



Developing Power: International Equity, Economics and Electricity

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Two Modest Premises – and a Conclusion

First, access to electricity is a basic human right.

Second, the systems for providing power in developed countries do not work in poorer countries.

If these premises are correct, it follows that we need a different system for providing power in much of the world.

A century ago, no one would have seen access to electricity as a basic human right. But today the difference that electricity makes to a family or a business is huge. The difference is so great that it isn't fair for some to be denied the benefits that others have. Furthermore, it is in society's interest for young people to be able to study at night, for clinics to have refrigerators, and for workshops to have power tools. Electricity can be a major input in meeting other basic needs, such as pure water.

As an example of the importance society puts on electricity, the Republic of South Africa has a Reconstruction and Development Programme, dating back to 1994, which is inspired by the Freedom Charter of 1955. This 1955 document states that everyone has a right to electricity along with education, health care, housing, food, etc.

The Problem of Cost

Unfortunately for those who live in poorer countries, turbines and transformers and conductor cost as much in Karachi as in Pittsburgh. Oil is traded in international markets and is worth about the same everywhere. But in much of the world people cannot afford to pay. The cost of producing electricity makes it a luxury item there.

For instance, Argentina, where we recently spent three years, is far from being a third-world country. It is one of the most prosperous countries in Latin America. We found that a modest home using 300 kWh/month paid 67 pesos under cost-based tariffs that were set when a peso was worth a dollar. The same 300 kWh/month cost about \$68 in upstate New York. But 67 pesos represented about 17% of the Argentine minimum wage – and most people live on less than the minimum wage. In New York, \$68 is about 8% of the minimum wage. Most New York families live on more than the minimum wage.

Today semi-nomadic tribes live in the huge Northwest Frontier province of Pakistan. Large areas are only nominally under government control. People who live there do not participate in the national economy. Their annual per capita income is on the order of \$100. They obviously cannot afford electricity that costs about as much to produce there as it does in the USA.



Stealing Power

Tariffs usually have some relationship to costs. It is easy to see why in a hundred countries between Karachi and Buenos Aires non-technical “black losses” (thefts) are common. In some countries black losses make up around 50% of power generated.

I know a small Argentine grocery store with several refrigerated display cases. Neighbors say that the owner pays someone to come by once a month to adjust the electric meter. Neighborhood experts in poor areas hook houses to distribution circuits (without meters) as a favor or for a fee.

Some power companies wink at this. One family, living in a risky slum in Argentina, decided to be honest with the power company and asked to have a meter installed. When the company heard where they lived it declined, saying, “Use it for free.”

In Pakistan’s Northwest Frontier they steal power in exchange for not shooting the generation and transmission crews. This informal arrangement has gone on long enough that it is really a special tariff class. The government-owned utility puts up with it because it has to, because it can make up the revenue shortfall from other sources, and because it is in the country’s interest for those people to have some electricity.

Upward Pressure on Tariffs

Power companies are under pressure to raise tariffs.

For instance, in the 1990’s foreign companies, mainly European, bought the Argentine power companies for Euros or US dollars. In the Argentine economic

meltdown of 2002 the peso lost two thirds of its value against the dollar. Suddenly utilities’ revenues were cut to 1/3 in dollar terms. They are howling for relief, but the government will not raise rates. Dollarizing the tariffs would mean that 300 kWh would cost perhaps one-third of the minimum wage.

In many countries, tariffs are not high enough to recover capital investment and meet operating costs. International development bank economists want tariffs raised to full capital-recovery levels. This would be close to the marginal cost of producing the power and would make power sectors self-sustaining. Pressure from the banks is important because they are a major source of financing.

Defining the Solution to the Cost Problem

I don’t know what the solution is, *but I know what it looks like*. And readers of this journal are singularly qualified to create the solution.

The solution requires resolving the conflicting objectives associated with providing electric power in developing countries (below). Other objectives not listed, like maintaining safety and protecting the environment, are important in practice but not for purposes of this argument.

Objectives: Electric Power in Developing Nations

1. Make electricity available to all.
2. Promote self-sufficiency and honesty.
3. Send correct economic signals.
4. Be financially sustainable.

There is an interesting precedent. The creation of the electric utility system a



century ago also required dealing with important conflicting objectives. The genius of Edison and others was in resolving them.

- Society was opposed to monopolies.
- Investors wanted monopoly-type protection to make money and to minimize the risk associated with the huge capital investments needed.
- Power companies needed to seize real estate, but this was a constitutionally limited government right.
- Customers did not want to pay monopoly prices.

In addition, many difficult technical problems had to be solved both to supply and to use electricity. We all know something about these technical problems and about how the conflicting objectives were resolved.

The Traditional Model Doesn't Satisfy the Objectives

The solution of 100 years ago was developed in rich countries at the peak of the industrial revolution. It was not designed to solve today's problems in the developing world.

Specifically, the traditional utility with full-recovery cost-based rates does not work in developing countries. It may satisfy sidebar objectives 3 and 4. But too many people are priced out of the market or are tempted to steal, violating objectives 1 and 2.

The current system promotes inefficient use of electricity, violating sidebar objective 3. For instance, I'm told that some poor Argentines getting free power use a novel "cycle" to heat their homes.

Apparently a bicycle wheel, with one conductor on the hub and the other on the rim, glows cheerfully at 220 volts. (Remove the tire before trying this at home.) One suspects that this not the best way to provide heat.

Pieces of the Solution

Making power widely available in developing countries means finding ways to satisfy all of the conflicting objectives in the sidebar. It requires new ways of generating, transmitting, distributing, selling, using, financing, and regulating power. For example,

- Inverted rate structure. Whatever else is done, the first few kWh each month have to be cheap in order to satisfy objectives 1 and 2.
- Subsidies. Some sort of subsidy – more correctly, social investment – will be needed, similar to Franklin D. Roosevelt's programs for rural electrification and hydro development in the USA in the 1930's and 1940's.
- Pre-paid meters. People who live hand-to-mouth aren't very good at paying bills at the end of the month. Meters that take coins or tokens would avoid this problem. Meters that accept prepaid cards wouldn't require power company employees to carry cash in risky areas.
- Interruptible rates. Interruptible rates can replace investment in generation and to some extent in distribution. Interruptions could be triggered by frequency or voltage excursions, as suggested by Prof. Fred Schweppe 25 years ago. Pre-paid cards could be bought for interruptible or non-interruptible



power and meters with load-shedding capability could do the rest.

- Manpower must replace capital. In developing countries manpower is cheap and unemployment is high. Equipment, standards, and procedures should be designed to replace unavailable capital with cheap utility and customer labor.
- Discount rates are very high. Economic analyses and decisions must recognize that the cost of capital used in economic decision-making is very high. Policies should not require customers to pay more now in exchange for lower prices later. Limitations on available capital mean that the true discount rates for utilities are also high. When people or companies have little money, it is more important to reduce initial costs than to reduce long-range costs.
- Weaker standards. Developing areas cannot afford and do not need the same service quality (including reliability) as New York City or Tokyo. Developing countries should recognize that it is no disgrace to drive a Ford or a Fiat. It is a disgrace to insist on a Mercedes Benz that they cannot afford. Generation, transmission, and distribution planning and design criteria should be changed. Standards should be developed for a very different point on the cost-vs.-quality

tradeoff curve. Reduced quality should be accepted in order to reduce costs. These new standards will create new operating problems. These also must be solved.

- Cheaper appliances. We need appliances that are cheaper to buy and that use less power. Features and maybe durability should be sacrificed to reduce initial cost.
- Different technologies. Innovative technologies can focus on the uses of energy rather than just on supplying energy. For example, a recent project installed solar-powered lights in homes in a poor, remote area in Latin America. The real cost per kWh of this technology is high. The quality of light is poor. But it is more practical to provide a small amount of light this way than to extend the transmission and distribution system to provide equivalent conventional power.

Opportunities

People of vision can make great contributions by designing and developing power systems that meet the needs of the developing world. With imaginative thinking, systems and methods and technologies can be adapted to tear down barriers that impede economic and human development in poorer nations, by making electricity and its applications available where now they are not.

