastructure investment is risky enough even in the most stable of contexts, and in post-conflict contexts there are a host of additional risks which will be discussed further below.

Challenges to Filling the Gap: Infrastructure, the Electricity Sector, and Post-Conflict Countries

Infrastructure: why is it so difficult?

The infrastructure sector presents a unique challenge for investment in all countries, whether developed or developing, for reasons which have been widely documented in the literature.[27] Infrastructure often requires a level of government involvement that is not present in other sectors, in large part because infrastructure can be a case of market failure in which the free market does not supply the good efficiently on its own.[28] Infrastructure is often seen as a public good, which cannot exclude non-paying users, which makes investing the large upfront sums necessary unattractive. In addition, the large upfront investments create barriers to entry for potential competitors, which tend to create natural monopolies.[29] The state therefore often has to step in to play a more prominent role, either incentivizing investment or regulating it.[30] Another prominent characteristic that distinguishes the infrastructure sector from some others is the necessity of mobilizing very large amounts of capital and investing them

[23] Stewart ibid.
[24] Ibid.
[25] *Infrastructure and Growth in Sierra Leone* (Tunis: The African Development Bank,[2011]).
[26] *Somaliland National Public Private Partnership Policy and Public Private Dialogue Policy*Ministry of Commerce, Industry and Tourism, Republic of Somaliland.
[27] See for example Anand; Jones and Howarth; Stewart.
[28] P. B. Anand, *Getting Infrastructure Priorities Right in Post-Conflict Reconstruction* (Helsinki: United Nations University, World Institute for Development Economics Research,[2005]).
[29] Jones and Howarth ibid.
[30] Anand ibid.

as difficult-to-recuperate sunk costs.[31] Infrastructure projects, from power plants to seaports to road networks, require sums of money that are generally on an order of magnitude much larger than other sectors with large fixed costs, such as manufacturing, and these projects can take several years until they begin to receive positive cash flows. For this reason the infrastructure sector encourages more risk-averse behavior in investors than some other sectors.

The challenges described above are further exacerbated in developing countries. Many developing countries are faced with technical barriers to implementing projects including lack of knowledge and technical capacity, and an unattractive enabling environment, for example due to cumbersome regulatory barriers.[32] They are also faced with financial barriers, including high real or perceived sovereign risk, giving investors a lack of confidence in the government as a counterparty and making it difficult for the government to receive an investment-grade rating. Local financial markets are often underdeveloped, with nascent capital markets and limited and expensive domestic borrowing. Limited available data makes estimating key project economic variables, such as customer usage, difficult. All of these factors result in a shortage of projects which are considered acceptably bankable or profitable by international investors.[33]

Challenges of the electricity sector in particular

Not all infrastructure sectors are equal in their attractiveness to investors. Sectors such as transport, electricity, water/sanitation, and telecommunications vary in their cost structures and other characteristics which affect their profitability. Evidence shows that investments in the telecommunications sector are generally the first to emerge in countries even during or immediately after conflict.[34] Investments in telecommunications, particularly mobile telephony, generally have a much shorter cost recovery period than other investments.[35]A key reason for this is that mobile telephony can easily be turned into a pay-as-you-go system, which in general fits more easily into the small, unpredictable income streams of users in developing and unstable countries.[36] Pay-as-you-go is possible for mobile telephony because of the cost structure of the technology, which typically features lower fixed costs, and therefore low-consumption users can pay in small installments as they have available funds instead of having to pay one large lump sum upfront.[37] Another success factor of mobile telephony is that it represents very real cost savings for consumers which are not easily substitutable. In cash-strapped communities, time and energy (manpower or animal power) is usually one of the few resources which is freely abundant, so the cost savings that electricity can achieve in terms of people's time are not as valuable. On the other hand, a mobile phone call can replace an hour's or day's worth of travel into town, which is not easily substitutable. Finally, deregulation in many developing countries'

[31] Jones and Howarth ibid.
[32] Stewart ibid.
[33] Ibid.
[34] Schwartz ibid.
[35] Ibid.
[36] *The Potential for Alternative Private Supply of Power in Developing Countries* (Washington DC: The World Bank,[2014]).
[37] Ibid.

telecommunications sectors has led to robust competition among companies, driving down prices for consumers.

In contrast, for electricity (as well as most other types of infrastructure including fixed-line telephony), many of these features of mobile telephony are not feasible. [38] It is difficult to make electricity into a pay-as-you-go system, with the exception of some innovative models which are in the early stages of development, such as portable batteries which customers can pay to charge.[39] The cost structure of electricity generally entails much higher fixed costs, both for generation, which can entail huge investments in power plants, as well as in transmission/distribution, especially for regions which are not already grid-connected such as rural areas. Investment is therefore very unattractive in areas in which consumers are likely to consume little or be unable to pay (as will be discussed further in Chapter Three). While electricity can create cost savings, there are also productive substitutes for electricity (such as manpower or kerosene) which may be cheaper or perceived to be cheaper by poor customers.[40] The electricity sector also tends to feature heavier regulation than mobile telephony, for reasons including the natural tendency toward monopoly created by electricity's high barriers to entry, as well as the greater safety concerns associated with electricity generation and distribution.

Challenges for post-conflict states in particular

There are many reasons why infrastructure investment in post-conflict states is particularly difficult, which have also been widely documented elsewhere.[41] Post-conflict countries face two related difficulties: first, attracting private investment, and second, absorbing nonprofit donor funding.[42] At the most basic level, institutions and legal arrangement generally no longer function as well as they did before the conflict.[43] Conflict can cause diminished collective action, through overall distrust as well as sectarian dynamics exacerbated by the conflict, further aggravated by large-scale displacements.[44] Accountability mechanisms which were often weak before a conflict, (in some cases contributing directly to the conflict itself), generally deteriorate even further during the conflict.[45]

From an economic perspective, post-conflict countries are often in a particularly bad macroeconomic state to attract infrastructure investment. Governments have frequently depleted their foreign reserves and taken on large levels of borrowing due to the need for military spending.[46] Governments are also typically very unattractive counterparties as conflict has weakened the social fabric and rule of law, leading to poorly defined property rights and higher risk of non-payment, and higher performance risk due to lingering security threats. It may be easier for governments to attract donor reconstruction aid, but this can create distortionary effects on local prices in the long run as free or concessionary-priced

[38] The Potential Supply of Power in Developing Countries 2014
[39] See for example http://egg-energy.com/.
[40] The Potential Supply of Power in Developing Countries 2014
[41] See for example Anand, Schwartz, Jones and Howarth, CEPA.
[42] Schwartz ibid.
[43] Ibid.
[44] Anand.
[45] Ibid.
[46] CEPA.

infrastructure can underprice and crowd out regular infrastructure investments set at cost-recovering prices.[47] The project finance environment is typically characterized by low capacity, weak systems such as procurement processes, and an incentive to rush through projects as quickly as possible to deliver visible results and restore faith in the government.[48] On the other hand, rushed projects have the potential to do more harm than good if they are unsuccessful and cause people to actually lose faith in the government, potentially exacerbating local tensions or sending negative signals to potential international investors.[49]

Conclusions

In sum, while all developing countries face challenges attracting investment to infrastructure, particularly electricity, post-conflict governments face even greater challenges in attempting to rebuild their countries' devastated infrastructure. These governments must be all the more innovative and persistent if they are to be successful in attracting the investment their countries so desperately need.

References

African Development Bank. *Infrastructure and Growth in Sierra Leone*. Tunis: The African Development Bank, 2011.

The Potential for Alternative Private Supply of Power in Developing Countries. Washington DC: The World Bank, 2014.

Somaliland National Public Private Partnership Policy and Public Private Dialogue Policy: Ministry of Commerce, Industry and Tourism, Republic of Somaliland.

Anand, P. B. *Getting Infrastructure Priorities Right in Post-Conflict Reconstruction*. Helsinki: United Nations University, World Institute for Development Economics Research, 2005.

Calderon, Cesar. *Infrastructure and Growth in Africa*. Washington DC: The World Bank, 2009.

Collier, Paul. *Post-Conflict Recovery: How should Policies be Distinctive?*. Oxford University: Centre for the Study of African Economies, Department of Economics, 2007.

Eberhard, Anton, Orvika Rosnes, Maria Shrakatan, and Haakon Vennemo. *Africa's Power Infrastructure: Investment, Integration, Efficiency*. Washington DC: The World Bank, 2011.

Jones, Stephen and Simon Howarth. *Supporting Infrastructure Development in Fragile and Conflict-Affected States: Learning from Experience*. London: UKAid, 2012.

[47] Ibid.
[48] Jones and Howarth.
[49] Ibid.

Schwartz, Jordan, Shelly Hahn, and Ian Bannon. *The Private Sector's Role in the Provision of Infrastructure in Post-Conflict Countries: Patterns and Policy Options*. Washington DC: The World Bank, 2004.

Stewart, Fiona. "Practical Solutions and Models for Addressing Obstacles to Institutional Investment in Infrastructure in Developing Countries." Concept Note.

Tipping, Andrew and Paul Lewington. "The Potential for Alternative Private Supplies of Electricity, Presentation to the International Finance Corporation."

Chapter Two: Review of Existing Scholarship

Overview

There is a small but growing literature on infrastructure investment in post-conflict settings, much of it in the form of "lessons learned," knowledge-gathering documents making policy recommendations. The literature tends to reveal a general consensus on certain aspects of post-conflict infrastructure investment, such as the sequencing pattern of the order in which sectors tend to attract investment. Much of the literature also comes to the same general conclusions on lessons learned, for example the need to attract private investment as early as possible. Although these studies draw on the empirical evidence of the experience of governments, donors, and investors, they tend to draw fairly generalized conclusions that do not provide very specific, actionable recommendations. The present study seeks to address this gap in the literature by developing a quantitative model based on real-world data of a specific post-conflict context, the autonomous region of Somaliland.

This chapter reviews the overall literature on infrastructure investment in post-conflict contexts. It also reviews two other bodies of literature: 1) the body of work on public-private partnerships (PPPs); and 2) literature on "alternative private supply of power" (APS) or "small power producers" (SPPs). Both models have demonstrated advantages and disadvantages. The literature on public-private partnerships has shown that when well-executed, these projects attract critical international investment to places that might otherwise be considered too risky and bring long-term developmental benefits.[1] On the other hand, evidence has shown that these projects can be subject to many challenges including poorly prioritized investments, poorly forecasted costs and revenues, inability to recover costs, and lack of long-term engagement, as well as bribery and corruption issues.[2] Small-scale alternative private providers have certain benefits including their tolerance for risk, low transaction costs, ability to accept local currency, and understanding of local contexts.[3] On the other hand, they face major challenges including lack of access to capital and technology, and lack of quality controls.

Infrastructure investment in post-conflict settings

P.B. Anand (2005) presents an overview of the particular challenges and unique characteristics of infrastructure investment in post-conflict contexts; in these settings, reconstruction is essential, yet also particularly difficult for a variety of reasons, including complex sectarian dynamics, diminished collective action due to conflict, weak accountability mechanisms, missing baseline data, and displacement of

[1] See {{11 PPIAF/World Bank 2009;}}; Benjamin Esty, Frank Lysy and Carrie Ferman, *An Economic Framework for Assessing Development Impact* (Boston: Harvard Business School,[2003]).

[2] See Philippe Dongier and Laszlo Lovei, *Infrastructure: Lessons from the Last Two Decades of World Bank Engagement* (Washington DC: The World Bank,[2006]).; Charles Kenny, *Publishing Construction Contracts as a Tool for Efficiency and Good Governance* (Washington DC: Center for Global Development,[2011]).

[3] See *Provision of Infrastructure in Post Conflict Situations* (Cambridge: Mott Macdonald,[2005]).; *The Potential for Alternative Private Supply of Power in Developing Countries* (Washington DC: The World Bank,[2014]).

people.[4] As discussed in Chapter One, the infrastructure sector itself is unique for a variety of reasons. Anand outlines a series of general steps to plan infrastructure priorities including inclusive consultations and coordination with stakeholders, conflict analyses to determine how infrastructure issues might affect conflicts, setting of long-term and short-term goals, creating accountability mechanisms, and learning from mistakes. Yet the paper does not provide any specific examples of how these steps have been/could be applied in practice.

DFID's 2005 study commissioned on "Provision of Infrastructure in Post-Conflict Situations" provides many similar recommendations.[5] The study recommends that potential investors engage relevant stakeholders early, be committed for the long term, and also be prepared to begin early, sometimes even before conflict has fully stopped. Investors should also work to ensure their work is conflict-sensitive, meaning that it "does no harm," for example by creating corruption or security issues due to the large amounts of funds distributed. For this reason infrastructure providers also need to invest in good governance and a good strategic analysis of the underlying causes of conflict. The paper mentions that there is an important role to be played by small-to-medium infrastructure providers due to their tolerance for risk, low transaction costs and ability to receive payments in local currency, and understanding of local context. Yet the paper does not clarify exactly what this role is, and how it complements that of international investors. Like those of Anand, the study's recommendations are not very actionable or clearly applicable in practice.

Jones and Howarth (2012) again present the particular benefits, as well as the unique challenges, of post-conflict infrastructure investment.[6] The study presents evidence of the high economic returns on infrastructure investments in these contexts; for example, infrastructure investment in sub-Saharan Africa has shown a positive correlation with economic growth and a negative correlation with income inequality. Evidence shows that roads and transport have a particularly stimulating effect on development and job creation. The paper points out several of the same challenges inherent to post-conflict countries mentioned above, above and beyond the general issues facing large project finance including the high sunk costs and upfront capital needed. These issues are particularly salient in fragile states, where failure can bring high costs such as deterring future investors or aggravating local tensions.

The study differentiates the comparative advantages and disadvantages of local versus international investors. Local private sectors tend to be weak and lack financial resources, which constricts their ability to design, build or manage infrastructure. On the other hand, international investors are wary of insecure environments. The study admits that there is limited evidence of how private participation can be promoted before a secure business environment is in place, other than obvious recommendations such as the need for reformed legal and regulatory frameworks. In general, the paper makes several of the same suggestions as previous studies: plan and commit for the long term, develop local capacity, and involve and engage the community. The article does not provide very detailed real-world examples,

[4] P. B. Anand, *Getting Infrastructure Priorities Right in Post-Conflict Reconstruction* (Helsinki: United Nations University, World Institute for Development Economics Research,[2005]).
[5] Mott Macdonald ibid.
[6] Stephen Jones and Simon Howarth, *Supporting Infrastructure Development in Fragile and Conflict-Affected States: Learning from Experience* (London: UKAid,[2012]).

but suggests several further research topics, including primary research on specific infrastructure programs in post-conflict environments and a compilation of lessons learned from local contracting processes.

The research of Schwartz et al. (2004) is one of the most widely-cited in the literature.[7] The study examines the available evidence of strategies that post-conflict countries have used to attract private investment in infrastructure development, with mixed success. The paper reiterates the characteristics of post-conflict countries which make them unattractive for investment. The article particularly emphasizes the importance of encouragement of small-scale private service providers, suggesting that these entrepreneurs often have a key role to play. Although they tend to be small-scale, local, and diaspora-funded, and do not have the advantages of debt financing, economies of scale, official recognition, or quality of service regulation, these investors have certain advantages, including that they are surprisingly common in post-conflict countries, and can mobilize resources quickly. On the other hand, they are unlikely to follow quality standards, are often very expensive, do not have access to international finance, and cannot make large-scale investments.

The study presents general recommendations for governments, among these: eliminate as many regulatory risks/barriers to entry as possible, move quickly and avoid complex bidding arrangements, use appropriate macroeconomic policies and incentives, make use of anchor projects and project sequencing, and support small-scale local investors (provided they have some minimum level of regulation). These recommendations are still in fairly general terms and the paper makes clear that further research is needed to develop new strategic approaches for investment in post-conflict countries.[8]

An additional comprehensive study on promotion of infrastructure investment in post-conflict countries, with a focus on PPPs, was conducted by Cambridge Economic Policy Associates (2005).[9] The study addresses the observed lack of investment in PPPs in post-conflict countries despite the overall increase in PPP investment worldwide. The study recognizes that the barriers to investment described above tend to be present to some extent in all lower/middle-income countries, but are exacerbated in post-conflict countries and result in a particular shortage of well-structured, profitable projects. Mitigating these types of risks is difficult, as there are limited guarantee, insurance, and hedging products available. The paper reiterates many of the recommendations to governments, including policy reforms to attract private sector interest to PPPs, as well as better structuring of risk allocation and leveraging of risk-mitigation facilities such as MIGA.

The study provides a brief examination of the role that smaller-scale local infrastructure entrepreneurs may play in the investment landscape. The study recommends that regulation of such providers remain as light as possible so as not to stifle entrepreneurial activity, and that policymakers promote local

[7] Jordan Schwartz, Shelly Hahn and Ian Bannon, *The Private Sector's Role in the Provision of Infrastructure in Post-Conflict Countries: Patterns and Policy Options* (Washington DC: The World Bank,[2004]).
[8] Ibid.
[9] *Harnessing Existing Financing Facilities to Promote Public-Private Partnership for Infrastructure Investment and Service Delivery in Post-Conflict Countries* (London: Cambridge Economic Policy Associates,[2005]).

financing through microfinance institutions and other informal financing strategies such as rotating savings and credit groups. The study does present real-world applications of its recommendations through three "pilot project" cases: a donor trust fund to underwrite a portion of a political risk insurance coverage plan by a facility such as MIGA; a strategy to increase demand for modern energy services in rural areas by promoting demand-side subsidies and microfinance, funded by a loan commitment or guarantee from a donor; and a hybrid international/local partnership through which an international private sector firm would rebuild the major of a system, and would engage local small-scale providers to extend them to the poorest households, with the government providing "light touch" regulation. These examples provide a useful contribution to the literature as they present applications of the authors' recommendations, yet still none are applied to an actual real-world case.[10]

Academic scholarship on public-private partnerships

The existing body of literature on PPPs in emerging markets covers many procedural issues, from the selection of attractive projects, to project structuring and risk allocation, to methods for measuring developmental and economic returns. The World Bank Public-Private Infrastructure Advisory Facility (PPIAF) has released a series of advisory notes and guides focused on particular contexts including sub-Saharan Africa and post-conflict countries. Its 2009 manual, "Attracting Investors to African Public-Private Partnerships: A Project Preparation Guide," gives an overview of strategies for the public sector and donors to engage the private sector and coordinate with them to implement successful PPPs in sub-Saharan Africa.[11] The guide provides recommendations for every step of the project process, although it does not go into specific examples about real-world projects which have actually avoided potential pitfalls.

Some critical analyses exist of the large-scale PPP model for infrastructure in emerging markets, including post-conflict countries. Paul Collier (2007) writes that a typical failure of power generation projects in post-conflict countries is that one sophisticated "ideal" project is proposed, which turns out to be much more complicated to implement in practice than anyone had imagined and becomes controversial.[12] The World Bank has conducted its own evaluation of the successes and failures of its many infrastructure projects over the course of twenty years.[13] Although the Bank has had many successful investments, its projects have also faced many challenges, including weak cost-benefit and financial analyses, optimism bias in expected rates of return, unreliable demand forecasting and financial projections, consequent lack of financial sustainability, and difficulty raising tariffs to sustainable rates for political or economic reasons.[14]

[10] Ibid.
[11] See PPIAF/World Bank 2009.
[12] Paul Collier, *Post-Conflict Recovery: How should Policies be Distinctive?* (Oxford University: Centre for the Study of African Economies, Department of Economics,[2007]).
[13] Dongier and Lovei, *Infrastructure: Lessons from the Last Two Decades of World Bank Engagement*
[14] Ibid.

The World Bank PPIAF has also released a "Post-Conflict Countries Series," assessing the role of PPPs and private sector participation in general in post-conflict infrastructure reconstruction, which points out many of the same challenges identified in previous studies (limited institutional capacity, high underlying risk conditions, etc.).[15] Yet the study argues that PPPs are still one of the best strategies for promoting infrastructure investment in post-conflict countries; the key is to maximize private involvement as early as possible (to bring capital, expertise and focus) and if necessary significantly reallocate risks. The study provides three recommendations for governments; first, work to promote the comparatively "easier" industries, most notably telecommunications, where investors are generally able to receive returns more quickly; second, use other types of assets such as natural resource extraction projects as "anchor projects," (as in the often-cited case of the MOZAL project in Mozambique); and third, encourage small-scale cooperative governance structures as a method of spreading risk and making small infrastructure investment more "bankable." Through this structure, governments would provide financing to small groups of citizens to form cooperatives that pool their resources and share, and in theory, cooperatives would insist on setting fair prices because they would be their own customers.[16]

A final issue addressed in the literature is the important but difficult task of accounting for the economic or developmental returns of large PPP projects for the ultimate beneficiaries which the projects aim to serve. These analyses are different than the typical NPV/IRR analyses of strictly private sector investors. Multiple methods have been developed in an attempt to evaluate these difficult-to-quantify benefits. One method proposed is the "economic rate of return" (ERR), calculated by considering the net impacts with or without the project for all of the stakeholder groups affected by the project, including financiers, employees, customers, suppliers, competitors, and the rest of society.[17] Yet these "societal cash flows" can be very difficult to calculate. Another method proposed by the World Bank's International Finance Corporation is to quantify the value of "sustainability" investments (i.e. activities such as community engagement and CSR) through its "Financial Valuation Tool for Sustainability Investments (FV Tool)." This method has been used in a real-world extractive industries project in Ghana, which demonstrated the difficulty of integrating the "social returns" dimensions into a company's operating policies.[18]

Alternative Private Supply of Power

Observers have increasingly noted that in very fragile contexts, in particular post-conflict countries, solutions that are sometimes "technically less than perfect, but robust to circumstances" are the most appropriate.[19] In many cases local private suppliers have sprung up to fill infrastructure gaps, and

[15] *Post-Conflict Countries Series: A Strategy for More Investment* (Washington DC: PPIAF, The World Bank,[2011]).
[16] Ibid.
[17] Esty ibid.
[18] Witold Henisz and Tim Gray, *Calculating the Net Present Value of Sustainability Initiatives at Newmont's Ahafo Mine in Ghana* (Philadelphia: The Wharton School, University of Pennsylvania,[2013]).
[19] *World Development Report 2011: Conflict, Security and Development* (Washington DC: The World Bank,[2011]).

although they are often environmentally inefficient and/or significantly more expensive than public services, they are still viable, if temporary, alternatives, as documented in countries such as Lebanon.

Very recent scholarship by the World Bank has begun to document this trend. The Bank's 2014 working paper on alternative private supply of power (APS) in developing countries seeks to address the question of whether APS approaches can be part of the optimal long-term power supply of a developing country, or at a minimum part of an effective second-best solution.[20] The study defines APS to include an entire spectrum of approaches, including large private commercial self-generation; small-scale individual power generation/storage for self-consumption; mini-grids (privately-owned and operated generators that sell to residential, commercial or cooperative end users); and small distribution systems which purchase power wholesale from the grid and distribute it through privately-operated networks. Based on the evidence, the study comes to several conclusions: although the optimal power supply approach depends on each individual country's circumstances, and there is no one-size-fits-all solution, APS can be an effective alternative solution and under the right circumstances can be economically viable. In some situations, mini-grids may be the optimal solution, depending on a variety of factors. However, in some areas of sub-Saharan Africa these have been found to be unprofitable due to low affordability, low consumption, and high costs. The paper compares electricity sector investment to mobile telephony to understand the latter's comparative success, even in frontier markets.

Small-scale independent power producers and distributors are the subject of another extensive 2014 World Bank guide, "From the Bottom Up: How Small Power Producers and Mini-Grids Can Deliver Electrification and Renewable Energy in Africa."[21] The guide responds to a gap in the literature: there is widespread agreement on the need for, and most African governments' national electrification strategies recommend, a two-track (centralized plus decentralized) approach to electrification. However, these strategies provide few if any details of how to do this, and the guide is intended to provide specific recommendations for regulatory and policy decisions for the implementation of the decentralized track - the creation of commercially-viable small power producers (SPPs) and mini-grids, particularly in rural areas. According to the report, there is already evidence of the success of the decentralized SPP and mini-grid approach.

In a body of literature which tends to use several terms (distributed generation, mini-grids, community-level mini-utilities) fairly interchangeably, the report defines SPP with specificity: an independently-operated electricity producer that sells electricity to retail customers or the national utility on a mini-grid, typically with a generation capacity of less than 10 megawatts. An SPP can also sometimes convert to a small power distributor (SPD), whose primary business is distribution – to buy power wholesale and resell it. Along very similar lines are "community-level mini-utilities" and "isolated mini-grids," which typically refer to a generating unit plus a distribution system (a few kilometers of distribution lines) which operate separately from the grid. A "mini-grid" is generally defined as having a capacity of tens of

[20] *The Potential for Alternative Private Supply of Power in Developing Countries*

[21] Bernard Tenenbaum et al., *From the Bottom Up: How Small Power Producers and Mini-Grids can Deliver Electrification and Renewable Energy in Africa* (Washington DC: The World Bank,[2014]).

kilowatts to tens of megawatts, while "micro-grids" are defined as hundreds of watts to only a few kilowatts. The IFC estimates that there are over 29 million rural households worldwide that could be served on a commercial basis by isolated mini-grids.[22]

The report focuses on recommendations for regulatory decisions governing SPPs, covering technical, commercial, economic, and procedural issues. These issues can have major implications for SPPs, the vast majority of whom operate on extremely thin margins. Because regulation has the potential to affect the economic interests of so many stakeholders, from the SPPs themselves to the national utility, they are often very controversial and subject to significant political pressure. The paper also discusses alternative strategies for SPPs once the "big grid" has arrived. There are several main options: 1) SPPs cease to generate and become solely distributors; 2) SPPs stop distributing and exclusively sell generated power to the main grid; 3) the utility buys out the SPP; or 4) the SPP is abandoned.[23]

Finally, a comprehensive review performed by Barnes et al. examines alternatives for providing electricity infrastructure in low-demand/low-consumption rural areas through a compilation of case studies of best practices in rural electrification programs.[24] Rural electrification is inherently challenging because of its characteristics of high costs and low consumption. Policymakers must take into account a variety of issues including the setting of initial connection charges and tariff structures, cross-subsidization, project prioritization, and regulatory frameworks. Barnes et al. select "success story" cases from countries around the world falling under three different models (electric cooperatives, public companies, and private companies), and identifies common factors among successful programs. These include development of effective subsidies, the set-up of effective institutional structures, making cost recovery a priority, and setting correct prices and connection fees.

Conclusions

The academic literature on infrastructure investment in post-conflict contexts, as well as developing economies in general, is fairly extensive but tends to reiterate many of the same issues. While the older literature focuses on the more "traditional" model of PPP or large-scale public sector-led projects, the most recent literature is beginning to point toward a possible new model: alternate supply of power by small, private companies. In order to better understand the strengths and flaws of these models, one must delve more deeply into specific real-world cases, which will be the subject of the following chapter.

References

[22] Ibid.
[23] Ibid.
[24] Douglas F. Barnes, ed., "Meeting the Challenge of Rural Electrification in Developing Nations: The Experience of Successful Programs," Energy Sector Management Assistance Program, March 2005.

PPIAF/World Bank. Attracting Investors to African Public-Private Partnerships: A Project Preparation Guide. Washington DC: PPIAF, The World Bank, 2009.

Harnessing Existing Financing Facilities to Promote Public-Private Partnership for Infrastructure Investment and Service Delivery in Post-Conflict Countries. London: Cambridge Economic Policy Associates, 2005.

Post-Conflict Countries Series: A Strategy for More Investment. Washington DC: PPIAF, The World Bank, 2011.

The Potential for Alternative Private Supply of Power in Developing Countries. Washington DC: The World Bank, 2014.

Provision of Infrastructure in Post Conflict Situations. Cambridge: Mott Macdonald, 2005.

World Development Report 2011: Conflict, Security and Development. Washington DC: The World Bank, 2011.

Anand, P. B. *Getting Infrastructure Priorities Right in Post-Conflict Reconstruction*. Helsinki: United Nations University, World Institute for Development Economics Research, 2005.

Collier, Paul. *Post-Conflict Recovery: How should Policies be Distinctive?*. Oxford University: Centre for the Study of African Economies, Department of Economics, 2007.

Dongier, Philippe and Laszlo Lovei. *Infrastructure: Lessons from the Last Two Decades of World Bank Engagement*. Washington DC: The World Bank, 2006.

Esty, Benjamin, Frank Lysy, and Carrie Ferman. *An Economic Framework for Assessing Development Impact*. Boston: Harvard Business School, 2003.

Henisz, Witold and Tim Gray. *Calculating the Net Present Value of Sustainability Initiatives at Newmont's Ahafo Mine in Ghana*. Philadelphia: The Wharton School, University of Pennsylvania, 2013.

Jones, Stephen and Simon Howarth. *Supporting Infrastructure Development in Fragile and Conflict-Affected States: Learning from Experience*. London: UKAid, 2012.

Kenny, Charles. *Publishing Construction Contracts as a Tool for Efficiency and Good Governance*. Washington DC: Center for Global Development, 2011.

Schwartz, Jordan, Shelly Hahn, and Ian Bannon. *The Private Sector's Role in the Provision of Infrastructure in Post-Conflict Countries: Patterns and Policy Options*. Washington DC: The World Bank, 2004.

Tenenbaum, Bernard, Chris Greacen, Tilak Siyambalapitiya, and James Knuckles. *From the Bottom Up: How Small Power Producers and Mini-Grids can Deliver Electrification and Renewable Energy in Africa*. Washington DC: The World Bank, 2014.

Chapter Three: Electricity Investment Strategies in Developing Countries - Examples from the Case Literature

This chapter examines the existing investment models for electricity infrastructure in post-conflict countries, as well as selected relevant models from rural or difficult-to-reach areas of non-post-conflict countries. These real-world cases, drawn from a diverse group of countries from different regions and levels of development, serve to illustrate the models discussed in the academic literature reviewed in Chapter Two. The first group of cases examines the model of public sector-led or public/private partnership development through the cases of Afghanistan (entirely public sector-led), Sierra Leone (public sector-led but making steps toward privatization), and Pakistan (the case of the privatization of the Karachi utility company).

The second section examines the electricity cooperative model, which has had a degree of success in a number of rural areas which are not necessarily recovering from conflict but still face many similar challenges including low consumption rates and very high capital expenditure costs (Costa Rica and the rural United States). However, this literature currently lacks examples from frontier markets such as sub-Saharan Africa, or post-conflict states. The third section examines the model of entirely private, independent suppliers, which has developed in certain conflict-affected countries including Lebanon and Cambodia. The chapter seeks to draw out relevant lessons from the cases, including factors leading to success (or lack thereof).

Model one: public sector and PPPs

Afghanistan

An extreme case of a post-conflict state with dramatic electricity investment needs is Afghanistan. Still considered "one of the most unstable countries in the world,"[1] Afghanistan has a vast electricity infrastructure deficit. According to the recently-developed Afghanistan Master Electricity Plan, undertaken by the Asia Development Bank, only 28% of Afghan households are currently connected to power supply systems.[2] The government of Afghanistan (GoA) hopes to achieve a 65% household connection rate in rural areas, and near 100% in urban areas, in a four-stage plan by 2032. It is estimated that the required investment will total USD 10.09 billion (USD 7.3 billion for generation, USD 1.7 billion for large-scale transmission, and USD 1.04 billion for transmission within the provinces).[3] It is unclear where the majority of this funding will come from.

Currently, the Afghan power system is run by the national power utility DABS (Da Afghanistan Breshna Shirkat). The majority of local power generation, which averages 800-1000 GWh, is hydropower, supplemented by thermal generation. This has also been supplemented by imports totaling up to 73% in

[1] See for example http://library.fundforpeace.org/fsi13-troubled10-2.
[2] Fichtner/Asian Development Bank, *Afghanistan Power Sector Master Plan*Islamic Republic of Afghanistan Ministry of Energy and Water,[2013]).
[3] Ibid.

2011, predominantly from power purchase agreements with the neighboring countries of Iran, Tajikistan, Turkmenistan, and Uzbekistan. During high load periods, DABS faces large voltage drops along these import lines, from voltages of 32 kV to 16.5 kV. The majority of the existing large hydropower plants require rehabilitation, including Assassabad, Charikar, Jabul, Ghorband, Grishk, and Pul-e-Chomri hydropower plants.[4]

The domestic hydropower system is highly in need of upgrades, and is supplemented by the heavy use of diesel generation. Diesel-fired thermal generation is used because electrical grid coverage is extremely low, and because diesel generators can be installed virtually anywhere. In addition, small diesel generating sets (gensets) are used for small capacity power supply because the necessary capital expenditures and technical complexity required are low, and diesel fuel can be easily transported.[5] The conclusion to be drawn from Afghanistan's data is that the GoA's centralized, national utility-focused approach to electrification is in reality being supplemented extensively by small-scale local-level independent generation and supply. As in many post-conflict countries, there is a significant gap left by the government's energy program, which independent producers have stepped in to fill.

Sierra Leone

While smaller than Afghanistan in terms of population and land mass, Sierra Leone has an even greater energy deficit. Despite the civil war having ended in 2002, the country still lacks a national grid and as of 2011 had an electrification ratio below 10% (mainly due to an inadequate transmission network).[6] The government of Sierra Leone has set an ambitious objective to achieve 75% household power access by 2025, which is expected to necessitate the investment of approximately USD 1.465 billion. The government's Poverty Reduction Strategy Paper identifies power as a priority subsector for enabling economic growth, for example by spurring development in the agricultural sector by allowing the processing of such products as rice and palm.

Sierra Leone's power system is run publically and distributed through the National Power Authority (NPA), the state-owned distribution company. Funding for the country's power system comes predominantly from donor partners and public funds; the country's largest generation capacity investment, the Bumbuna I hydropower plant completed in 2010, was financed entirely by the African Development Bank and the Italian government. This plant increased the country's installed capacity from 13 to as much as 63 MW during the rainy season, and is estimated to be able to supply the country's entire household demand once transmission lines are in place. Yet power pricing is a major challenge for the country. In general, much of sub-Saharan Africa pays some of the highest electricity tariffs in the world, averaging up to USD 0.46 per kWh as compared to USD 0.05 – 0.10 per kWh in the United States. Sierra Leoneans pay the highest electricity tariffs in ECOWAS, at an average of USD 0.42 per kWh, despite the fact that cheap hydropower is available.[7]

[4] Ibid.
[5] Ibid.
[6] *Infrastructure and Growth in Sierra Leone* (Tunis: The African Development Bank,[2011]).
[7] Ibid.

Sierra Leone's excessively high power tariffs are in large part due to the NPA's very high operating costs, resulting from overstaffing as well as a 40.8% technical loss rate, of which 18.9% results from equipment deterioration and chronic under-investment and 21.9% results from theft. Yet the tariff structure still does not recover costs, and the NPA's cost recovery ratio is the lowest in West Africa, at only 39%. The NPA is essentially bankrupt, making it impossible for the company to invest in system upgrades. Furthermore, the power from the Bumbuna plant is being supplied at exorbitant rates; the NPA pays USD 0.15 per kWh for power from the Bumbuna Hydropower Plant, even though the marginal costs are estimated to be much lower at approximately USD 0.02 per kWh. This is because the plant has higher-than-warranted operating costs due to an expensive management contractor, who was chosen by the government through a non-competitive process during the project's first phase, suggesting troubling governance patterns.[8]

The government of Sierra Leone has indicated that it hopes to attract significant private sector participation into its several large envisioned generation projects. Yet it is clear that there are several deeply-rooted challenges in the sector which will need to be addressed if the government is to realistically attract private sector participation, challenges that are common to many other post-conflict countries. The first challenge is to lower the country's electricity prices, potentially by using more competitively-priced power from the region which may benefit from economies of scale. A second challenge is the need for "soft side" investments in sector management and institutional reform. This includes legislative and regulatory reforms, as well as a much-needed unbundling of the NPA, ideally opening the sector up to greater competition among private operators. Furthermore, the NPA would need to be made financially viable and would need to overcome its existing non-commercial practices such as overstaffing and toleration of nonpayment, and general poor collection and billing. The NPA is currently slated for privatization, although it is unlikely to attract much investor interest in its current financial state. Finally, it is essential that tariffs be cost-recovering. This is typically politically difficult in most developing countries, because poorly-applied subsidy schemes that fall regardless of income level in practice usually become cross-subsidies from poorer households to wealthier households. All of these issues are problems typically faced by many developing countries, both conflict-affected and not, which are dominated by the public sector but hope to attract the participation of the private sector.[9]

Pakistan

In Karachi, Pakistan, a unique case has unfolded in which an underperforming public utility was successfully bought out by none other than one of the largest private equity investment firms in the Middle East/North Africa.[10] The city of Karachi is clearly not in and of itself a post-conflict state, but it is considered by many to have very complex conflict dynamics which may "threaten to destabilize" the rest of the country.[11] Pakistan as a whole faces power constraints so large that they are one of its

[8] Ibid.
[9] Ibid.
[10] Josh Lerner, Asim Ijaz Khwaja and Ann Leamon, *Abraaj Capital and the Karachi Electric Supply Company* (Boston: Harvard Business School,[2013]).
[11] See for example Huma Yusuf, "Conflict Dynamics in Karachi," United States Institute for Peace, 2012.

biggest constraints on growth, and it has a generation gap of up to 4,500 MW.[12] The textiles industry, the country's most important export industry, was found to lose an equivalent of USD 4 billion in 2010 due to power interruptions. The country's transmission system's losses exceed 38%, compared to typical losses of 6.5% in the United States, and more than half of the population face blackouts that last at least eight hours a day.[13] Similarly to Sierra Leone, the major problem facing the country's power system is pricing; in Pakistan's case, restrictions were placed on the prices that could be charged for power and the difference needed to cover the costs is made up by subsidies, which are frequently not paid on time, leaving power companies without cash to reinvest in their systems. Studies found that tariffs need to be raised 49% to reflect the true costs of production, but there is little political will to do this. Due to the system's unreliability, those who can afford private generators do so.[14]

The city of Karachi, Pakistan's largest city, with approximately 18 million residents, is supplied by the Karachi Electric Supply Company (KESC). The company, previously nationalized, was privatized in 2005, but due to the legacy of its years of mismanagement it continued to struggle and faced cash losses of USD 15 million per month in 2008. The system faced many of the same challenges as the power sectors of many other developing countries, in particular post-conflict countries, including very high rates of technical losses due to theft (which was considered essentially socially acceptable), customers who refused to pay, and highly politicized staffing. The non-cost-recovering tariff structure led to circular debt with government agencies, which led to the company being unable to invest in improvements, which led to power supply gaps. [15]

The company sought a private sector investor with both the necessary capital and the will to execute the complex restructuring so desperately required. Abraaj Capital, one of the largest private equity firms in the Middle East/North Africa, eventually agreed to completely buy out the company for the paltry sum of USD 50 million. This came only after a long period of negotiations and monitoring by Abraaj, during which they managers identified the many key challenges that would need to be addressed before they agreed to invest. The management of Abraaj fully understood the magnitude of the challenge they were undertaking but were willing to commit for the long term; in their words, they knew the utility "had no value as a going concern…The value was all in the improvements we could make."[16]

Abraaj would go on to install 14 of its staff into management positions for the first 28 months, and to invest an initial USD 361 million followed by a subsequent USD 900 million into the company. Ultimately, Abraaj was able to achieve impressive progress, notably negotiating a power purchase agreement (PPA) with the National Transmission and Distribution Council (NTDC), the government body responsible for managing power allocations and purchases, which allowed KESC to reduce its costs of power purchases by 38%. Through changes such as these, as well as revising tariffs upward and reducing the nontechnical system losses by addressing the culture of theft, the company was able to achieve a positive EBITDA for the first time ever. It was also able to invest in increased generation capacity of 450 MW, which served

[12] Lerner et al. ibid.
[13] Ibid.
[14] Ibid.
[15] Ibid.
[16] Ibid.

to reduce the blackout issue. Although a variety of challenges still remained, the success of the buyout marked an entirely new way of doing business for the company.[17] This example suggests that there are potentially useful roles for the private sector to play in the power sector even in cases that are seemingly extremely unattractive from an investor's perspective, such as an underperforming utility in a conflict-prone city. The key is to find private sector partners who are truly intent on making the necessary changes and willing to make a commitment for the long term.

Model two: electrification through cooperatives

Rural United States

The United States, the world's largest economy with one of its most stable democracies, may seem one of the least relevant cases for a thesis discussing investment in fragile countries recovering from conflict. Yet as late as 1935, 44% of the U.S. population still lived in rural areas, and of these only 12.6% had access to electricity.[18] Customers living in these areas were underserved by utility companies, many of which were private, because these connections were considered impossible to make cost-recoverable; the capital expenditures required to extend the grid were too high, and consumption too low, so that the utilities charged rural farmers unreasonably high rates to construct lines to reach them. Electricity cooperatives emerged in the U.S. as early as 1914, when groups formed in Minnesota and Washington states without public sponsorship to extend distribution lines to themselves, but many quickly turned over their lines and assets to the private utility companies.

During President Franklin Roosevelt's first term, at the height of the Great Depression, a federal agency was created, the Rural Electrification Administration (REA), to systematically address the issue of rural electrification. The REA financed rural cooperatives by extending them 25-year loans on close to market rates primarily for investments in distribution lines and home wiring. Many of these first cooperatives were also able to purchase low-cost power from the Tennessee Valley Authority, another major federal project, which had built hydropower projects in the Midwest and South. A division of the REA evaluated the creditworthiness of cooperatives and issued loans, as well as providing technical, managerial and supervision services. It was found that although rural electrification required some government financing guarantees and technical assistance, it did not need subsidization; although most cooperatives were operated as nonprofits, most quickly amortized their loans and were on a self-financing fiscal status.[19]

Cooperatives typically required a total capital investment of USD 400,000, featured a membership of approximately 1000 consumers (of whom typically 80% were farmers), and invested in distribution systems of approximately 425 miles of line. There were payment plans for the lowest-income households, and in some cases poorer members were able to contribute "sweat equity" instead of initial

[17] Ibid.
[18] Paul Wolman in Douglas Barnes ed., *Meeting the Challenge of Rural Electrification in Developing Nations: The Experience of Successful Programs*Energy Sector Management Assistance Program,[2005]).
[19] Ibid.

membership fees. Cooperatives typically had a small permanent staff including a manager, bookkeeper, and head lineman. [20]

During the course of the program, the rural cooperatives system was successful in bringing power to approximately 4.4 million of the country's poorest and most isolated households, through over a thousand cooperatives and approximately 1.4 million miles of lines. Although the cooperatives were ultimately economical, the government program was found to be necessary to fill in the gap that the market would not provide efficiently on its own; private utilities either could not or would not make the investments to extend the grid to "uneconomical" areas. Although the cooperatives were self-sustaining, a key success factor of the program was the security of the financing and technical assistance provided by the U.S. government. This case suggests that an analogous solution might be possible in a developing or post-conflict country context in which the government, or its development partners, has a basic level of technical capacity and the ability to issue loans. The electricity cooperatives system enables local communities to take responsibility for their own extension of the grid, even if they themselves have limited technical ability with regard to electrification, as was the case for poor farmers in the United States during the Great Depression. [21]

Costa Rica

Costa Rica presents a second, ultimately successful, model of rural electrification through cooperatives. Like the rural United States model, Costa Rican cooperatives run through a combination of low-cost financing and capital contributions made by members, and day-to-day management is provided by employed staff. Yet the Costa Rican model also differs significantly in that it features only four cooperatives (as opposed to over one thousand in the US), and the initial low-cost financing was provided not by a concessionary loan from the Costa Rican government but from the US Agency for International Development (USAID).

Costa Rica is a relatively politically and economically stable country with a successful history of establishing cooperatives in agriculture and other sectors, and given the U.S.'s own past success with the rural electrification through cooperatives, it was receptive to the Costa Rican's early requests for assistance with its own sector. In 1966, USAID initiated a program in which three sites were selected for cooperatives. USAID provided a concessional loan of USD 3.3 million at annual interest rates of 1-2.5% for a period of 40 years, with a grace period of 10 years, augmented by a USD 800,000-equivalent contribution from the National Bank of Costa Rica, technical support by the national power utility (Instituto Costariccense de Electricidad), and contributions from the rural cooperative members themselves, who were expected to contribute a minimum of USD 118,000 in start-up funds through local savings committees. The cooperatives were responsible for the administration, maintenance and expansion of their own distribution systems, and were legally liable for the USAID loan. [22]

[20] Ibid.
[21] Ibid.
[22] Gerald Foley in Barnes ibid.

The initial cooperative, COOPESANTOS (Cooperativa de Electrificacion Rural de los Santos), began to supply power in 1969 and was immediately successful, and the number of customers rapidly increased. Part of the success of the model is attributed to the fact that from the beginning the need was "never questioned" for full cost recovery, including recovering operating costs, debt repayments, and interest.[23] With the support of the national utility, the cooperatives were responsible for initially designing the scheme and calculating the costs, projecting out the cash returns required to make the project financially viable, and only continuing when the the community was willing to pay the difference. The cooperatives continue to exist and are run by a general assembly with elected delegates representing the communities, an administrative council, and a small employed staff. [24]

Over the the past 30 years, Costa Rica's electricity cooperatives have grown to four and have become efficient, financially viable organizations which supply about 20% of the country's rural residents. The cooperatives did face three sets of challenges. First, minimum consumption tariffs were initially set too low, and costs for marginal consumption above this threshold were significantly higher, so customers attempted to restrict themselves to the minimum usage per month. This caused cash flows to suffer, so the minimum fixed charge was eventually increased. A second issue was that the original USAID loan was made without thought for exchange rate fluctuations, and as the Costa Rican currency depreciated slowly over the 1970s, the cooperatives eventually lobbied for the loan repayments to be reverted to the original exchange rate. Finally, significant investments in technical and administrative training were necessary to fill the capacity gaps of the cooperative staff. [25]

In addition to the cooperatives' focus on cost recovery, part of the success of the Costa Rican cooperative's model is also attributed to the availability of concessionary-rate capital through the USAID loan. It was argued that the use of concessionary capital does not breach the principle of cost recovery, but simply allowed the expansion of distribution systems into difficult-to-reach areas where the tariffs required under strictly commercial financing would be unreasonably high. Additionally, the cooperatives included cash contributions from the local communities themselves, which ensured their buy-in. This cooperative model may be relevant in other contexts where communities have some local capital (or perhaps international funding from diasporas abroad), but lack the technical capacity to carry out electrification projects entirely on their own. The model would also likely require a development donor partner willing to contribute concessionary financing over a long time horizon. [26]

Model three: private suppliers

Lebanon

Limited data exists on entirely private suppliers of electricity in post-conflict or emerging markets, as these types of actors tend to be very low profile, informal, and unlikely to meet the attention of

[23] Ibid.
[24] Ibid.
[25] Ibid.
[26] Ibid.

academic researchers and case writers. One example that the literature has touched on is the case of Lebanon, where the private sector supplied the vast majority of electricity during the civil war and continues to remain an important supplier to this day.[27] During the war, as a result of the destruction of the country's electricity sector and the absence of a functioning public sector, a mix of individual and collectively-owned generators evolved, some formal businesses and the majority informal. The resilience of this sector has been attributed to both the open and unregulated economy and the country's "strong culture of entrepreneurship."[28] These private sector providers remained a critical component of the country's power sector even after the civil war ended, with private generators continuing to supply electricity to both households and businesses and even entire neighborhoods, often during blackouts from the national power supply. In 1994, it was estimated that 98% of businesses and 95% of households had access to 24-hour electricity, a significant portion of which came from private supply.[29]

According to the World Bank, these small, unregulated private providers present a "technically less than perfect, but robust to circumstances" solution to the country's unique energy challenges.[30] Diesel-fueled generation is environmentally, as well as economically, inefficient; electricity prices charged by private operators in Lebanon are twice as high as public generation. Due to these longer-term inefficiencies, the Bank's report recommends that these types of stopgap measures be phased out over time.

Cambodia

Similarly to Lebanon, Cambodia also experienced major destruction of its electricity infrastructure during its lengthy civil war, a gap which the private sector stepped in to fill. By the end of the conflict, only 2% of the population had access to the national grid, and small energy enterprises became the main source of electricity for the majority of the population. [31] Nearly 15% of these small-scale enterprises had established themselves before the peace agreement ending the war was even signed. As in Lebanon, although these companies filled a critical need, they faced many challenges and inefficiencies. In particular, they had very limited access to working capital; for example, one study found that the typical breakdown of the financing structure of a small-scale private electricity provider was 49% owner's equity, 22% family borrowing, 23% informal debt, and 6% microfinance. These types of informal loans typically had tenors of 12 months or less. In addition to capital constraints, the study found that these private providers typically had limited managerial and technical capacity, and did not utilize standardized procurement processes or monitoring.[32]

Despite the inefficiencies of the small-scale private provider model identified, the study does not recommend they be phased out completely or "regulated out of existence." Instead the study recommends improving small-scale private provider access to finance in order to allow them to invest in

[27] *World Development Report 2011: Conflict, Security and Development* (Washington DC: The World Bank,[2011]).
[28] Ibid.
[29] Ibid.
[30] Ibid.
[31] *Harnessing Existing Financing Facilities to Promote Public-Private Partnership for Infrastructure Investment and Service Delivery in Post-Conflict Countries* (London: Cambridge Economic Policy Associates,[2005]).
[32] Ibid.

efficiencies and improvements. The study recommends the promotion of access to finance through the use of microfinance institutions, which are more likely to be viable in urban settings, or government-run rural development funds. The study finds that these types of small-scale entrepreneurs are very important in post-conflict countries as they are more familiar with and able to potentially mitigate local risks, and able to operate more freely in the local environment. However, these suppliers also face great constraints beyond financial and technical capacity, including ill-defined land and property rights and potentially stifling regulatory regimes. [33]

Cambodia is an example of a case where the government has successfully integrated the private providers into the country's national electrification strategy. The country implemented a "light touch" regulatory scheme, and as of December 2012 licenses had been issued to 312 private entrepreneurs, of whom 288 were distributing electricity through privately owned mini-grids.[34] 89 of the companies sold their diesel generators and converted to solely distribution companies. All of these companies were initially created without external subsidies or grants. The typical provider is estimated to serve approximately 440 customers with an installed capacity of approximately 0.15 MW, and a distribution network of 4.4 kilometers. Overall, these companies provide 42% of the country's rural power, to a total of 120,000 customers. However, this solution is not without inefficiencies; these companies must charge tariff rates of USD 0.40 to 1.25 per kilowatt-hour, which are much higher than the those of the urban grid.[35]

Conclusions

There are numerous cases of electrification strategies from which post-conflict countries can draw lessons. Many countries emerging from conflict have chosen to pursue a public sector-led or public-private partnership approach to electricity investment. Yet as illustrated by the cases of Afghanistan and Sierra Leone, these approaches have often not been successful in bringing electricity to the vast majority of the population. In one case a public utility was able to improve its efficiency (Pakistan), but this occurred when it was bought out by a private equity firm. Some countries have not necessarily experienced conflict but had large portions of their territories that were historically difficult to reach with grid electrification, for logistical and/or economic reasons. There are several success stories of governments in these cases promoting successful rural electrification programs through the community-led cooperative model. However, none of these to date have taken place in a post-conflict country. Very few examples of truly successful post-conflict electricity infrastructure rehabilitation exist. In one small group of cases, including Lebanon and Cambodia, small, entirely private-funded companies have improvised a "less than perfect," but surprisingly effective solution. Without public funding or foreign investment, they have stepped in to play a critical role in filling the electricity infrastructure gap. However, these have typically resulted in solutions which are viable in the short term but extremely

[33] Ibid.
[34] Bernard Tenenbaum et al., *From the Bottom Up: How Small Power Producers and Mini-Grids can Deliver Electrification and Renewable Energy in Africa* (Washington DC: The World Bank,[2014]).
[35] Ibid.

economically and environmentally inefficient. Further evidence is required to determine whether this approach could represent a long-term solution. To examine this question, the following chapter turns to an in-depth analysis of the energy sector in Somaliland.

References

Harnessing Existing Financing Facilities to Promote Public-Private Partnership for Infrastructure Investment and Service Delivery in Post-Conflict Countries. London: Cambridge Economic Policy Associates, 2005.

Infrastructure and Growth in Sierra Leone. Tunis: The African Development Bank, 2011a.

World Development Report 2011: Conflict, Security and Development. Washington DC: The World Bank, 2011b.

Barnes, Douglas, ed. *Meeting the Challenge of Rural Electrification in Developing Nations: The Experience of Successful Programs*: Energy Sector Management Assistance Program, 2005.

Fichtner/Asian Development Bank. *Afghanistan Power Sector Master Plan*: Islamic Republic of Afghanistan Ministry of Energy and Water, 2013.

Lerner, Josh, Asim Ijaz Khwaja, and Ann Leamon. *Abraaj Capital and the Karachi Electric Supply Company*. Boston: Harvard Business School, 2013.

Tenenbaum, Bernard, Chris Greacen, Tilak Siyambalapitiya, and James Knuckles. *From the Bottom Up: How Small Power Producers and Mini-Grids can Deliver Electrification and Renewable Energy in Africa*. Washington DC: The World Bank, 2014.

Chapter Four: Case Study of a Post-Conflict Energy Sector - Somaliland

Lying in the northwestern corner of Somalia, Somaliland is an internationally-unrecognized, self-declared independent state which considers itself to have seceded from Somalia proper in 1991. Somalia continues to consider Somaliland an autonomous region. Somalia as a whole is known almost ubiquitously as the quintessential "failed state," reflected for example in its routine topping of the rankings in various "failed states" indices.[1] Although the failed state epithet is used vaguely and somewhat meaninglessly, it is generally recognized that since the fall of Somalia's Cold War-era regime, led by Siad Barre, in 1991, the country has never had a single central government that has retained territorial control over the entire country.

In contrast to southern Somalia, which was colonized by Italy and formerly known as Italian Somaliland, the current state of Somaliland was a protectorate of Britain established in 1888 and known as British Somaliland. In 1960, both the Italian and British Somalilands gained independence from their respective colonizers and subsequently united several days later to form the Somali Republic. During the Somali Civil War which began in the 1980s, Somaliland was particularly targeted for internal repression by the regime of Siad Barre, and with the fall of the regime Somaliland promptly declared independence on May 18, 1991. The country has since instituted its own government, diplomatic presence, and even currency regime, but continues to be unrecognized by any government in the world, except informally by Ethiopia.

Although many continue to consider southern Somalia an active conflict zone, Somaliland is generally recognized to have achieved post-conflict status. It has established a hybrid democratic government which has held several nominally open (if imperfect) elections with peaceful transitions of power. A comprehensive examination of Somaliland's socio-political history and current context is beyond the scope of this paper.[2] This chapter will provide a background on Somaliland's current economic climate, followed by an overview of the country's infrastructure sector with a focus on energy. The chapter will discuss technical and financial challenges facing the sector as well as barriers to investment, and finally will consider possible solutions.

The Somaliland Economic Context

Although Somaliland has not experienced conflict for approximately two decades, it is still a post-conflict economy further complicated by the fact that it does not have access to international development aid. As the country is unrecognized by any foreign governments, any official development assistance must be channeled through the government of southern Somalia in Mogadishu, with which the Government of Somaliland (GoSL) does not have a stable diplomatic relationship. With little access to foreign aid and an extremely limited domestic revenue base, the public sector has long ceased to play a major role in providing services, including infrastructure, to the population, and the private sector has stepped in vigorously to fill this role. Observers remark that the government is permanently "playing catch-up with

[1] See for example http://library.fundforpeace.org/fsi13-troubled10

[2] Readers may refer for example to Mark Bradbury, *Becoming Somaliland, (*African Issues, 2008); Matt Bryden, *Rebuilding Somaliland: Issues and Possibilities* (Red Sea Press, 2005).

the private sector,"[3] which provides almost all services including up to an estimated 96% of electricity and 80% of delivered water.[4] Despite all of its barriers, Somaliland's economy has experienced strong growth, with a (reported) estimated growth rate of 8-11% for the past five years.[5] The economy's most successful sectors are the livestock, fisheries, and gum (resin) sectors, while the economy is experiencing the most difficulty in attracting investment to the roads and energy sectors.[6]

Somaliland's financial sector is impacted by both its lack of international recognition, and the unclear legal status of conventional banking practices. Due to its unrecognized status the country cannot access official bilateral and multilateral loans from foreign governments, and furthermore has no relationships with international banks and no existing payment systems to allow payments between domestic and international businesses.[7] This is in part because the status of conventional (Western) banking practices in Somaliland is unclear; an Islamic banking law has been passed, but a law on conventional banking is still pending, and is considered a sensitive issue.[8] As a result, formal interest-bearing loans are essentially prohibited in the country, and all formal lending activities in the country have virtually stopped and there are limited deposit-taking institutions.[9] The government is therefore unable to use interest rates as an economic lever. In addition, there is no formal central bank role, although the country has established its own currency (the Somaliland shilling) with an official exchange rate. The government itself has essentially no foreign currency reserves; the vast majority of the country's hard currency is held by the country's wealthy businessmen and owners of large companies, who in essence control the exchange rate.[10] However, the economy has essentially become entirely dollarized and the Somaliland shilling is predominantly used only for petty purchases.[11]

In addition to the lack of banking regulation, the country has a generally weak regulatory framework overall, which represents a constraint for the expansion of businesses because of the lack of formal contract enforcement mechanisms.[12] The majority of investment capital in the economy comes from remittances from diaspora Somalilanders in Western countries and the Middle East, which represents a major source of financing. However, the reliance on international remittances has contributed to the dollarization of the economy and local price inflation.[13] Somalilanders abroad are estimated to remit an average of USD 650-800 million to their home country annually, of which 41% is estimated to go toward household maintenance, and 30% toward capital and financial investments. [14] These funds transfers are largely facilitated through several main money transfer companies, including Dahabshiil, Mustaqbal,

[3] Interview, DAI Somaliland Partnership for Economic Growth, Zaki Raheem, 21 May 2013.
[4] Adam Ismail Hassan, "Somaliland: Prospects for Economic Development and Future Priorities for Investment" .
[5] Ibid.
[6] Interview, Head of Somaliland Chamber of Commerce, Mohamed Shukri Jama, 26 May 2013.
[7] Adam Ismail Hassan, "The Role of Remittance in the Economic Development of Somaliland" (Hargeisa, Somaliland, 2012).
[8] Interview, DAI Somaliland Partnership for Economic Growth,
[9] Ismail 2012 ibid.
[10] Ismail 2013.
[11] Author's observations.
[12] Ismail 2013.
[13] Ismail 2012.
[14] Ibid.

Kaah, Amal, and Tawakal. Some of these international funds transfer companies also offer basic banking services such as non-interest-bearing deposit or savings accounts, but they are unable to provide a full range of financial services.[15] Currently, some of these companies are beginning to expand into Islamic banking, most notably Dahabshiil, which has licensed a full-service Islamic bank in neighboring Djibouti and has opened Islamic bank branches in Somaliland.

The Somaliland Energy Sector

Somaliland's electricity utilities

With energy tariffs of USD 1.00 per kilowatt hour, Somaliland has some of the highest energy costs in the world (see Exhibit 1). The high cost of electricity is one of the primary reasons cited for businesses failing in Somaliland.[16] Businessmen have specifically stated that they have been dissuaded from opening new factories because the electricity costs were too high.[17] Yet Somaliland is also reported to have some of the highest rates of electricity penetration in Africa,[18] and it is believed to have the largest percentage of private sector investment in its energy sector in East Africa.[19] Somaliland's energy sector is a prime example of a post-conflict context in which private independent power providers (otherwise known as small power producers or community-level mini-utilities) have stepped in to dominate the provision of services, in a manner which is "robust to circumstances" if "technically less than perfect." However, Somaliland's energy sector faces several notable challenges to investment including the regulatory environment, technical challenges, social context issues, and financial issues, which will be discussed in turn below.

Much of Somaliland's infrastructure, including almost all of its roads, was built during Somalia's previous Cold War-era regime led by Siad Barre.[20] In the decades since Somaliland's self-declared independence, certain infrastructure sectors have been very successful in attracting private investment, in particular mobile telecommunications, while the roads and energy sectors have been much less successful. Somaliland's official public electricity utility, the Somaliland Electricity Agency (SEA), is a remnant of the former Ente Nazionale Energia Elettrica (ENEE) of southern Somalia, and operates only in Hargeisa.[21] It is reported to serve approximately 20% of Hargeisa's connected consumers, with an estimated 3 MW, but these claims are not substantiated by data. Otherwise, Somaliland's electricity is entirely generated and supplied by independent power providers (IPPs), of which there are over 43. These companies vary in size from large companies such as KAAH, which supplies much of Hargeisa as well as other towns, to

[15] Ibid.
[16] Raheem 2013.
[17] "Energy Regulatory and Legal Framework Development" (Berbera, Somaliland Partnership for Economic Growth, USAID, 2011).
[18] *Somaliland Private Sector Development Assessment* (Hargeisa: Development Alternatives International/USAID,[2011]).
[19] *Energy Regulatory and Legal Framework Development*
[20] Raheem 2013.
[21] DAI/USAID 2011.

businesses such as hotels or telecom companies that operate their own generators and sell their surplus electricity.[22]

These IPPs exemplify the category of supplier described in the literature in Chapter Two, characterized variously as "alternate power suppliers" (APS), "small power producers" (SPPs) or "small power distributors" (SPDs), "isolated mini-utilities," or "isolated mini-grids."[23] Whichever descriptor is used, these companies are typically owned and run by a businessman, group of businessman, or another company. They generate and distribute their own power almost exclusively through diesel generators, which run on imported petroleum products. The diesel fuel is imported primarily from the Middle East, and IPPs are therefore extremely sensitive to price fluctuations, to which they generally attribute the exorbitant costs of the electricity they produce.[24] Yet a related but additional problem is that the vast majority of generation equipment these companies use is small and inefficient, sometimes generators not much larger than the private backup generators used in other countries in case of blackouts. Much of Somaliland's equipment is extremely old and secondhand, repurposed from countries including Saudi Arabia, Yemen, Dubai, and China. It is believed that over 70 MW of installed power generation potential exists if all of the country's equipment were fully operational, which is not currently the case, as much of the equipment is currently idle or temporarily out of commission. Of the electricity that is supplied, it is estimated that 70% goes to household use, 20% to commercial use, and 2% to industrial use. A 2011 assessment estimated that the sector's total customer base is 127,000 to 130,000 connections, with a total revenue base of USD 4,026,700 per month or USD 50,000,000 per year. [25]

Energy use in Somaliland

According to Somaliland's Ministry of Energy, Somaliland's major urban areas have a rate of electricity access of 68%, which if true would give Somaliland one of the highest rates of electricity penetration in Africa.[26] However, these results are not based on reliable data, and an assessment found them to be unrealistic in part because connection rates of this magnitude would result in much higher revenues for the private power companies. In the main city of Hargeisa, the capital, reportedly a few years ago very little of the city had coverage, but the "business community joined to work together to improve the energy situation" and now the "whole city has coverage," according to the head of the Somaliland Chamber of Commerce.[27] Yet the limited quantitative data that exist suggests that the true proportion of connected buildings may be much lower.

It is estimated that the majority of Somaliland's electricity usage is for illumination. Dry wood and charcoal are predominantly used for cooking and heating.[28] It is estimated that both rural and urban households spend approximately USD 65 per month on energy, or an exorbitant 35% of average

[22] Ibid.
[23] Bernard Tenenbaum et al., *From the Bottom Up: How Small Power Producers and Mini-Grids can Deliver Electrification and Renewable Energy in Africa* (Washington DC: The World Bank,[2014]).
[24] DAI/USAID 2011.
[25] Ibid.
[26] Ibid.
[27] Interview, Head of Somaliland Chamber of Commerce, Shukri Jama, Mohamed.
[28] DAI/USAID.

household income. Evidence suggests that few households would be able to afford these prices without the hard currency coming from remittances from relatives in the diaspora. Some researchers believe that remittances are in fact creating a distortionary effect, in which Somaliland can afford to pay more for imported diesel fuel from the Middle East than it makes in export revenues (predominantly from the livestock industry), and makes up the hard currency difference from remittances.[29]

The regulatory context

Although Somaliland is believed to have one of the highest rates of private investment in its energy sector in East Africa, it is provided at a much higher cost and at lower quality. The government has recognized that a major constraint of the sector is the lack of a comprehensive energy law to regulate prices, safety standards, and other issues.[30] Even the IPPs allegedly recognize that a formal law will provide benefits to all including lower prices for consumers and higher margins for producers, and would "allow us to look more like an organized country."[31] In the words of one Somaliland government document, "Somaliland must show investors that this is an attractive place to invest and hence the regulatory framework and laws must be put in place to ensure investors that their investments are safe here."[32] Yet the passage of such a law is a complex and sensitive issue in a country with a history of sectarian violence, and major business interests with potential to gain or lose by the outcomes.

In preparation for formal regulation, in 2010 the Somaliland Council did ratify and approve a Somaliland Energy Policy. This document was the result of a long dialogue process between state, non-state, and energy sector stakeholders, and was a key priority of Somaliland's National Development Plan. Although it calls for the development of an energy regulatory framework as soon as possible, it does not actually set out the steps for doing so, and none has yet been implemented. [33] A key focus of the document is the creation of an independent energy commission. The commission is envisioned to comprise seven members representing community and civil society leaders, government officials, and energy producers themselves.[34] The establishment of such a commission is a particularly complex issue in a post-conflict country such as Somaliland due to its history of sectarian violence along intricate clan affiliation lines.[35] The energy commission is envisioned to "take into account clan affiliations," perhaps with an unofficial quota or distribution system among sub-clans.[36] Questions still remain over who would be involved in appointing the commission, whether the president or the parliament. However, it is estimated that it could be as much as ten years until the commission would be fully operational. [37] The energy policy dialogue held a second session with discussions among stakeholders on issues including the setting of

[29] Ibid.
[30] Public Private Dialogue report 2011.
[31] "Energy Regulatory and Legal Framework Development" (Hargeisa, 2012).
[32] Public Private Dialogue report 2011.
[33] DAI/USAID ibid.
[34] Public Private Dialogue report 2011.
[35] Clans, or lineage groups, are the defining social structure in Somali society, with each Somali the member of a specific clan and sub-clan traceable back generations.
[36] Public Private Dialogue report 2011.
[37] Ibid.

tariffs and cost of service; customer service; license issuing, time periods and application criteria; and dispute resolution mechanisms.[38] These issues remain to be addressed in a formal energy law.

Technical challenges

The Somaliland energy sector faces a number of technical challenges which deter investment and generate losses. A primary challenge is a lack of technical capacity among IPPs, as well as the government agencies which oversee them. In the words of one observer, there is overall a "phenomenal lack of knowledge" about electrical engineering in Somaliland's power sector.[39] Although there are many universities and technical schools in Somaliland which offer engineering programs, students reportedly prefer civil or telecommunications engineering because they see them as more lucrative fields. As a result, there is a shortage of electrical engineers and IPP owners tend to be small businessmen without a technical background, who have a poor understanding of technical terms and concepts. Many IPPs often do not know how much electricity they are generating because they do not have motor controllers.[40] Due to a lack of understanding of load estimation, IPPs sometimes overproduce power and overrun their machines.[41] IPPs often do not have a full understanding of electricity units such as kilowatt hours and kilovolts, and measure generation simply in terms of liters of diesel consumed.[42] They are unaware of what their unit costs are, making it difficult to calculate metrics such as revenues and cost recovery. IPPs tend to invest in diesel generators because there is the perception that they deliver power quickly and therefore begin generating revenues quickly.[43]

Because IPPs gather very limited quantitative data about their systems, it is very difficult for them to gauge past performance. The lack of power generation data, such as power plant load curves on a day to day basis, also makes it difficult to forecast future power consumption.[44] Forecasting power consumption would allow IPP to use models to make informed decisions about future investment options, allowing for more efficient use of current systems. Presently, the only way to estimate future power consumption is to simply estimate population growth, urbanization rates, and returns from the diaspora, and based on this it is estimated that power demand could grow by as much as 20% per year.[45] It is estimated that IPPs could meet this demand by expanding their businesses to increase penetration, yet this would require addressing a number of issues including the unsustainably high costs of fuel.

As in many other developing countries, Somaliland IPPs also experience major technical losses which significantly cut into their margins. IPPs are estimated to face losses of up to 40% per company, including technical losses of 10% and theft/nontechnical losses of 20%.[46] Fuel costs alone are believed to

[38] Public Private Dialogue report 2012.
[39] Interview, Somaliland electrical engineer and professor, Gollis University, Ivan Jackson, 25 February 2014.
[40] Interview, Director General, Somaliland Ministry of Energy, Suleiman Abdullahi, May 2013.
[41] DAI/USAID 2011.
[42] Jackson,
[43] Ibid.
[44] DAI/USAID 2011.
[45] Ibid.
[46] Public Private Dialogue report 2011.

eat up 60-65% of Somaliland IPPs' sales revenues, amounting to as much as USD 35 million per year.[47] Although companies are able to pass on the majority of these losses to customers through higher tariffs, they are still heavily incentivized to identify alternative technologies and sources of fuel.

Most Somaliland IPPs are vertically-integrated small grids, at the same time providing generation, transmission (if existent), and distribution functions.[48] This is highly inefficient, as none of the companies benefit from the economies of scale which typically exist in electricity sectors, which tend to be natural monopolies. In some cases, this can go as far as multiple suppliers running electrical distribution lines down the same street in a neighborhood, with unsynchronized systems, which is highly inefficient.[49] For example, in the town of Gabiley there are four companies currently operating: Afgal (which also operates in Hargeisa), Telesom and Somtel (the country's two major mobile telecommunications companies, which have also expanded into the electricity sector), and a recent entrant, Bhor.[50] This recent entrant encountered resistance from the previous three providers when it tried to enter the market.[51] All four of the companies run their own wires through the town, and it is reported that this is why one can see four electrical wires on one pole (see Exhibit 2). These situations of overactive competition result from the sector's overall lack of regulation, compounded by a lack of trust between suppliers, who refuse to share business information.[52] Due to the sector's high degree of competition and deregulation, IPPs are reluctant to share details such as performance indicators and profit and loss statements (if such detailed information is kept).[53]

Economies of scale, and cheaper energy prices, could potentially be achieved by importing more power from neighboring Ethiopia, which produces large amounts of cheap hydropower and currently provides some power to the Ethiopia/Somaliland border town of Wajaale. Although there is allegedly an agreement signed with Ethiopia, it is estimated that transmission lines from Ethiopia to all of Somaliland would cost multiple millions of dollars, which is beyond the capacity of any one local government or IPP.[54]

Despite the many inefficiencies of the Somaliland system, there is in a sense one silver lining: unlike in many other developing and post-conflict countries, Somaliland does not have a bloated state monopoly that needs to be unbundled[55] (as for example in Sierra Leone). This may allow the country's energy sector to be more nimble and to adapt more quickly to opportunities for increased efficiencies. In addition, although corruption is an issue as in most developing and post-conflict countries, there is a general sense that Somaliland's public sector features relatively lower levels of corruption simply because there is so little to steal. Because the country does not have access to bilateral or multilateral aid from donor governments, the GoSL is mainly limited to its domestic revenue base, which is

[47] DAI/USAID 2011.
[48] Public Private Dialogue report 2011.
[49] Ibid.
[50] Interview, Gabiley Mayor , 22 May 2013.
[51] Ibid.
[52] DAI/USAID 2011
[53] Ibid.
[54] Interview, mayor of Gabiley town, 22 May 2013.
[55] Public Private Dialogue report 2011.

extremely small. The country also does not have a large rent-generating industry such as an extractive industry, and it is difficult to extort large rents from the country's dominant industries such as livestock trading and telecommunications. As a result, instead of supporting themselves with money extorted through corruption, many GoSL officials tend to essentially work part-time and are in the office very little, more often attending to side businesses.[56] Although this is counterproductive for government efficiency, it at least allows the energy sector a certain degree of autonomy.

Cultural context

As touched on above, another major factor that plays a role in Somaliland's energy sector, as in all aspects of Somalilander economic, social and political life, is Somaliland's clan (or lineage group) system. Part of Somaliland's relative stability is often attributed to the fact that, in contrast to southern Somalia, it is largely controlled by one major clan, although other major clans also exist, and the main clan itself is subdivided into a variety of sub-clans. Any economic or political project of any kind, whether private, public, or non-profit sector led, must take into account the role of the local level clan dynamics. In general, all social, legal and economic disputes or conflicts arising among Somalilanders are settled through the clans' mediation structures, as opposed to through the formal Western legal system, which is nascent and seldom used. Disputants rarely go to courts, and instead go first to clan elders, or for disputes of greater magnitude that cannot be resolved at this level they seek out the "good offices" of their clan politicians.[57] Clan affiliations play a major role in businesses of all kinds; clan members typically lend to, and borrow, procure, and hire from, the members of their own clans, based entirely on the strength of assumed clan loyalties. On the other hand, a member of another clan or sub-clan does not have this built-in "background check" system, which makes inter-clan business dealings more difficult.

Research on the establishment of PPPs in water and electricity in Somaliland has found that there is a wide variation in the success rate of PPPs, depending on local dynamics. In one town, which was dominated by one major sub-clan, there was local enthusiasm for a PPP and it was established quickly.[58] Other towns can be as much as a 50/50 split between two clans, and PPPs can take much longer. According to Oxford researcher Emma Lochery's work on the dynamics of the Somaliland utility industry, most towns have an Infrastructure Committee or Board-like group, who essentially act as mediators and often use traditional clan dispute resolution mechanisms, and conflicts are moved further and further up the clan channels depending on their seriousness. These groups are stronger or weaker in some locales than in others, depending on the local clan composition.[59]

Clan dynamics are more or less volatile depending on the economic sector. Somaliland's gum industry, which harvests the resin of trees to create frankincense, a type of incense for which Somalia has been famous since biblical times, has often been subject to clan conflict.[60] The industry is currently believed to

[56] Adam Ismail Hassan, 26 May 2013.
[57] Ibid.
[58] Interview, PhD researcher, Oxford University, Emma Lochery, 28 May 2013.
[59] Ibid.
[60] Interview, World Bank consultant, Jim Miller, 26 May 2013.

produce approximately 500 tons per year, while it reportedly has the potential to produce as much as 1,500 tons, which is hindered by the competing territorial claims of the sub-clans in the region where the resin is harvested. In contrast, the fishing industry has reportedly been less subject to clan conflict as there are fewer clans involved in the industry.[61]

One industry in Somaliland that has experienced unexpected success is the water bottling industry. Although Somaliland has an estimated population of only 3.5 million, it has more than five or six major bottled water brands, each mainly associated with one region of the country and its corresponding sub-clan. Water bottling companies are considered a good investment for a number of reasons including the common cultural practice of chewing the mild stimulant *qat* (also known as *khat, chaat* or *miraa*), which has a side effect of increased thirst.[62] It is estimated that the average qat chewer drinks 1.5 liters of water a day, at a cost of USD 0.50.[63] In addition, there is a perception that the water bottling industry is able to generate more immediate returns to investment because of its relatively low barriers to entry; an entrepreneur must only buy the water bottling equipment (usually imported from China or Dubai), install it, and then begin distributing the bottled water to shops and stores and receive payments on the spot.[64] In contrast, electricity requires the high fixed cost investments of transmission and distribution lines in addition to the generator, and also faces the challenge of the highly saturated and competitive electricity IPP market. New entrants must be able to compete with cheaper prices, which would require investment in more efficient technologies than diesel generators, which requires an initial capital amount which is beyond the capacity of most small- and medium-scale entrepreneurs.[65] While the water bottling industry is competitive and features a variety of clan-affiliated competitors, it is considered an example of a sector in which clans have been able to comfortably share the market, "working things out in a Somali way."[66]

A final example of an industry which has been impacted by clan dynamics is the transport industry, specifically the country's airports. The country's capital, Hargeisa, does not currently have a functioning airport, and international flights arrive into the city of Berbera on the coast of the Gulf of Aden, although both airports were funded by a donation from the Kuwaiti government of USD 10 million, making them one of the largest and most complicated infrastructure projects in Somaliland. The lack of success of the Hargeisa airport as compared to the Berbera airport is in part attributed to the manner in which the contract was handed out.[67] The contract for the Hargeisa airport, requiring renovations including a modified runway and a security fence, was awarded to a relative of the president, while the contract for the Berbera airport was not. Whereas the contractor for the Berbera airport hired Somali consultants, the Hargeisa contractor had no technical expertise and hired a Chinese mining company that had no background in the country or sector. The Chinese consultants rotated through the country on brief several-month stints, and eventually left when they did not receive payment. The project experienced

[61] Ibid.
[62] Interview, Somaliland project manager, Abdishakur Mohamoud, 23 December 2013.
[63] Ibid.
[64] Email communication, Abdishakur Mohamoud, 13 January 2014.
[65] Ibid.
[66] Interview Zaki Raheem.
[67] Interview, former airport contractor, May 2013.

long delays in procuring materials and equipment and eventually hired new consultants. Because of the personal relationships that mired the contracting process, priority was not given to hiring quality contractors, to the detriment of the project. [68]

The sectarian dynamics that feature prominently in the gum, fisheries, water bottling, and transport industries also bear upon the electricity sector. As mentioned previously, current electricity IPPs are highly resistant to new market entrants, particularly from different lineage groups. In addition, they are wary of efforts to restructure or consolidate the sector to create economies of scale because they fear the loss of their own market share.[69] As part of the dialogue process to develop the new energy policy, current IPPs expressed the sentiment that their businesses should be protected, as compensation for having taken the initial risk to establish the first new generation and distribution systems in the country.[70] The idea of allowing grid consolidation and low-cost competitors has been described as "devastating" to these businesspeople, many of who have been in the industry for years.[71] These divisive issues have the potential to be exacerbated by clan dynamics. Those familiar with the context report that a key way to address these sensitivities is to allow extensive, transparent opportunities for dialogue, which is crucial to traditional Somali dispute resolution mechanisms.[72]

Financial constraints and access to credit

The major obstacle to expansion and efficiency in Somaliland's energy sector is generally recognized to be the limited capital available for investment (as in many developing and post-conflict countries).[73] The major reason that companies do not have money to invest is because they have very limited access to credit.[74] There is no access to formal credit on a large scale, and much lending is simply informal lending of cash within families or clan groups in exchange only for "future goodwill."[75] Although some large funds transfer companies such as Dahabshiil have begun to move into Islamic banking, it is generally believed that this borrowing is still limited to those with connections to the major wealthy families.[76] Those who are able to get interest-free loans from Dahabshiil are believed to be "somehow related to the owner."[77] In addition, even Dahabshiil is reported to ask for collateral, which is not strictly compliant with Islamic finance principles.[78]

Challenges and opportunities for private sector investment in Somaliland's energy sector

[68] Ibid.
[69] Public Private Dialogue report 2012.
[70] Ibid.
[71] Interview Zaki Raheem.
[72] Ibid.
[73] USAID/DAI 2011.
[74] Interview Ministry of Energy Director General.
[75] Ismail 2012.
[76] Ismail 2013.
[77] Interview, Somaliland businessperson, December 2013.
[78] Ibid.

Somaliland's energy sector features many of the same characteristics as those of other post-conflict countries documented in the literature, including Lebanon, Cambodia, and Liberia. Although localized private suppliers are able to provide a relatively high rate of coverage (at least in urban areas), they lack economies of scale, and are unable on an individual basis to access the large amounts of capital needed to make system investments and efficiency upgrades. In many countries, this is exacerbated by ongoing sectarian divisions (whether ethnic, religious or clan-based), making it more difficult for providers from different groups to cooperate and consolidate to pool resources. Any action by central governments, or international actors, to force independent providers into more integrated solutions similar to infrastructure systems in developed countries can be extremely controversial, as such an action is likely to be seen as sectarian- or ethnically-motivated and aligned with whatever group is currently in control.

Experience in other countries has shown that, when conflicts finally end and international donor funding begins to flow again, local private providers are unable to compete with these projects because their equipment is outdated and inefficient and they do not have the capital and technical expertise to upgrade them. Yet local companies do bring value; they have the demonstrated ability to operate in hostile environments, having taken the initial steps to establish infrastructure as efficiently as circumstances allowed. Research has shown that these small private providers can play an important role in power provision when they have access to the appropriate resources. Moreover, they build local capacity and sustainability, which is often a missing feature of donor-funded projects. Somaliland is unlikely (for better or worse) to face the issue of inflows of official donor funding in the near term, as it is internationally unrecognized and will likely remain so at least for the immediate future. However, the current system is indisputably highly inefficient due to all of the challenges identified above, which lends an element of urgency to the need to reform. The question, then, is how to encourage investments in efficiencies and upgrades among private providers who have such limited access to resources and low margins, and whether one way to achieve this would be through greater consolidation among the IPPs.

A 2011 assessment found that Somaliland's energy sector's efficiency could be maximized if all of the IPPs were integrated into a single interconnected and synchronized grid configuration (although this was estimated to cost as little as USD 1.5 million, which is likely to be a gross underestimate).[79] With any type of energy system, a large customer base is required to make large fixed-cost investments in generation and distribution lines profitable. In addition, generation technologies themselves benefit from economies of scale; whether the technology used is diesel generators or solar photovoltaics, the larger the system capacity, the lower the costs per watt installed. According to observers, there is an understanding within the Somaliland energy sector that they cannot "continue to add diesel generation endlessly," and that small diesel generation will not be sustainable in the long-term as Somaliland's demand for energy increases.[80] IPPs have an increasing desire to expand their customer bases, recognizing that for any type of large capital investment they would need a larger customer pool, even if they do not have the formal financial analyses to support this.[81] To some there is a sense that

[79] DAI/USAID 2011.
[80] Interview Ivan Jackson.
[81] Ibid.

"something tremendous will take place in the energy sector in a few years."[82] IPPs in Somaliland have an "appetite to improve," and recognize that although diesel can generate the most rapid returns on investment, there is significant profit to be made in investing in more efficient technologies with slightly more delayed returns, over a time horizon longer than two to three years.[83] However, despite the impressive relative stability achieved in Somaliland, it is still a high-risk country with considerable uncertainty about the country's future status, even for local and diaspora investors, and any investment timeframe longer than two to three years represents a major investor risk. There are therefore many conflicting incentives for those investing in the sector.

Modeling Somaliland's Energy Sector

Exhibits 3.1-6 provide a best-estimate model of the Somaliland energy sector according to the limited data available, and perform a sensitivity analysis of the financial effect of various types of capital investment improvements to the system. Much of the data are drawn from a comprehensive baseline survey conducted by the consulting firm Development Alternatives International for USAID. Some missing information has been filled in using data from Afghanistan, which is considered to have a relatively analogous power sector, as well as interviews conducted with key informants knowledgeable about the Somaliland power sector. Reliable quantitative data are extremely difficult to collect for the Somaliland power sector, so wherever possible the attempt has been made to "truth-check" the numbers with other sources. Some of the revenue streams may appear unexpectedly high, for example the estimate that yearly cash inflows for an IPP in Hargeisa total over USD 52 million. However, the DAI/USAID baseline assessment estimated a nationwide annual aggregate revenue base of approximately USD 50 million per year, of which the majority comes from Hargeisa, so these numbers seem at least on the correct order of magnitude.

Exhibit 3.1 shows the estimated revenue streams of a hypothetical diesel power IPP in Somaliland (responsible for both generation and distribution, assuming that high-voltage transmission is essentially negligible as is the case in Somaliland). This is done for a variety of scales: very small and medium-sized neighborhoods (50 to 200 connected households, respectively), and representative towns and cities of Somaliland, including Tog Wajaale and Las Anood (two small towns), Burao (a medium-sized city), and Hargeisa (the country's largest city). Exhibit 3.1 illustrates the key assumptions which affect this model, including the number of households connected, energy tariff charged, diesel price paid, and the collection rate of tariffs. The model assumes a 70% collection rate (very representative for East Africa), an energy tariff of USD 1.00 per kilowatt-hour (the current average in Somaliland), and a diesel price of USD 1.00 per liter (also the current average in Somaliland, see Exhibit 4). Two other variables which affect the model (not shown) are the relative efficiency of the generator, as reflected by the number of kilowatt-hours which can be generated from one liter of diesel, and the total number of utilization hours per year. An international average for diesel generator efficiency has been identified as 3.2 kilowatt-

[82] Email communication, Abdishakur Mohamoud.
[83] Ivan Jackson ibid.

hours per liter,[84] but given the out-of-date technology in Somaliland which is imported secondhand from Dubai and China, it is assumed that Somaliland generators will have a lower efficiency of 2.0 kilowatt-hours per liter consumed. Load utilization hours are estimated based on data from Afghanistan,[85] and it is assumed that load utilization will be able to be increased for larger generator capacities, though still below full 24/7 utilization (8760 hours in one year).

As the model shows, a typical power provider has relatively small but positive revenue inflows in the base case, with much larger revenue inflows for the larger system capacities, suggesting economies of scale. However, the model also shows that these margins are extremely sensitive, and with assumed decreases in efficiency of 20%, 30%, and 40% in years 3, 4, and 5 respectively the revenue streams quickly decrease and turn negative.

Exhibit 3.2 shows an assumed scenario in which the power provider continues to utilize the same diesel generation technology but makes capital investments in expanding the number of grid connections it serves (requiring both investments in generation and distribution capacity). The model assumes that an IPP in each location would attempt to increase the connection rate by 10 percentage points, i.e. from 60% to 70% in the town of Tog Wajaale. In the case of Hargeisa, it was found that the total population used in the baseline assessment was significantly underestimated, and therefore a connection increase of 50% (to 150,000 connections) was assumed. As the model shows, several of the sensitive variables are similar to the base case, including tariff collection rates, tariff prices, diesel prices, generator efficiency, and load utilization hours. Additional variables now include generation capital expenditure costs per kilowatt-hour (assumed to show slight economies of scale, decreasing from USD 0.81 per kilowatt-hour to USD 0.50 per kilowatt-hour for the very largest installment), distribution costs per connection (assumed to begin at USD 710 per connection based on data from Afghanistan, but to decrease slightly with economies of scale to USD 400 per connection), and the discount rate used, which is assumed to be 0.20.

As show in Exhibit 3.2, these capital investment expenditures are unprofitable (have a negative NPV) for very small operators, i.e. those making connection increases of 50 to 200 connections. For all of the towns and cities, beginning with Tog Wajaale (a trading town on the Ethiopian border assumed to add 300 new connections to its existing 1800), the NPV of the capital investment (both generation and distribution) is found to be positive. The NPV for the city of Hargeisa is both positive and relatively large. This indicates that economies of scale exist, which make larger-scale projects more attractive. However, even the smallest town (Wajaale) requires an investment of almost USD 500,000, which would in itself be beyond the capacity of the majority of Somaliland's IPPs, and grid expansion of the magnitude required by the city of Hargeisa would require an estimated investment of over USD 80 million. Therefore, it is clear that although investments of such a magnitude are financially attractive, they would require pools of capital which are beyond the access of Somaliland's current IPPs. This analysis was conducted for a relatively short time horizon (a project length of five years) given the reality of the

[84] See http://www.csiro.au/helix/sciencemail/activities/energyuse.html.

[85] Fichtner/Asian Development Bank, *Afghanistan Power Sector Master Plan*Islamic Republic of Afghanistan Ministry of Energy and Water,[2013]).

investment climate in Somaliland; investors expect the fastest possible returns (as quickly as two to three years if possible) and a project lasting anything longer than five years would likely be considered unfeasible.

Exhibit 3.3 shows the effects of an assumed scenario in which the IPP makes the investment in system expansion through an upgrade to a technology with longer-term efficiency (in this case assumed to be solar PV). Although solar PV is more expensive than several forms of generation such as natural gas or hydropower, it is cheaper in terms of operating costs than small-scale diesel generation (solar PV tariffs in other countries can often be less than half the current tariffs found in Somaliland). This scenario addresses the question of whether to implement overall system efficiency upgrades that will make the system more profitable in the long term, but which are more expensive in the short term. Much of the assumptions are similar to the diesel generation cases, with some adjustments. Total utilization hours are assumed to be 2,200 per year, based on data of daily solar irradiation patterns in Somaliland. Capital expenditures for solar PV installation are assumed to be USD 6.8 per watt installed, based on international data (also assumed to demonstrate basic economies of scale, decreasing to USD 3.0 per installed watt for larger installations).[86] Operational expenditures are assumed to be USD 0.13 per kilowatt-hour total, mainly taking into account replacement costs for batteries.[87]

As illustrated by Exhibit 3.3, the NPV for any size solar PV installation for this time horizon is negative, whether for an increase of a single household or 50,000 households. However, Exhibit 3.4 shows a sensitivity analysis of the effect of increasing the investment time horizon, allowing discounted cash flows to pay back the project over ten years instead of five. Solar PV projects are generally assumed to require a longer time horizon to pay for themselves than other generation technologies, in particular diesel generation, which is perceived to have the shortest payback period. As Exhibit 3.4 shows, the change in time horizon does make project NPV positive at certain scales. A small business adding capacity of only 4 kilowatts, and the towns of Las Anood and Burao, adding 300 and 353 connections respectively, become profitable. However, the largest scale installation in Hargeisa remains unprofitable.

Exhibit 3.5 performs a sensitivity analysis using the five-year time horizon for solar PV but assuming that the IPP is able to make efficiency improvements in the form of increased tariff collection. If tariff collection rates are assumed to increase to 80%, the NPV for a five-year project on the scale of the town of Las Anood (adding 300 connections) becomes positive. When the same analysis is conducted for an assumed increase in collection rates to 90%, the NPV for a five-year project for the towns of both Las Anood and Burao, (adding 300 and 353 connections respectively), becomes positive. These results suggest that for medium-sized projects, efforts made to increase collection rates can have significant impacts on project profitability.

Clearly, the solar PV analysis presents the same issue identified above with diesel generation. An investment in as little as 0.4 kilowatts of solar PV capacity would cost over USD 5,000, while the investment required to connect 50,000 additional households in Hargeisa using solar PV would require as much as USD 29 million. All of these investments would require access to a level of capital currently

[86] DAI/USAID.
[87] Fichtner ibid.

non-existent in Somaliland. The results of the financial analysis suggest that there are attractive and profitable investments to be made in the Somaliland energy sector, but they will require a fundamental restructuring of the investment climate if they are to be realized. Recommendations to go about this are discussed further in the final chapter.

References

"Energy Regulatory and Legal Framework Development." Berbera, Somaliland Partnership for Economic Growth, USAID, 2011.

"Energy Regulatory and Legal Framework Development." Hargeisa, 2012.

Somaliland Private Sector Development Assessment. Hargeisa: Development Alternatives International/USAID, 2011.

Abdullahi, Suleiman. May 2013.

Fichtner/Asian Development Bank. *Afghanistan Power Sector Master Plan*: Islamic Republic of Afghanistan Ministry of Energy and Water, 2013.

Ismail Hassan, Adam. 26 May 2013.

———. "The Role of Remittance in the Economic Development of Somaliland." Hargeisa, Somaliland, 2012.

———. "Somaliland: Prospects for Economic Development and Future Priorities for Investment.".

Jackson, Ivan. 25 February 2014.

Lochery, Emma. 28 May 2013.

Mayor, Gabiley,. 22 May 2013.

Miller, Jim. 26 May 2013.

Mohamoud, Abdishakur. 23 December 2013.

Raheem, Zaki. 21 May 2013.

Shukri Jama, Mohamed. 26 May 2013.

Tenenbaum, Bernard, Chris Greacen, Tilak Siyambalapitiya, and James Knuckles. *From the Bottom Up: How Small Power Producers and Mini-Grids can Deliver Electrification and Renewable Energy in Africa*. Washington DC: The World Bank, 2014.

Chapter Five

Conclusions and Recommendations

The key point illustrated by the discussions in Chapter Four is that investments in electricity system upgrades and expansions in Somaliland can be profitable, even for the relatively expensive but efficient technology of solar PV, (if the time horizon for the project is expanded and/or tariff collection rates are increased), but that these investments require access to much larger pools of capital than are currently available in Somaliland. Many Somalilander businesspeople do have access to relatively large amounts of US dollars, in comparison to other post-conflict and lower-income countries, through the large remittance network from the international diaspora. Data about these funds are very limited, as they are almost entirely outside the formal banking system, but it is believed that some Somaliland businessmen may have access to sums as large as USD 1-2 million. Yet as demonstrated by the analysis in Chapter Four, such amounts individually are not large enough to fund the majority of the capital investments required to make the Somaliland power sector sustainable in the long run. In addition, as discussed earlier, this money is almost entirely tied to clan/lineage connections; those with direct kinship relationships to the major wealthy families are able to borrow informally, generally in cash, without formal interest payments, and based on the expectation of future "goodwill." This type of informal financing is not available to all Somalilander businesspeople, depending on their lineage group, which creates further inefficiencies in the system.

Recommendations

Based on the results of the preceding financial analysis, this thesis advances the following recommendation: in order to develop the Somaliland energy sector, greater emphasis should be placed on coordination and consolidation among independent power providers to create opportunities for pooled financing and economies of scale. This does not have to entail the squeezing-out of individual small-scale IPPs, as has happened in other post-conflict countries when foreign aid financing began to return; instead, a more efficient solution would be for smaller IPPs to either join with each other or be "bought out" by larger ones. In this way, the IPPs' initial work of building distribution grids and basic generation capacity will not be lost but could be leveraged for future benefit.

This recommendation raises three immediate questions: first, what is the optimum size and structure for one of these IPP conglomerations? Second, could this system allow investors to utilize longer time horizons for their investments, permitting investment in efficient technologies which are more cost-effective in the long run but require more capital investment upfront? Third, given the cultural context of Somaliland, is this recommendation at all realistic?

The analysis suggests that the more IPPs that are able to consolidate, and thus the greater the aggregated size of the IPP merger, the greater the economies of scale, and thus the greater the profitability. The analysis suggests that if IPPs were able to consolidate to a size able to serve a medium-sized town such as Burao, with an estimated population of approximately 21,000 and a total number of connections of 17,000 (at a connection rate of 80%), they could potentially afford the capital investment necessary for a PV solar installation. The benefit of switching to a technology such as solar PV is not

simply its environmental advantages over diesel; over the long term solar generation requires much lower operating costs because it does not rely on the continued purchase of diesel fuel. The financial model demonstrates how sensitive Somaliland's energy sector currently is to fluctuations in diesel fuel prices. In order to expand Somaliland's electricity system to meet increased demand and reach those who are currently unconnected, diversification of generation will be necessary, including to technologies that do not feature such volatile input prices.

However, it is important to remember that solar PV will in general not be profitable unless the time horizon of the project is extended beyond the current average of five years or less. Whether or not solar PV is used, investment in more efficient technologies will necessarily require a fundamental shift in attitudes in Somali investing, to one which has an appetite for slightly longer timeframes. What is more, it will require a shift in the climate among current IPPs from one which is fiercely competitive, where all other providers are viewed as a direct threat (often also with the additional overlay of complex lineage group affiliations), to one which is not a zero-sum game, in which other IPPs are seen as potential collaborators and there is an understanding that coordination and even consolidation can "increase the pie" for everyone. If Somaliland IPPs are able to invest in more efficient technologies, if only more efficient diesel generators, they will be able to generate power which is automatically cheaper than anything that is currently being produced in Somaliland. Therefore it is in the interests of IPPs to consolidate as much as possible to bring down their costs. This would require the sharing of knowledge and in particular the sharing of business performance information, which at the moment is extremely sensitive information. Therefore an equally important aspect is the changing of attitudes among power providers.

Clearly, there are complex cultural and socio-political forces at play that keep the Somaliland power sector in its current fragmented state. IPPs did not purposefully develop in an economically inefficient way; in a post-conflict climate, large-scale capital investment is very difficult and investors rely on the guarantees provided by their lineage group structures, particularly in the Somaliland context where clans have always played such a historically influential role. Experience from other sectors in Somaliland has shown that one of the most successful ways of bringing about cooperation and effectively addressing issues, both clan-related and not, is to convene an open dialogue with all of the involved parties. In this way, stakeholders may be able to "work things out in a Somali way," as in the case of the domestic water bottling industry. This type of informal conflict resolution system is widespread in many cultures that have recently experienced sectarian violence, and is all the more so in a traditionally oral culture such as that of the Somalis. Accordingly, a recommendation for a first step toward effecting the consolidation of the Somaliland energy sector would be to convene a dialogue of all of the country's IPPs, specifically intended to discuss the inefficiencies of the current system, and ways to potentially address them going forward.

Benefits

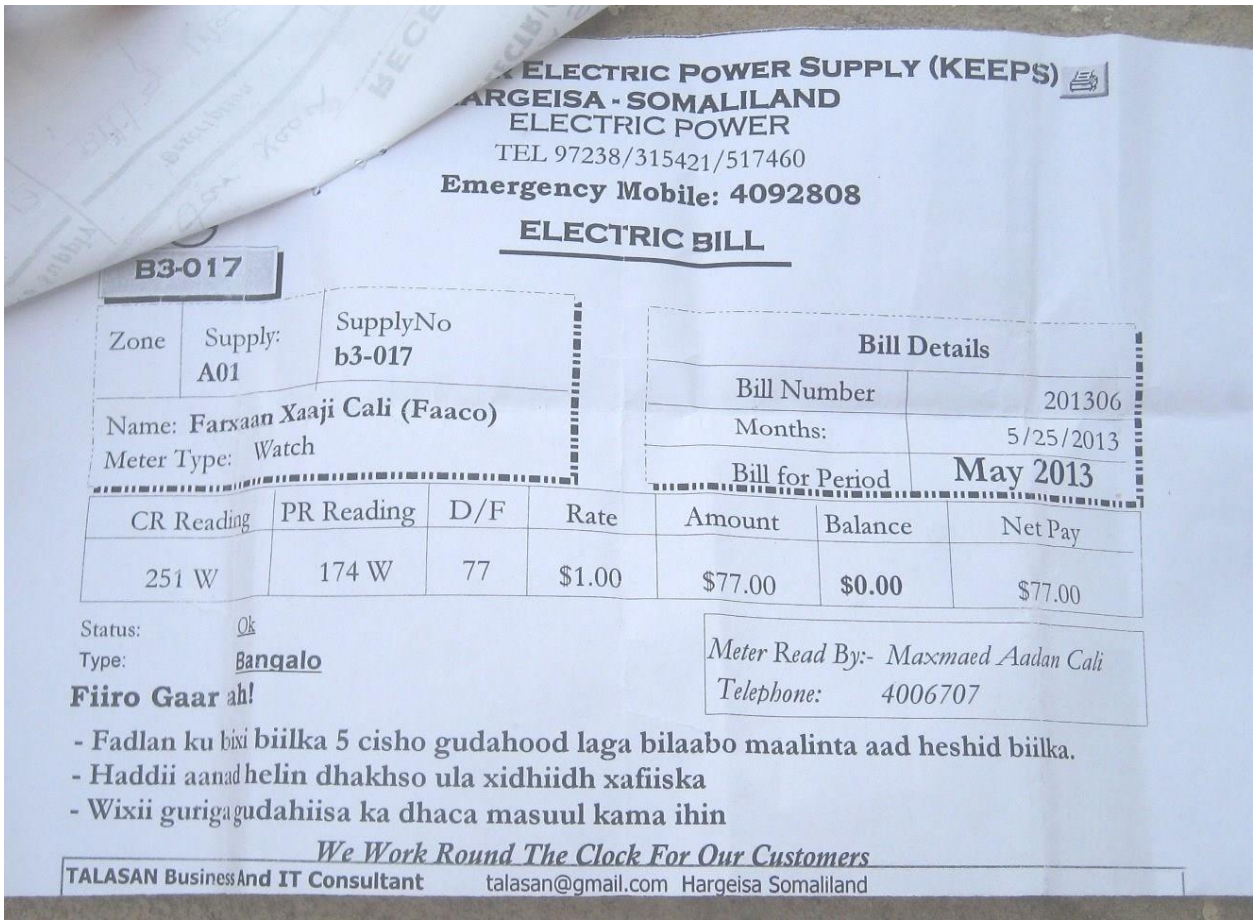
Such a consolidation among Somaliland's power sector as the one described above would allow the country's first steps toward the creation of synchronized town- and city-wide grids. These could even potentially be transformed into an eventual country-wide grid system if it was found to be cost

effective. The economies of scale created would allow efficiencies such as upgrading distribution lines, installing transformers, installing modern metering equipment, and perhaps even a system to monitor the entire integrated grid. This is essentially what was produced in the United States with the Independent System Operator (ISO) system. However, the context in Somaliland is vastly different from the United States. The capital constraints are obvious, but the problem is not simply a question of math; if it was, perhaps some of the efficiency investments would already have been made. Any intervention in the Somaliland power sector, as in many post-conflict or low-income countries in general, must take into account the local cultural, social, and political dynamics. In Somaliland, the role of clan dynamics is an important factor to be considered. However, the power sector is also a business, and in the end it is very possible that "economics beats clans." If power providers and their investors can be convinced of the benefits of consolidation and cooperation, it is very likely that these divisions can be overcome. In the words of one Somalilander, "there's good business here in Somaliland."[1]

The Somaliland example has potential implications for other post-conflict contexts around the world. In places where public resources are limited, donor funding is shrinking, and foreign direct investment is unlikely to materialize any time soon, domestic private investment may represent a viable alternative, if basic capacity is already in place. Yet as demonstrated in countries from Somaliland to Cambodia to Lebanon, these local solutions tend to be inefficient. Local private suppliers need capacity building to understand new technologies and appreciate the value of efficiency upgrades, and support to cooperate and rationalize their disjointed systems. Local financial institutions, where existent, need support to be able to lend to capital-starved but risky power companies. These types of interventions require relatively minimal resources of time and money by the international community (as opposed to the large investments needed for donors to build the projects by themselves, or through PPPs). Through this type of support, international actors can enable local, sustainable solutions to post-conflict countries' acute energy shortages, bringing direct benefits to marginalized and vulnerable communities around the world.

[1] Interview, Director General, Somaliland Ministry of Energy, May 2013.

Exhibit 1



ELECTRIC POWER SUPPLY (KEEPS)
ARGEISA - SOMALILAND
ELECTRIC POWER
TEL 97238/315421/517460
Emergency Mobile: 4092808

ELECTRIC BILL

B3-017

Zone	Supply:	SupplyNo
	A01	b3-017

Name: **Farxaan Xaaji Cali (Faaco)**
Meter Type: Watch

Bill Details	
Bill Number	201306
Months:	5/25/2013
Bill for Period	May 2013

CR Reading	PR Reading	D/F	Rate	Amount	Balance	Net Pay
251 W	174 W	77	$1.00	$77.00	**$0.00**	$77.00

Status: Ok
Type: Bangalo

Meter Read By:- Maxmaed Aadan Cali
Telephone: 4006707

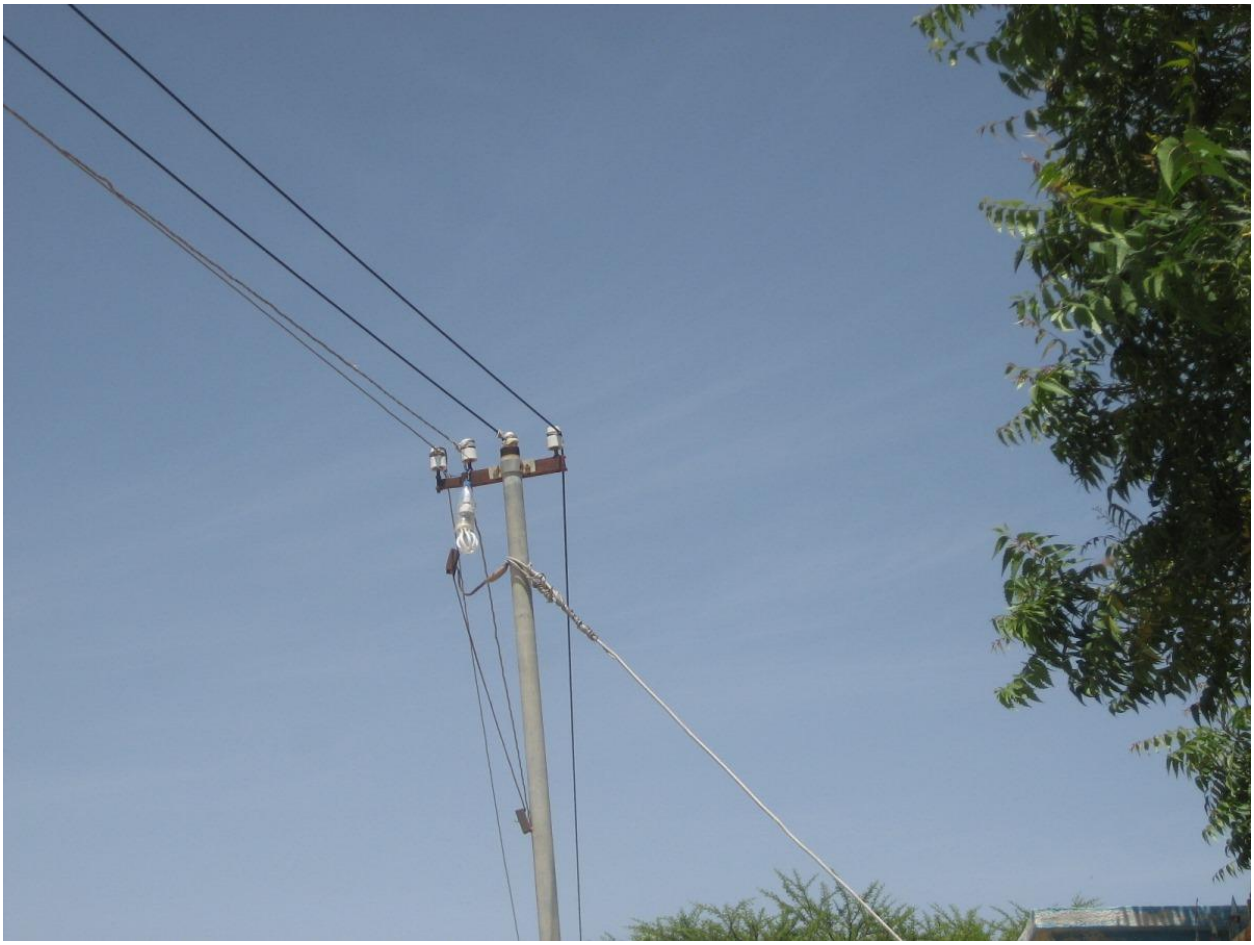
Fiiro Gaar ah!

- **Fadlan ku bixi biilka 5 cisho gudahood laga bilaabo maalinta aad heshid biilka.**
- **Haddii aanad helin dhakhso ula xidhiidh xafiiska**
- **Wixii guriga gudahiisa ka dhaca masuul kama ihin**

We Work Round The Clock For Our Customers

TALASAN Business And IT Consultant talasan@gmail.com Hargeisa Somaliland

Exhibit 2



Assumptions:	Neighborhoods		Medium towns		Large towns	
	Small:	Medium:	Tog Wajaale:	Las Anood:	Burao:	Hargeisa:
Number of connections:	50	200	1,800	3,000	15,000	100,000
Total energy produced (kW-h/yr)	52,000	210,000	1,920,000	4,800,000	38,500,000	52,500,000
Energy tariff (USD/kWh)	1.00					
Diesel price (USD/liter)	1.00					
Costs of operating generator (USD/kwh)	0.045					
Amount of diesel needed (liters/yr)	26,000	105,000	960,000	2,400,000	19,250,000	26,250,000
Collection rate	0.70					

Small neighborhood:

Year	0	1	2	3	4	5
Cash inflow	52,000	52,000	52,000	41,600	36,400	31,200
Assume 70% collection rate:	36,400	36,400	36,400	29,120	25,480	21,840
Cash outflow (OPEX):	28,340	28,340	28,340	28,340	28,340	28,340
Net revenues:	8,060	8,060	8,060	780	(2,860)	(6,500)

Medium neighborhood:

Year	0	1	2	3	4	5
Cash inflow	210,000	210,000	210,000	168,000	147,000	126,000
Assume 70% collection rate:	147,000	147,000	147,000	117,600	102,900	88,200
Cash outflow	114,450	114,450	114,450	114,450	114,450	114,450
Net revenues:	32,550	32,550	32,550	3,150	(11,550)	(26,250)

Tog Wajaale:

Year	0	1	2	3	4	5
Cash inflow	1,920,000	1,920,000	1,920,000	1,536,000	1,344,000	1,152,000
Assume 70% collection rate:	1,344,000	1,344,000	1,344,000	1,075,200	940,800	806,400
Cash outflow	1,046,400	1,046,400	1,046,400	1,046,400	1,046,400	1,046,400
Net revenues:	297,600	297,600	297,600	28,800	(105,600)	(240,000)

Las Anood:

Year	0	1	2	3	4	5
Cash inflow	4,800,000	4,800,000	4,800,000	3,840,000	3,360,000	2,880,000
Assume 70% collection rate:	3,360,000	3,360,000	3,360,000	2,688,000	2,352,000	2,016,000
Cash outflow	2,616,000	2,616,000	2,616,000	2,616,000	2,616,000	2,616,000
Net revenues:	744,000	744,000	744,000	72,000	(264,000)	(600,000)

Burao:

Year	0	1	2	3	4	5
Cash inflow	38,500,000	38,500,000	38,500,000	30,800,000	26,950,000	23,100,000
Assume 70% collection rate:	26,950,000	26,950,000	26,950,000	21,560,000	18,865,000	16,170,000
Cash outflow	20,982,500	20,982,500	20,982,500	20,982,500	20,982,500	20,982,500
Net revenues:	5,967,500	5,967,500	5,967,500	577,500	(2,117,500)	(4,812,500)

Hargeisa:

Year	0	1	2	3	4	5
Cash inflow	52,500,000	52,500,000	52,500,000	42,000,000	36,750,000	31,500,000
Assume 70% collection rate:	36,750,000	36,750,000	36,750,000	29,400,000	25,725,000	22,050,000
Cash outflow	28,612,500	28,612,500	28,612,500	28,612,500	28,612,500	28,612,500
Net revenues:	8,137,500	8,137,500	8,137,500	787,500	(2,887,500)	(6,562,500)

Assumptions:	Neighborhoods		Medium towns		Large towns	
	Small:	Medium:	Tog Wajaale:	Las Anood:	Burao:	Hargeisa:
Number of current connections:	50	200	1,800	3,000	15,000	100,000
Total energy produced (kW-h/yr)	52,000	210,000	3,000,000	7,184,874	42,857,143	375,000,000
Energy tariff (USD/kWh)	1.00					
Diesel price (USD/liter)	1.00					
Costs of operating generator (USD/kwh)	0.045					
Amount of diesel needed (liters/yr)	26,000	105,000	1,500,000	3,592,437	21,428,571	187,500,000
Increase in connections:	50	200	300	353	2,143	50,000
Energy costs per watt (USD/kWh)	0.81	0.60	0.60	0.60	0.60	0.50
Discount factor	0.20					
Collection rate:	0.70					

Small neighborhood:

Year	0	1	2	3	4	5
Cash inflow		52,000	52,000	52,000	41,600	36,400
Assume 70% collection rate:		36,400	36,400	36,400	29,120	25,480
Cash outflow (OPEX):		28,340	28,340	28,340	28,340	28,340
Net cash inflows:		8,060	8,060	8,060	780	(2,860)
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		6,717	5,597	4,664	376	(1,149)
New CAPEX for generation:	(42,000)					
New CAPEX for distribution:	(35,500)					
NPV:	(61,295)					

Medium neighborhood:

Year	0	1	2	3	4	5
Cash inflow		210,000	210,000	210,000	168,000	147,000
Assume 70% collection rate:		147,000	147,000	147,000	117,600	102,900
Cash outflow (OPEX):		114,450	114,450	114,450	114,450	114,450
Net cash inflows:		32,550	32,550	32,550	3,150	(11,550)
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		27,125	22,604	18,837	1,519	(4,642)
New CAPEX for generation:	(126,000)					
New CAPEX for distribution:	(142,000)					
NPV:	(202,557)					

Tog Wajaale:

Year	0	1	2	3	4	5
Cash inflow		3,000,000	3,000,000	3,000,000	2,400,000	2,100,000
Assume 70% collection rate:		2,100,000	2,100,000	2,100,000	1,680,000	1,470,000
Cash outflow (OPEX):		1,635,000	1,635,000	1,635,000	1,635,000	1,635,000
Net cash inflows:		465,000	465,000	465,000	45,000	(165,000)
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		387,500	322,917	269,097	21,701	(66,310)
New CAPEX for generation:	(257,143)					
New CAPEX for distribution:	(213,000)					
NPV:	464,763					

Las Anood:

Year	0	1	2	3	4	5
Cash inflow		7,184,874	7,184,874	7,184,874	5,747,899	5,029,412
Assume 70% collection rate:		5,029,412	5,029,412	5,029,412	4,023,529	3,520,588
Cash outflow (OPEX):		3,915,756	3,915,756	3,915,756	3,915,756	3,915,756
Net cash inflows:		1,113,655	1,113,655	1,113,655	107,773	(395,168)
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		928,046	773,372	644,477	51,974	(158,809)
New CAPEX for generation:	(453,782)					
New CAPEX for distribution:	(250,588)					
NPV:	1,534,690					

Burao:

Year	0	1	2	3	4	5
Cash inflow		42,857,143	42,857,143	42,857,143	34,285,714	30,000,000
Assume 70% collection rate:		30,000,000	30,000,000	30,000,000	24,000,000	21,000,000
Cash outflow (OPEX):		23,357,143	23,357,143	23,357,143	23,357,143	23,357,143
Net cash inflows:		6,642,857	6,642,857	6,642,857	642,857	(2,357,143)
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		5,535,714	4,613,095	3,844,246	310,020	(947,283)
New CAPEX for generation:	(3,214,286)					
New CAPEX for distribution:	(1,071,429)					
NPV:	9,070,078					

Hargeisa:

Year	0	1	2	3	4	5
Cash inflow		375,000,000	375,000,000	375,000,000	300,000,000	262,500,000
Assume 70% collection rate:		262,500,000	262,500,000	262,500,000	210,000,000	183,750,000

Cash outflow (OPEX):		204,375,000	204,375,000	204,375,000	204,375,000	204,375,000
Net cash inflows:		58,125,000	58,125,000	58,125,000	5,625,000	(20,625,000)
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		48,437,500	40,364,583	33,637,153	2,712,674	(8,288,725)
New CAPEX for generation:	(62,500,000)					
New CAPEX for distribution:	(20,000,000)					
NPV:	34,363,185					

Assumptions:	Individual Users		Medium towns		Large towns	
	Household:	Business:	Tog Wajaale:	Las Anood:	Burao:	Hargeisa:
Total energy produced (kW-h/yr)	880	8,800	1,100,000	2,200,000	4,400,000	6,600,000
Energy tariff (USD/kWh)	1.00					
Solar PV operating costs (USD):	0.13					
Increase in connections:	1	1	300	353	2,143	50,000
Discount factor	0.20					
Collection rate	0.70					

Household:

Year	0	1	2	3	4	5
Value of electricity produced (USD):		880	880	880	880	880
Cash outflow (OPEX):		114	114	114	114	114
Net cash inflows:		766	766	766	766	766
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		638	532	443	369	308
New CAPEX for generation:	(6,800)					
New CAPEX for distribution:	0					
NPV:	(4,510)					

Business:

Year	0	1	2	3	4	5
Value of electricity produced (USD):		8,800	8,800	8,800	8,800	8,800
Cash outflow (OPEX):		1,144	1,144	1,144	1,144	1,144
Net cash inflows:		7,656	7,656	7,656	7,656	7,656
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		6,380	5,317	4,431	3,692	3,077
New CAPEX for generation:	(27,200)					
New CAPEX for distribution:	0					
NPV:	(4,304)					

Tog Wajaale:

Year	0	1	2	3	4	5
Cash inflow (USD):		1,100,000	1,100,000	1,100,000	1,100,000	1,100,000
Assume 70% collection rate:		770,000	770,000	770,000	770,000	770,000
Cash outflow (OPEX):		143,000	143,000	143,000	143,000	143,000
Net cash inflows:		627,000	627,000	627,000	627,000	627,000
Discount factor:		1.20	1.44	1.73	2.07	2.49

Present value of inflow:		522,500	435,417	362,847	302,373	251,977
New CAPEX for generation:	(3,400,000)					
New CAPEX for distribution:	(213,000)					
NPV:	(1,737,886)					

Las Anood:

Year	0	1	2	3	4	5
Cash inflow		2,200,000	2,200,000	2,200,000	2,200,000	2,200,000
Assume 70% collection rate:		1,540,000	1,540,000	1,540,000	1,540,000	1,540,000
Cash outflow (OPEX):		286,000	286,000	286,000	286,000	286,000
Net cash inflows:		1,254,000	1,254,000	1,254,000	1,254,000	1,254,000
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		1,045,000	870,833	725,694	604,745	503,954
New CAPEX for generation:	(4,000,000)					
New CAPEX for distribution:	(250,588)					
NPV:	(500,361)					

Burao:

Year	0	1	2	3	4	5
Cash inflow		4,400,000	4,400,000	4,400,000	4,400,000	4,400,000
Assume 70% collection rate:		3,080,000	3,080,000	3,080,000	3,080,000	3,080,000
Cash outflow (OPEX):		572,000	572,000	572,000	572,000	572,000
Net cash inflows:		2,508,000	2,508,000	2,508,000	2,508,000	2,508,000
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		2,090,000	1,741,667	1,451,389	1,209,491	1,007,909
New CAPEX for generation:	(8,000,000)					
New CAPEX for distribution:	(1,071,429)					
NPV:	(1,570,973)					

Hargeisa:

Year	0	1	2	3	4	5
Cash inflow		6,600,000	6,600,000	6,600,000	6,600,000	6,600,000
Assume 70% collection rate:		4,620,000	4,620,000	4,620,000	4,620,000	4,620,000
Cash outflow (OPEX):		858,000	858,000	858,000	858,000	858,000
Net cash inflows:		3,762,000	3,762,000	3,762,000	3,762,000	3,762,000
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		3,135,000	2,612,500	2,177,083	1,814,236	1,511,863
New CAPEX for generation:	(9,000,000)					

New CAPEX for distribution:	(20,000,000)
NPV:	(17,749,317)

Assumptions:	Individual Users		Medium towns		Large towns	
	Household:	Business:	Tog Wajaale:	Las Anood:	Burao:	Hargeisa:
Total energy produced (kW-h/yr)	880	8,800	1,100,000	2,200,000	4,400,000	6,600,000
Energy tariff (USD/kWh)	1.00					
Solar PV operating costs (USD):	0.13					
Increase in connections:	1	1	300	353	2,143	50,000
Discount factor	0.20					
Collection rate	0.70					

Household:

Year	0	1	2	3	4	5	6	7	8	9	10
Value of electricity produced (USD):		880	880	880	880	880	880	880	880	880	880
Cash outflow (OPEX):		114	114	114	114	114	114	114	114	114	114
Net cash inflows:		766	766	766	766	766	766	766	766	766	766
Discount factor:		1.20	1.44	1.73	2.07	2.49	2.99	3.58	4.30	5.16	6.19
Present value of inflow:		638	532	443	369	308	256	214	178	148	124
New CAPEX for generation:	(6,800)										
New CAPEX for distribution:	0										
NPV:	(3,590)										

Business:

Year	0	1	2	3	4	5	6	7	8	9	10
Value of electricity produced (USD):		8,800	8,800	8,800	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Cash outflow (OPEX):		1,144	1,144	1,144	1,144	1,144	1,144	1,144	1,144	1,144	1,144
Net cash inflows:		7,656	7,656	7,656	7,656	7,656	7,656	7,656	7,656	7,656	7,656
Discount factor:		1.20	1.44	1.73	2.07	2.49	2.99	3.58	4.30	5.16	6.19
Present value of inflow:		6,380	5,317	4,431	3,692	3,077	2,564	2,137	1,781	1,484	1,236
New CAPEX for generation:	(27,200)										
New CAPEX for distribution:	0										
NPV:	4,898										

Tog Wajaale:

Year	0	1	2	3	4	5	6	7	8	9	10
Cash inflow (USD):		1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000
Assume 70% collection rate:		770,000	770,000	770,000	770,000	770,000	770,000	770,000	770,000	770,000	770,000
Cash outflow (OPEX):		143,000	143,000	143,000	143,000	143,000	143,000	143,000	143,000	143,000	143,000
Net cash inflows:		627,000	627,000	627,000	627,000	627,000	627,000	627,000	627,000	627,000	627,000
Discount factor:		1.20	1.44	1.73	2.07	2.49	2.99	3.58	4.30	5.16	6.19
Present value of inflow:		522,500	435,417	362,847	302,373	251,977	209,981	174,984	145,820	121,517	101,264
New CAPEX for generation:	(3,400,000)										
New CAPEX for distribution:	(213,000)										
NPV:	(984,320)										

Las Anood:

Year	0	1	2	3	4	5	6	7	8	9	10
Cash inflow		2,200,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000
Assume 70% collection rate:		1,540,000	1,540,000	1,540,000	1,540,000	1,540,000	1,540,000	1,540,000	1,540,000	1,540,000	1,540,000
Cash outflow (OPEX):		286,000	286,000	286,000	286,000	286,000	286,000	286,000	286,000	286,000	286,000
Net cash inflows:		1,254,000	1,254,000	1,254,000	1,254,000	1,254,000	1,254,000	1,254,000	1,254,000	1,254,000	1,254,000
Discount factor:		1.20	1.44	1.73	2.07	2.49	2.99	3.58	4.30	5.16	6.19
Present value of inflow:		1,045,000	870,833	725,694	604,745	503,954	419,962	349,968	291,640	243,034	202,528
New CAPEX for generation:	(4,000,000)										
New CAPEX for distribution:	(250,588)										

NPV:	1,006,772										

Burao:

Year	0	1	2	3	4	5	6	7	8	9	10
Cash inflow		4,400,000	4,400,000	4,400,000	4,400,000	4,400,000	4,400,000	4,400,000	4,400,000	4,400,000	4,400,000
Assume 70% collection rate:		3,080,000	3,080,000	3,080,000	3,080,000	3,080,000	3,080,000	3,080,000	3,080,000	3,080,000	3,080,000
Cash outflow (OPEX):		572,000	572,000	572,000	572,000	572,000	572,000	572,000	572,000	572,000	572,000
Net cash inflows:		2,508,000	2,508,000	2,508,000	2,508,000	2,508,000	2,508,000	2,508,000	2,508,000	2,508,000	2,508,000
Discount factor:		1.20	1.44	1.73	2.07	2.49	2.99	3.58	4.30	5.16	6.19
Present value of inflow:		2,090,000	1,741,667	1,451,389	1,209,491	1,007,909	839,924	699,937	583,281	486,067	405,056
New CAPEX for generation:	(8,000,000)										
New CAPEX for distribution:	(1,071,429)										
NPV:	1,443,291										

Hargeisa:

Year	0	1	2	3	4	5	6	7	8	9	10
Cash inflow		6,600,000	6,600,000	6,600,000	6,600,000	6,600,000	6,600,000	6,600,000	6,600,000	6,600,000	6,600,000
Assume 70% collection rate:		4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000	4,620,000
Cash outflow (OPEX):		858,000	858,000	858,000	858,000	858,000	858,000	858,000	858,000	858,000	858,000
Net cash inflows:		3,762,000	3,762,000	3,762,000	3,762,000	3,762,000	3,762,000	3,762,000	3,762,000	3,762,000	3,762,000
Discount factor:		1.20	1.44	1.73	2.07	2.49	2.99	3.58	4.30	5.16	6.19
Present value of inflow:		3,135,000	2,612,500	2,177,083	1,814,236	1,511,863	1,259,886	1,049,905	874,921	729,101	607,584
New CAPEX for generation:	(9,000,000)										
New CAPEX for distribution:	(20,000,000)										
NPV:	(13,227,920)										

Assumptions:	Individual Users		Medium towns		Large towns	
	Household:	Business:	Tog Wajaale:	Las Anood:	Burao:	Hargeisa:
Total energy produced (kW-h/yr)	880	8,800	1,100,000	2,200,000	4,400,000	6,600,000
Energy tariff (USD/kWh)	1.00					
Solar PV operating costs (USD):	0.13					
Increase in connections:	1	1	300	353	2,143	50,000
Discount factor	0.20					
Collection rate	0.80					

Household:

Year	0	1	2	3	4	5
Value of electricity produced (USD):		880	880	880	880	880
Cash outflow (OPEX):		114	114	114	114	114
Net cash inflows:		766	766	766	766	766
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		638	532	443	369	308
New CAPEX for generation:	(6,800)					
New CAPEX for distribution:	0					
NPV:	(4,510)					

Business:

Year	0	1	2	3	4	5
Value of electricity produced (USD):		8,800	8,800	8,800	8,800	8,800
Cash outflow (OPEX):		1,144	1,144	1,144	1,144	1,144
Net cash inflows:		7,656	7,656	7,656	7,656	7,656
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		6,380	5,317	4,431	3,692	3,077
New CAPEX for generation:	(27,200)					
New CAPEX for distribution:	0					
NPV:	(4,304)					

Tog Wajaale:

Year	0	1	2	3	4	5
Cash inflow (USD):		1,100,000	1,100,000	1,100,000	1,100,000	1,100,000
Assume 70% collection rate:		880,000	880,000	880,000	880,000	880,000
Cash outflow (OPEX):		143,000	143,000	143,000	143,000	143,000
Net cash inflows:		737,000	737,000	737,000	737,000	737,000
Discount factor:		1.20	1.44	1.73	2.07	2.49

Present value of inflow:		614,167	511,806	426,505	355,421	296,184
New CAPEX for generation:	(3,400,000)					
New CAPEX for distribution:	(213,000)					
NPV:	(1,408,919)					

Las Anood:

Year	0	1	2	3	4	5
Cash inflow		2,200,000	2,200,000	2,200,000	2,200,000	2,200,000
Assume 70% collection rate:		1,760,000	1,760,000	1,760,000	1,760,000	1,760,000
Cash outflow (OPEX):		286,000	286,000	286,000	286,000	286,000
Net cash inflows:		1,474,000	1,474,000	1,474,000	1,474,000	1,474,000
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		1,228,333	1,023,611	853,009	710,841	592,368
New CAPEX for generation:	(4,000,000)					
New CAPEX for distribution:	(250,588)					
NPV:	157,574					

Burao:

Year	0	1	2	3	4	5
Cash inflow		4,400,000	4,400,000	4,400,000	4,400,000	4,400,000
Assume 70% collection rate:		3,520,000	3,520,000	3,520,000	3,520,000	3,520,000
Cash outflow (OPEX):		572,000	572,000	572,000	572,000	572,000
Net cash inflows:		2,948,000	2,948,000	2,948,000	2,948,000	2,948,000
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		2,456,667	2,047,222	1,706,019	1,421,682	1,184,735
New CAPEX for generation:	(8,000,000)					
New CAPEX for distribution:	(1,071,429)					
NPV:	(255,104)					

Hargeisa:

Year	0	1	2	3	4	5
Cash inflow		6,600,000	6,600,000	6,600,000	6,600,000	6,600,000
Assume 70% collection rate:		5,280,000	5,280,000	5,280,000	5,280,000	5,280,000
Cash outflow (OPEX):		858,000	858,000	858,000	858,000	858,000
Net cash inflows:		4,422,000	4,422,000	4,422,000	4,422,000	4,422,000
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		3,685,000	3,070,833	2,559,028	2,132,523	1,777,103
New CAPEX for generation:	(9,000,000)					

New CAPEX for distribution:	(20,000,000)
NPV:	(15,775,513)

Assumptions:	Individual Users		Medium towns		Large towns	
	Household:	Business:	Tog Wajaale:	Las Anood:	Burao:	Hargeisa:
Total energy produced (kW-h/yr)	880	8,800	1,100,000	2,200,000	4,400,000	6,600,000
Energy tariff (USD/kWh)	1.00					
Solar PV operating costs (USD):	0.13					
Increase in connections:	1	1	300	353	2,143	50,000
Discount factor	0.20					
Collection rate	0.90					

Household:

Year	0	1	2	3	4	5
Value of electricity produced (USD):		880	880	880	880	880
Cash outflow (OPEX):		114	114	114	114	114
Net cash inflows:		766	766	766	766	766
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		638	532	443	369	308
New CAPEX for generation:	(6,800)					
New CAPEX for distribution:	0					
NPV:	(4,510)					

Business:

Year	0	1	2	3	4	5
Value of electricity produced (USD):		8,800	8,800	8,800	8,800	8,800
Cash outflow (OPEX):		1,144	1,144	1,144	1,144	1,144
Net cash inflows:		7,656	7,656	7,656	7,656	7,656
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		6,380	5,317	4,431	3,692	3,077
New CAPEX for generation:	(27,200)					
New CAPEX for distribution:	0					
NPV:	(4,304)					

Tog Wajaale:

Year	0	1	2	3	4	5
Cash inflow (USD):		1,100,000	1,100,000	1,100,000	1,100,000	1,100,000
Assume 70% collection rate:		990,000	990,000	990,000	990,000	990,000
Cash outflow (OPEX):		143,000	143,000	143,000	143,000	143,000
Net cash inflows:		847,000	847,000	847,000	847,000	847,000
Discount factor:		1.20	1.44	1.73	2.07	2.49

Present value of inflow:		705,833	588,194	490,162	408,468	340,390
New CAPEX for generation:	(3,400,000)					
New CAPEX for distribution:	(213,000)					
NPV:	(1,079,952)					

Las Anood:

Year	0	1	2	3	4	5
Cash inflow		2,200,000	2,200,000	2,200,000	2,200,000	2,200,000
Assume 70% collection rate:		1,980,000	1,980,000	1,980,000	1,980,000	1,980,000
Cash outflow (OPEX):		286,000	286,000	286,000	286,000	286,000
Net cash inflows:		1,694,000	1,694,000	1,694,000	1,694,000	1,694,000
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		1,411,667	1,176,389	980,324	816,937	680,781
New CAPEX for generation:	(4,000,000)					
New CAPEX for distribution:	(250,588)					
NPV:	815,509					

Burao:

Year	0	1	2	3	4	5
Cash inflow		4,400,000	4,400,000	4,400,000	4,400,000	4,400,000
Assume 70% collection rate:		3,960,000	3,960,000	3,960,000	3,960,000	3,960,000
Cash outflow (OPEX):		572,000	572,000	572,000	572,000	572,000
Net cash inflows:		3,388,000	3,388,000	3,388,000	3,388,000	3,388,000
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		2,823,333	2,352,778	1,960,648	1,633,873	1,361,561
New CAPEX for generation:	(8,000,000)					
New CAPEX for distribution:	(1,071,429)					
NPV:	1,060,765					

Hargeisa:

Year	0	1	2	3	4	5
Cash inflow		6,600,000	6,600,000	6,600,000	6,600,000	6,600,000
Assume 70% collection rate:		5,940,000	5,940,000	5,940,000	5,940,000	5,940,000
Cash outflow (OPEX):		858,000	858,000	858,000	858,000	858,000
Net cash inflows:		5,082,000	5,082,000	5,082,000	5,082,000	5,082,000
Discount factor:		1.20	1.44	1.73	2.07	2.49
Present value of inflow:		4,235,000	3,529,167	2,940,972	2,450,810	2,042,342
New CAPEX for generation:	(9,000,000)					

New CAPEX for distribution:	(20,000,000)
NPV:	(13,801,709)

Exhibit 4

Table 5-2: Average Cost/Liter and Monthly Consumption: Berbera Fuel Terminal

Type of Petroleum Product	Average National Monthly Consumption (Official Only, Berbera)	Average Retail Cost/Liter (May 2011)
Refined Diesel Oil	7,874 Cubic Meters.	$0.98/Liter
Petrol	738 Cubic Meters.	$1.0/Liter
Kerosene	138 Cubic Meters.	$0.85/Liter
LPG	302 Metric Tons	$3.00/Liter

Source: Interview – Berbera Fuel Terminal, May 2011.