

MARCH 2011

Electricity in Zanzibar's Unguja Island: Initial Evaluation Findings

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The Millennium Challenge Corporation (MCC) is funding a new 100-megawatt (MW) electricity transmission cable to supplement, and eventually replace, the existing 45-MW cable that connects Unguja Island in Zanzibar to the electricity grid of mainland Tanzania. This activity is being implemented by the Millennium Challenge Account-Tanzania (MCA-T). Mathematica Policy Research is evaluating the activity to help MCC and the government of Tanzania determine its impacts on electricity use, reliability, and quality. To understand how the cable activity relates to economic growth and poverty, Mathematica is also conducting a case study of hotels in Zanzibar, which provide significant employment opportunities. This brief presents baseline findings from the impact evaluation and the case study before the cable installation. Information for the baseline analysis comes from electricity data provided by MCA-T and the Zanzibar Electricity Company (ZECO). The case study is based on a survey of 30 hotels. A follow-up analysis will take place in 2013 after the cable has been installed.

Policy Context

Zanzibar's economy has grown dramatically in the past two decades. GDP per capita more than tripled from 1990 to 2008, resulting in reduced poverty.¹ Despite this progress, many of Zanzibar's citizens are poor—roughly 49 percent of the rural population is below the poverty line.² With more than 621,000 people, or roughly 63 percent of Zanzibar's population, Unguja Island is Zanzibar's largest island.³ It is also the center of a growing tourism industry. With approximately \$108 million in revenues in 2010, the industry—driven largely by hotel revenues—constitutes 22 percent of GDP. It is also the source for about 80 percent of the state's tax revenues, employs roughly 10,000 directly, and is an indirect source of income for another 44,000 people.⁴ The hotels in the case study employed about 1,322 Zanzibaris in 2010, or approximately one-eighth of the total employment in Zanzibar's tourism industry.

Electricity on Unguja Island

Unguja Island gets its electricity through a 30-year-old submarine cable connected to the electricity grid on mainland Tanzania. The cable is nearing

the end of its useful life and operates near full capacity (45 MW) to serve demand on the island, especially during peak tourist seasons. Peak demand reached 44 MW in December 2008.⁵ Two major blackouts in the past three years were caused by problems with the cable. The first ran from May to June 2008, and the second, from December 2009 to March 2010. The only electricity came from diesel-fueled back-up generators. ZECO's revenues plunged in June 2008, down 74 percent from the previous June, and the utility received no income from December 2009 to February 2010.

Consumers suffered as well. The blackouts reduced the quality of basic services on Unguja Island, increased the risk of environmental and health hazards, and frustrated efforts to expand the economy and fight poverty. Nevertheless, the threat of blackouts is not the only concern. The day-to-day reliability of electricity has deteriorated in recent years. In 2008, power outages recorded at the island's main substation, which supplies power to the entire island, averaged fewer than one per month. But in 2009 and 2010, the number of outages affecting the entire island averaged 1.27 and 1.20 per month, respectively. Additionally, the duration of outages

has more than doubled, rising from an average of 1.31 hours per month in 2008 to 2.49 hours in 2009 and to 2.65 hours per month in 2010. Roughly one-quarter of the electricity received from the mainland is lost to technical and nontechnical problems in transmission and distribution on the island. Meanwhile, demand for electricity has grown even as reliability worsens. The number of customers increased roughly 3 percent a year from 2008 to 2010. Consumption has grown at an average of 3.6 percent a year from 2007 to 2009.

Electricity in Zanzibar Hotels

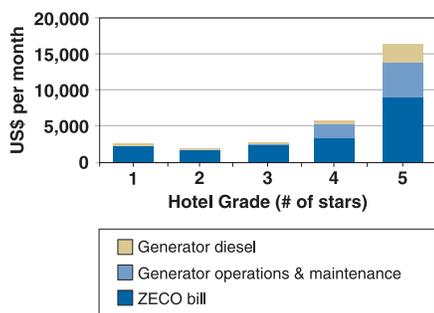
The 30 hotels surveyed confirmed that there are serious problems with the reliability and quality of electricity. During the summer of 2010, hotels had an average of 18.6 outages per month lasting roughly two hours each. There was also an average of 52 voltage fluctuations per month. As a result of these problems, 97 percent of the hotels surveyed have installed back-up generators, with an average of 1.9 generators per hotel.

Some hotels spent substantial resources on back-up generators to provide reliable, continuous electricity to their guests. The hotels' ZECO bills averaged \$3,082 per month in 2010. Spending on

back-up power, which averaged \$1,770 per month, went primarily to generator operations and maintenance (63 percent), and to diesel fuel (36 percent). Higher-grade hotels spent more on fuel and generator maintenance than lower-grade hotels. Spending on generators constituted 43 percent of the monthly cost of energy at five-star hotels, compared with only 16 percent at one-star hotels (see Figure 1).

Hotels also incurred indirect costs related to poor-quality power in 2010. For example, hotels spent \$652 per month on average to repair or replace electrical equipment damaged by voltage fluctuations. Hotels had to repair air conditioners, refrigerators, computers, and televisions more than other devices (see Table 1).

Figure 1.
Breakdown of Monthly Energy Costs During Summer 2010, by Hotel Grading



Source: Zanzibar hotel survey, June–August 2010.

Blackout's Effects on Hotels

The 2009-2010 blackout drove up hotels' costs significantly. During the blackout, energy costs equaled 38 percent of hotel revenues, compared with only 8 percent during the three summer months in 2010. Hotels operated back-up generators for an average of 18.6 hours a day. Six bought new generators and two bought accessories for existing ones. In three-and-one-half months, they spent four times more on generator maintenance and almost 30 times more on diesel fuel to operate generators than they did on electricity during the summer months in 2010, when there were no blackouts (Figure 2).

Hotels also spent more than usual on food and water during the blackout.

Device	Repair		Replace	
	# of hotels reporting any costs	Average monthly cost per hotel*	# of hotels reporting any costs	Average monthly cost per hotel*
Air conditioner	19	\$381	6	\$1,068
Computer	13	\$348	4	\$ 307
Refrigerator	14	\$159	2	\$1,054
Television	12	\$ 83	1	\$ 69

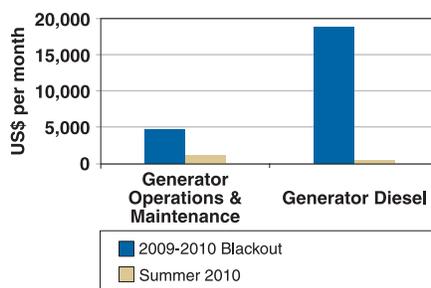
Source: Zanzibar hotel survey, June–August 2010.

*Includes only hotels that spent some amount repairing or replacing devices.

Sixty-three percent of hotels spent more on food because prices rose, primarily as a result of a lack of refrigeration. Fifty-two percent of hotels spent more on water because they had to truck it in when electric-powered pumps stopped operating. For nine hotels, water costs were, on average, roughly \$4,000 higher than usual during the blackout.

The blackout also took its toll on hotel revenues. Forty-eight percent of hotels said that occupancy rates were lower than normal, 38 percent reported an increase in cancellations, 28 percent said that bookings fell, 14 percent reported that guests did not stay as long as usual, and three hotels closed for the duration of the blackout.

Figure 2.
Spending on Back-Up Generators, Blackout Versus Summer 2010 Periods



Source: Zanzibar hotel survey, June–August 2010.

Higher costs and lower revenues undercut profits, forcing some hotels to reconsider their investment plans. Some canceled or delayed investments, whereas others made capital investments in alternative sources of energy, including additional back-up generators and green energy such as solar panels. Twenty percent of the hotels reduced their staff.

Next Steps

It is clear that Zanzibar's economy has suffered because of unreliable and poor-quality electricity. The next steps in the study will be to determine whether the situation improves after the new cable goes into service in 2012. In 2013, the study team will evaluate whether consumption increases and whether the quality and reliability of power improve. The team will then examine how the new cable affects the hotel industry, a key sector in Zanzibar's economy. Estimated impacts and MCA-T's cost estimates of the intervention will then be used to assess whether the cable activity is warranted based on the benefit-cost analyses and the realized economic rates of return.

Endnotes

- ¹ United Nations Statistics Division, Economics Statistics Branch. "National Accounts Estimates of Main Aggregates." New York, November 2009. Available at [http://data.un.org/Search.aspx?q=Zanzibar+GDP+per+capita].
- ² The Revolutionary Government of Zanzibar. "Zanzibar Strategy for Growth and Reduction of Poverty." January 2007. Available at [http://www.unpei.org/PDF/TZ-zanzibar-strategy-growth-poverty-reduction.pdf].
- ³ National Bureau of Statistics, Central Census Office. "2002 Population and Housing Census." Dar es Salaam, Tanzania, May 2004.
- ⁴ *The Citizen*. "Tanzania: Zanzibar Economy Grows Four Times." Dar es Salaam, Tanzania, March 6, 2010. Available at [http://allafrica.com/stories/201003080742.html].
- ⁵ Daly, Deirdre, et al. "Demand Side Management Strategies to Improve the Reliability and Sustainability of Zanzibar's Electricity Supply." Henry Luce Environmental Practicum Report. Baltimore, MD: Johns Hopkins University, Paul Nitze School of Advanced International Studies, 2010.

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