

# INSIDE INFRASTRUCTURE

## POWERING RURAL AFRICA

*John Kjorstad*



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In development, the term “end of the line” conjures images of remote places with spotty access to basic services. But hundreds of millions of people around the world—people who live beyond the “end of the line”—wish they could be so lucky.

According to the United Nations, 1.2 billion people live without electricity, 783 million people do not have access to clean water, and almost 2.5 billion do not have adequate sanitation. For marginalized populations beyond that last mile of essential public services, life without basic infrastructure is more than a constraint on their standard of living; it's a social and economic yoke that impedes progress and creates a cycle of poverty and outward migration. In 2004, former KPMG infrastructure professional Daniel Rea recognized this problem in a rural corner of northwestern Zambia.

At the Kalene Mission Hospital in Ikelenge, a visionary surgeon named Dr. Gill saw that the hospital's standard of care was badly

constrained by its lack of access to reliable power. Ikelenge is situated 240 miles from the national grid operated by the Zambia Electricity Supply Corporation (ZESCO). Knowing there was little hope of quickly extending the grid, Rea and his partners focused their efforts on the nearby Zambezi River, which runs 1,600 miles from Zambian wetlands to the Indian Ocean. The river's course begins not far from Ikelenge near the borders of Angola, the Democratic Republic of the Congo, and Zambia. With this renewable resource, Rea saw an opportunity to provide clean and reliable local generation; enough to independently power not only the hospital, but the whole community and its surrounding area as well.

## FROM IDEA TO INNOVATION

Dr. Gill, the surgeon, formed a team with Rea and his uncle (both engineers), to

develop a run-of-river hydroelectric scheme although they had no specific hydropower expertise and no capital. Three years later, in 2007, after heavily leveraging personal networks and raising more than \$2 million from charitable organizations and private individuals, the 750 kilowatt run-of-river Zengamina hydro project became operational 35 miles from the Zambezi River's source. Incredibly, the project was constructed by local villagers under the guidance of remote international experts at a high global standard and a fraction of what it would have cost using international contractors.

The project successfully powers the Kalene Mission Hospital and has also removed the wider community's dependence on expensive diesel fuel generators. The impact of Zengamina's power extends to local schools, where grades and attendance are improving. It has enabled local businesses to grow and prosper, creating a more dynamic economy and raising the standard of living in the area. It has also successfully transferred professional skills from international experts to locals who now operate and maintain the generating facility and related transmission infrastructure. Today, Zengamina's independent grid covers 19 miles and serves roughly 400 residential customers and 20 non-residential users.

However, success does not come without new challenges. Rural electrification requires a subsidy for its development and early years of operation. For example, the United States prioritized rural electrification nearly a century ago, with Congress legislating financial support to local cooperatives in 1935; government provided access to cheap federal loans to support expansion of the country's power generation and transmission infrastructure. Over time, access to cheap power allowed

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rural economies to develop and thrive, making the long-term finances of American power cooperatives more sustainable.

## BUT CAN IT BE REPLICATED?

Rea believes such transformation is possible in Ikelenge, but the wide-scale productive use of Zengamina's power has thus far been slow to materialize. People want to be connected, but the economics are challenging even when subsidized. The project has a popular social fixed-tariff for villagers of only \$8 a month, and a less popular commercial tariff, so overall it operates at a loss. Only 40 percent of the generating capacity is being

used at peak periods, and only 10 percent over 24 hours.

Rea regrets not working with a partner, such as a non-governmental organization, during the project's initial development, which would have established more productive uses and users of power in parallel. As a result, he has become his own customer and set up a pineapple processing factory and a stone

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crushing and concrete block business to buy some of the excess capacity.

Rea's long-term ambition is to make the Zengamina project profitable and see it expand. The scheme can be scaled up to 2.4MW with a cascading system, and other infrastructure improvements in the area could help drive demand. Additionally, ZESCO has

plans to expand Zambia's national grid to within 60 miles of Zengamina's reach. If that happens and the final gap miles are covered as well, the project could potentially sell its excess power into the national grid—vastly improving the economics.

Energy really is the foundation for everything in an economy, and rural electrification is a long-term challenge on the African continent. Rea says only about 3 percent of rural Zambians have access to a steady source of power. He is often asked: “How can Zengamina's successful development be replicated in other places?”

The short answer is that it cannot. Every infrastructure project is a unique product of local circumstances and highly dependent on its surroundings (physical and political), as well as the capacity and drive of local individuals seeking to create change. Zengamina cannot simply be cast and replicated. However, Rea's story of innovation can be repeated anywhere, and it should inspire others to look more closely at their own circumstances and determine what options are available to them.

Even without money or specific technical expertise, Rea has proven that success is achievable. The journey is not yet complete, but he and his partners have every right to be proud of what they've accomplished so far. This community developed project has triggered the remote local area to be classified as a Government District. Rea has reported most recently that contracts have been awarded for a large new secondary boarding school, new district hospital, new council administration block, court, police station, and post office. In addition, many houses and a water system is planned. The tide has turned.

*For more information, please contact Daniel Rea (dan.t.rea@gmail.com).*

The Zenzaminga hydro project aims to replace the current use of generators burning diesel to produce electricity. Benefits include:

#### IMMEDIATE BENEFITS

- Removal of diesel-generated power with its attendant high costs, unreliability, and associated air and noise pollution.
- 24-hour power to five hospitals/schools/services that currently use diesel generators.
- Power delivery to over 1000 rural towns and schools that have never had electricity.
- Employment for local Zambians.
- Increase in attractiveness of local professional jobs, especially in hospitals and schools.
- Improved living and working conditions for hospital staff and teachers.
- Introduction of better medical and support equipment because of continuous electricity supply, improving health care for patients.
- Power for computers and related equipment to enable updating of the hospital's infrastructure, along with that of six schools.

#### LONG-TERM BENEFITS

- Development of SMEs and increased employment in a region where unemployment is approximately 80 percent. Specifically, this project will supply cheap, sustainable power, enabling a viable pineapple canning enterprise to be reintroduced.
- Decreased economic dependence on expatriate income.
- Kalene Mission Hospital development.
- Power availability for drinking water and sanitation systems, leading to improved health and educational opportunities for the local population.