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Four Regulatory Principles to Promote Diverse Electrification

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This note is a summary of a study to be published by ESMAP and the Energy and Mining Sector Board in 2006. The study proposes four principles for regulatory systems that will help, rather than hinder, electrification. The principles and the accompanying real world examples show how successful electrification often requires that the traditional functions of regulation be performed in non-traditional ways.

REGULATION & ELECTRIFICATION

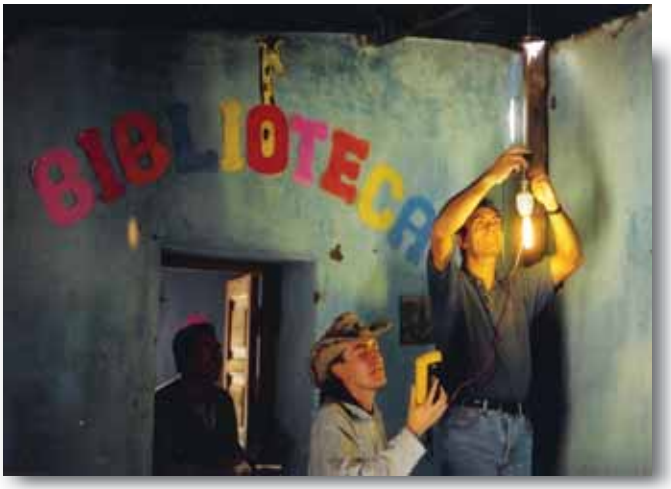
Regulation is government control of a business. When a government regulates an enterprise, it imposes direct and indirect controls on the enterprise's decisions or actions. *Electrification* is the supply of electricity to households, public facilities or businesses that have had limited or no access to electricity.

The design of regulatory systems to support electrification is complicated by the fact that electrification can be undertaken by different types of enterprises (e.g., public, private or community owned), each with different incentives. These enterprises may use very different technologies: "grid electrification" (the extension of existing transmission and/or distribution grids) or "off-grid electrification" (the installation of decentralized facilities that are not connected to existing transmission and/or distribution grids). Off-grid technologies are increasingly applied to electrify remaining areas that are too remote or dispersed to be reached via grid extension.

In thinking about how to design a regulatory system that will "help" rather than "hurt" electrification, it is useful to remember the two "golden rules of regulation":

Rule #1. Regulation is a means to an end. What ultimately matters are outcomes (e.g., sustainable electrification) not regulatory rules.
Rule #2. The benefits of regulation must exceed the costs of regulation.

ESMAP is a global technical assistance program managed by the World Bank Energy and Water Department (EWD) that promotes the role of energy in poverty reduction and economic growith in an environmentally responsible manner. Its work applies to low-income, emerging and transition economies and contributes to the achievement of internationally agreed development goals.



In the picture, engineers monitor the service quality of a PV system powering a remote school in rural Salta (Argentina) during a field visit with the offgrid regulator.

This note will focus on how these two general rules (sometimes referred to as meta-principles) can be applied to regulatory systems that affect electrification. At the same time, this note will show how successful electrification often requires that the traditional functions of regulation (e.g., setting maximum tariff levels, establishing minimum quality of service standards and specifying entry and exit conditions) be performed in nontraditional ways.

FOUR REGULATORY PRINCIPLES

This very general conclusion is based on four regulatory design principles implied by the two "golden rules". To make these principles more relevant for practitioners, each is illustrated below with examples of emerging regulatory practices.

Principle #1: Adopt light handed and simplified regulation. A regulatory rule will typically specify information that must be supplied or procedures that must be followed. Complying with a regulatory rule costs time and money. This is true regardless of whether the regulated enterprise is privately, publicly or community owned. For off-grid operators, one should be especially conscious of the costs of regulation because most off-grid enterprises operate on the "razor's edge" of commercial viability. They have high costs because

they often serve small isolated households and low revenues because these households usually can afford to buy only small quantities of electricity (typically around 50 kWh per month). Unnecessary regulation can easily destroy their commercial viability.

In designing a light handed regulatory system to support electrification, two questions need to be asked:

- Is the information really needed?
- Can the number of review and approval steps be reduced?

In Bolivia, prior to 2000, all operators of isolated village mini-grids above 300 kW installed generating capacity were required to become concessionaires. This created two problems: First, concessions could legally be granted only to entities that were shareholder companies and this conflicted with the fact that many mini-grids were operated by cooperatives; and second, the reporting requirements and technical standards for concessionaires were impossible (i.e., too costly) to satisfy for many of the smaller rural systems. A partial solution was introduced in 2000. The threshold of regulation was raised to 500 kW peak demand and cooperatives were allowed to maintain their legal status for an initial period of seven years. Discussions are now underway to lower reporting and technical requirements for all mini-grids in villages with less than 2,000 users.

In **Cambodia**, a novel, light handed approach to tariff setting has been proposed for several hundred isolated, privately owned mini-grid operators. These suppliers, known as Rural Electrification Enterprises (REEs), usually operate small, second hand diesel generators that produce electricity for sale to retail customers in one or more contiguous villages. It has been recommended that the maximum tariffs of these small operators be set through published "Tariff Tables." The "Tariff Tables" would relieve the REEs of the obligation to make an initial tariff filing with the regulator or to return to the regulator with requests for revisions in the tariffs. For each class of REEs, maximum tariffs would be set on a generic rather than on an individual enterprise basis with automatic adjustments keyed to a pre-specified formula.

Principle #2: The national or regional regulator should be allowed to "contract out" or delegate, either temporarily or permanently, regulatory tasks to other government or non-government entities. In many countries, a rural electrification agency or fund functions as a *de facto* regulator. Typically, the agency or fund imposes certain requirements in return for giving grants or subsidized loans. For example, it may specify a maximum allowed tariff, a required technical quality of new installations or technical and commercial quality for post-installation service. These are traditional regulatory functions - even if they are rarely described in that way.

Given this reality of *de facto* regulation, it makes sense for the regulator to delegate or "contract out" some traditional regulatory functions to the rural electrification agency or fund. This should lead to more efficient regulation, for several reasons: the agency will almost always be more knowledgeable than the regulator about the specific technical operations of the electrification provider; the agency will have a better appreciation of the cost implications of imposing different regulatory requirements; it will facilitate coordination between subsidy rules and tariff regulation; and it will reduce the risk of duplication and over-regulation.

Figure 1. Supply Model Matrix for Electrification

	Grid ← Technology →		Offgrid
	grid extension	**village minigrid**	**single user system**
small, decentral **private (for profit)**	Small grid reseller (India)	Diesel or hydro minigrid (Cambodia, Ethiopia) Hydro minigrids selling to local customers and to the main grid (China, Nicaragua) Formerly isolated minigrid now connected to grid, (Cambodia)	SHS (Honduras, Kenya, Indonesia, Sri Lanka) PV/wind/diesel water pumping (Brazil, Chile, Mexico) WHS or pico hydro (Argentina, Mongolia, Nepal)
large, central	Privatized concessionaire extends grid (Argentina, Chile, Guatemala, Uganda)	Offgrid concession (Argentina)	SHS (Bangladesh, Bolivia, Morocco, South Africa)
	Technology neutral electrification concession (Senegal)		
cooperative **non governmental** other community organizations	Cooperative finances grid extension (Costa Rica, Bangladesh, US)	Multi-service Coop with diesel or hydro microgrid (Bangladesh, Bolivia, Philippines)	Agricultural Coop using diesel genset
	Small "community gateways" (Bolivia)	Community microgrids (Brazil, Cambodia, Honduras, Indonesia, Nicaragua, Sri Lanka)	Diesel genset or renewable energy to power a school, clinic, community center, etc.
small, decentral **public** large, central	Small state-owned utility extends grid (Colombia, Brazil)	Municipal diesel or hydro minigrid (Bolivia)	
	State utility extends grid and sells at retail (Botswana, Mozambique, Thailand, Tunisia)	Residual state-owned isolated diesel-minigrids with fuel subsidies (Nicaragua, Cambodia)	SHS (Mexico)

In **Bangladesh**, more than 60 rural electric cooperatives have been created since 1978. The cooperatives are supervised and controlled by the Rural Electrification Board (REB), a semi-autonomous agency located within a ministry. In addition to acting as a banker, technical advisor, procurement agent, construction agent, manager supervisor and trainer, the REB also functions as a regulator by setting maximum prices and minimum quality of service standards. To perform these functions, it has also created a uniform system of accounts. Since the REB "walks like a regulator and talks like a regulator," it would be duplicative to add a new separate regulator with regulatory jurisdiction over the cooperatives' retail service.

Principle #3: The regulator should be allowed to vary the nature of its regulation depending on the entity that is being regulated. A regulator should be allowed to vary its methods (e.g., how tariffs are set or what needs to be regulated) depending on the type of regulated entity. Many regulatory statutes do not encourage such flexibility. They are either silent about regulatory methods or embody the view that "one size fits all." This does not do justice to the significant variation in electrification supply models (see Figure 1). The better approach is to provide the regulator with explicit legal authority to vary its methods depending on the type of entity being regulated.

For example, when a community based organization self-supplies electricity, the overarching regulatory concern that the operator may charge monopoly prices disappears. Owners of a cooperative do not have an incentive to charge monopoly prices because this would be equivalent to taking money from one pocket and putting it in another pocket. Hence, "self-supply" offers the possibility of "self-regulation." Such an approach has been adopted in **Sri Lanka** for off-grid village hydro systems that are owned and operated by community based cooperative societies. While the government continues to fix technical specifications and safety standards, the prices charged for sales of electricity within the village are determined by the cooperative's board of directors, not by a government ministry. In fact, since the community is self-supplying electricity, the charges are designated as membership fees rather than tariffs.

Principle #4: Quality of service standards must be realistic, affordable, monitorable and enforceable. Regulators often ignore quality of service regulation. This happens because it is easier to specify and monitor tariff levels than quality of service standards. Tariffs have two dimensions: level and structure. Both dimensions can be readily observed in customer bills. In contrast, quality of service is multi-dimensional and compliance is often difficult and costly to monitor, especially for dispersed off-grid systems. There is a real danger in ignoring quality of service: whatever good will was created through electrification will quickly disappear if quality of service falls short of what customers were expecting.

The photo shows the proud owner of a remote convenience shop and backpacker hostel in rural Bolivia which is powered by a PV system, allowing for light, TV and a small fridge.

A workable quality of service regulatory system should have the following characteristics:

- The standards should be based on customers' preferences and their willingness to pay for the costs of providing the specified level of quality. The standards need **not** be uniform across all customer categories or geographic areas. Offering a menu of service levels allows customer choice – but it can also increase transaction costs and decrease transparency if there are too many choices.
- Standards should be established for both technical and commercial dimensions of service.
- Required levels of service and associated penalties and rewards should be phased in over time and synchronized with changes in tariff levels.
- Where feasible and efficient, penalties should be paid to individual consumers.
- The regulatory entity should have the legal authority to delegate or contract out quality of service monitoring and the imposition of penalties to a third party subject to appropriate oversight.

This last element — contracting out — has been built into a new quality of service monitoring system for Solar Home Systems in **Bolivia**. A Technical Control Unit (TCU) consisting of three individuals within the Vice-Ministry of Electricity, Alternative Energy and Telecommunications is responsible for monitoring compliance with the pre-specified quality of service standards of Bolivia's IDTR project and it can impose penalties when operators fail to meet these standards.

Two reporting forms were created for monitoring purposes — a complaint form and an annual visit form. If a customer has a complaint about the performance of the system, he or she must initially contact the operator. If communication problems exist, the user can also make contact via the municipal government authority. The operator is required to log in the complaint and put it into a Management Information System that can be audited for accuracy by the TCU or a contractor hired by the TCU. Audits will be contracted out to a private contractor who "will witness what he sees." To reduce costs, the contractor will perform the audit on a sample basis (20 out of 1,000 customers). If the audit finds that the operator failed to meet the specified quality of service standards, then a larger sample may be taken and penalties will apply to the full 1,000 customers in the sample.

A MODEL LAW TO PROMOTE ELECTRIFICATION

Good intentions (i.e. increasing electricity access) do not necessarily lead to good outcomes. If the four regulatory principles are to be implemented, they need to be incorporated into legal instruments. To facilitate this outcome, the full publication (ESMAP and Energy and Mining Sector Board, 2006) proposes specific elements or standards of a model law.

The recommended standards of this model law "operationalize" the four principles presented in this note, and also provide specific additional guidance on tariff setting, subsidies, quality of service and coordination with other government entities.

CONCLUSION

No one likes to pay high prices for electricity with poorer quality than promised. This is true for any customer, new or old, whether the customer is served by a large, vertically integrated, power enterprise or by a small, stand-alone village level mini-grid operator. Regulation is supposed to protect consumers by setting maximum prices and minimum quality of service standards. Regulatory systems need to be designed with considerable care for smaller electricity system because they typically operate with high costs and in low customer demand. If the regulatory system fails to recognize these economic realities by adjusting how it regulates maximum prices and minimum service standards, it may accomplish nothing more than blocking much needed investment, forcing higher income customers to purchase their own expensive generators and causing poorer consumer to continue with no service at all. In the words of one Brazilian villager, it is always important to remember that "the most expensive electricity is when there is no electricity."

RELEVANT LITERATURE

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This note is part of the forthcoming report "Promoting Electrification: Regulatory Principles and a Model Law." Kilian Reiche worked as Energy Specialist for the World Bank's Latin America Region and is now head of iiDevelopment, a German consulting firm. Bernard Tenenbaum works as Lead Energy Specialist in the World Bank's Energy Anchor. Clemencia Torres works as Senior Regulatory Economist in the World Bank's Latin America Region.

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