# **Promoting Energy Efficiency In Reforming Electricity Markets**

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#### ABSTRACT

Many developing countries are initiating power sector reforms to stimulate private investment, increase operation and management efficiencies, and recover the full costs of power. Reforms may include unbundling generation, transmission, distribution and retail services; commercial management; competition; and private ownership. This paper draws upon six country case studies — Argentina, Chile, New Zealand, Norway, the United Kingdom, and the United States — to identify major models of power reforms and their implications for energy efficiency — both positive and negative. There are both structural and institutional features of reform that may discourage commercial offerings of end-use efficiency services. Valuable lessons are discussed regarding what reforms and policies have worked to promote energy efficiency and which have not. Several models are offered for how developing countries can promote energy efficiency under some of the more common forms of power sector restructuring. Conclusions and recommendations are directed at key decision-makers in developing countries contemplating power sector reforms.

### Background

#### Methodology

The underlying work for this paper built upon a literature review and case studies of six countries (Argentina, Chile, New Zealand, Norway, the United Kingdom, and the United States) where reforms were well underway and could provide ample evidence of utility and efficiency market.<sup>1</sup> Those selected represent different models of reform, with geographical diversity and varying degrees of public intervention on behalf of efficiency. Case studies were developed through reviews of documents and articles, and interviews with individuals representing national energy agencies and commissions, energy conservation agencies, conservation and environmental NGOs, ESCOs and their trade associations, power generation and distribution organizations, and others.

Together the case studies provide lessons regarding what types of reforms and policies have worked to promote energy efficiency, which have not, and why. Unfortunately, the reform efforts underway in India, Ukraine, Russia, Brazil and Central America are not sufficiently progressed to offer much insight yet. As a result, the lessons offered by the case study countries must be interpreted carefully when applied to developing countries where reforms may for the first time introduce

<sup>&</sup>lt;sup>1</sup> This paper is based on a project sponsored by the U.S. Agency for International Development, Office of Energy, Environment and Technology. The project produced a set of three reports designed to illuminate the debate surrounding the interaction between power sector reform and energy efficiency. These reports are *Bibliography: The Impact of Global Power Sector Restructuring on Energy Efficiency* (1998), Case Studies of The Effects of Power Sector Reform on Energy Efficiency (1998), and Promoting Energy Efficiency in Reforming Electricity Markets: A Guidebook for Stakeholders (1998).

principles of commercialization, and where there is little or no infrastructure of energy efficiency product suppliers or service providers.

### How Much Efficiency Potential is Untapped?

In the United States and other OECD countries, improvements in energy efficiency in industry, commercial buildings, and new consumer appliances have been substantial, based on user response to price, voluntary information and assistance programs by government and utilities, and government-mandated energy efficiency standards for new buildings and equipment. The opportunities for developing countries to optimize electricity use remain large relative to OECD countries. Estimates of this potential range from 20-40% improvements in efficiency, equivalent to a 5-10% reduction in forecast demand for power. (Seabright, 1997)<sup>2</sup>

Yet in many countries, including OECD, there is an "efficiency gap"<sup>3</sup> between the level of energy efficiency determined to be optimal from a society's perspective and the level actually achieved through natural market behavior. Causes include classic market failures, more attractive investment alternatives for end-users<sup>4</sup>, and lack of awareness of efficiency opportunities. The size of the efficiency gap determines whether it warrants public policy attention. Estimates of the gap vary widely — from 0% to 20% for OECD countries, to 20-40% for many developing countries. (Energy Modeling Forum, 1996.)

The efficiency gap consists of two components: efficiency gains that could result from price reforms and gains if the barriers to adjusting consumption were removed. Price is at least as important as non-price barriers in reducing the large efficiency gap in developing countries. Most reform efforts view price reform as either a primary objective or the most likely outcome. This paper, a result of work requested by the U.S. Agency for International Development (see footnote 1), explores how reforms affect both price-response and barriers to efficiency.

#### **Major Power Sector Reforms**

There are four major types of power sector reforms: commercialization, privatization, restructuring via wholesale markets or unbundling, and retail competition. These are displayed in Table 1. Within these reform types, there are different roles and labels for power sector entities. The *power supplier* may be a large generation company or an independent power producer (with one or more plants). Under unbundling, there is typically a monopoly *transmission company*, sometimes called an independent system operator (ISO). The monopoly *distribution utility* function may be fulfilled by one or more geographically-assigned power distributors that own and maintain local power lines, and typically read and maintain power meters. With retail competition numerous *power* 

<sup>&</sup>lt;sup>2</sup> For developing countries, Central/Eastern Europe, and the former Soviet Union, this amounts to the equivalent of 220-440 GW of new installed capacity.

<sup>&</sup>lt;sup>3</sup> From society's perspective, an end-use efficiency measure is cost effective if the benefits (avoided electricity supply costs including environmental costs) are at least as large as the combined government, utility and customer costs of implementing the measure, including marketing costs.

<sup>&</sup>lt;sup>4</sup> This includes the common bias of manufacturing and service businesses toward increased market share, new product development, and expanded production levels as being more important than increasing profit through lower operating costs.

retailers, or electricity marketers, compete to enter a contract with the end user to supply the power commodity, which is then delivered through the monopoly transmission and distribution companies at pre-established prices. Depending on the reform system, the power supplier (generation) and the power retailer (electricity marketer) may be independent or have some shared ownership. Where independent, the power retailer purchases electricity from one or more generation companies, or from a wholesale power pool.

### **Table 1. Common Power Sector Reforms**

Power sector reform, broadly defined, includes a broad range of changes in the power sector. These changes can include one or more of the following:

- corporatizing and commercializing the management of public utilities, which might include full cost recovery through subsidy removal;
- introducing private sector ownership of generation, transmission, and distribution assets and private sector management of operations;
- creating wholesale power markets in which independent power producers sell to the grid either through bilateral agreements or compete for sales to a power pool;
- functional unbundling of generation, transmission, distribution, and retail services;
- creating retail markets in which private entities compete to supply electricity services to end use customers.

# **General Impacts Of Reforms On Efficiency**

Several generalizations can be made about how reforms appear to affect motivations for efficiency, in comparison to the pre-reform era:

- Different reforms have different results. Commercialization and privatization generally strengthen incentives for efficiency due to cost-based prices. The effect of unbundling depends on how the retail supplier passes through upstream costs. Both wholesale and retail competition tend to weaken efficiency incentives, with some exception.
- Reforms affect the incentives of individual market actors differently. If power retailers pass their costs on directly and accurately to end-users, this increases the incentive users have to reduce demand and consumption, but lowers the incentive for power suppliers.
- Suppliers have greater incentives to reduce peak load than to reduce total consumption.
- Reforms leave untouched pre-existing market barriers to implementation of efficiency.

Table 2 summarizes how reforms are affecting retail power prices, power entity motivation to offer energy efficiency services, and the effects on non-utility service providers.

Power reforms adopted in a given country may increase energy efficiency incentives among some market actors while decreasing them among others, largely based on price changes. The net effect on adoption of efficiency measures could be positive or negative. If the efficiency gap becomes narrowed then policy measures may not be needed to offset the reform's effects. If the gap increases, then policy measures may be justified.

Market	Main Driver(s)	General Observations		
Actor	Affecting Behavior			
Electricity	Retail price of	Real prices have decreased as much as 15%, resulting in		
customers	electricity	reduced motivation to invest in energy efficiency.		
Power	Competition among	Power generators in competitive situations have no		
Sector	power sector entities	incentive to promote energy efficiency. Initial competition		
		among power suppliers emphasizes price alone. Power		
		marketers later facing non-price retail competition view		
		energy efficiency as a service to offer to retain customers.		
	Government	Distribution utilities and power retailers offer energy		
	regulation	efficiency services to the extent required by regulations.		
Non-utility	Changing market	There are limited large-scale, commercial ESCO operations		
service	environment	possibly due to small numbers of customers interested in		
providers		energy efficiency. Lower retail electricity prices constrain		
		the range of profitable projects.		

## Table 2. Summary of Effects of Reform on Three Market Actors

# **Observations From Six Case Study Countries**

The six case study countries have produced a number of common observations:

- Price competition has been paramount during the early years post-reform, and in many of these countries average retail prices have declined as much as 15%.
- End-use energy efficiency was ignored in the deliberations on power reform structure and rules in most countries, and has been an afterthought in two countries.
- Power generation, transmission and distribution organizations are motivated to promote peak load management, via time-of-use rates and other mechanisms, that can manage demand relative to capacity constraints.
- Pre-reform utility energy efficiency activities have largely diminished under reforms.
- Only the largest commercial and industrial energy users seem to attract the attention of energy service companies (ESCOs) and other private energy services providers.
- Hoped-for end use efficiency markets for small and medium-size users, served by equipment manufacturers and service companies, generally have failed to materialize due to residual market barriers unrelated to power sector reform.
- The only case of power organizations voluntarily offering efficiency services is in New Zealand, where regulations that all retailers buy from a single power pool dictate that power retailers compete on the basis of service, and not price.
- Subsequent efforts to append efficiency mechanisms after reform structures and rules are decided are politically unpalatable, and institutional options become more limited.

One exception is New Zealand where regulators opted for a system of non-price (or serviceonly) retail competition. There power suppliers are voluntarily offering technology promotion, advisory services, and other efficiency services for customer segments subject to service-only retail competition. Alliances in several countries now appear to be forming between energy efficiency providers and power generators or retailers, or between power distributors and product manufacturers. It also is apparent that some larger customers may be willing to pay for a variety of energy services (e.g., energy management software, informative billing, technical advisory services) and related financial services if these help lower the total energy bill. There are few competitive efficiency service offerings to residential power consumers.

**Changes affecting non-utility energy service providers.** With the exception of the U.S., there is very little evidence of large-scale operation of commercially-offered energy services, whether by ESCOs, energy efficiency companies, or local contractors. The most common explanation is the high transaction costs for entering into these services — both for the consumer who has to become informed about the details of performance contracting, and for the ESCO that has to bear the costs and risks of finding prospective clients and performing the technical and financial analysis necessary to propose contract terms.

Perhaps the most surprising observation is the absence in most countries of equipment vendor-supported promotional and leasing programs targeted directly at consumers. Vendors for major technologies for which energy efficiency models have been developed in the global market (e.g., lighting, air conditioning, refrigerators, and motors) do not appear to be mounting any increased sales efforts to promote efficiency. The most plausible explanation is that with an emphasis on price reduction, consumers do not view energy efficiency as a necessity.

Figure 1 summarizes the experience to date by representing the types of energy efficiency potential that are being targeted by private ESCO companies and power suppliers and retailers, as well as those which are the subjects of public programs and mandates. The unshaded portion of the energy efficiency potential circle designates the "Efficiency Gap" -- that portion of the efficiency potential that is not undertaken through the other agents. The relative size of this will be affected by the type of reform system adopted and its rules, the level of retail power prices, the relative development of private business services that can offer energy efficiency, and economic considerations such as trade policies, import duties, local manufacturing infrastructure, and availability of financing mechanisms.



#### Figure 1. The Market for Energy Efficiency Services

There are three common explanations why end use efficiency failed to be addressed in four of the case study countries:

- Ineffective policy attention (to issues of efficiency market barriers, short-term transition strategies, sustainable development, or climate change action plans)
- Inadequate legal or regulatory framework (with the authority or staff resources to review market response to price changes and competitive service offerings)
- Insufficient institutional capability and public constituency support (lacking in organization, political access, technical capabilities or timing by those in government and outside constituencies)

In the two countries where efficiency was addressed, all three of these factors were solved.<sup>3</sup>

After reforms were in place in four of the six countries, governments undertook remedial actions to preserve or initiate energy efficiency services.<sup>4</sup> These actions took four forms:

- Enabling laws to permit power organizations to participate in energy services, generators/ distributors and power suppliers to collaborate on activities, or joint ventures to occur between technology manufacturers and distributors
- Wires charges or sales surcharges to create a fund to support efficiency programs
- Mandatory requirements for power distributors to offer (free) efficiency services
- Publicly-supported programs for special constituencies (low income, elderly, etc.)

# **Lessons For Other Countries**

The lessons learned are presented under several categories – by player or audience, reform model, general business market conditions, and forms of government policy intervention.

### By Player in the Market

Several characteristics of reformed power sectors have been identified that can enhance the incentive of market actors to undertake energy efficiency measures.

For *electricity suppliers*, these are when:

- energy efficiency improvements they promote do not reduce overall net revenues<sup>5</sup>;
- retail pricing rules decrease the importance of maximizing sales;
- retail competition turns away from price toward service features; or
- government regulation mandates them to do so.

For end-use customers reforms can enhance price signals when:

- customer electricity use is accurately measured and revenues systematically collected;
- system-wide and customer class subsidies are eliminated;
- tariff structures reflect time and location specific costs; and

<sup>4</sup>This was the case in Argentina, Norway, the UK, and New Zealand.

<sup>5</sup> This is likely to be the case if there is still some regulation of power prices for certain customer classes, making certain customer classes less profitable than others. Assuming there is unmet demand for power at the supplier's more profitable pricing, efficiency actions targeted at less profitable consumers can enable a power supplier to redirect the "saved power" to higher profit sales.

<sup>&</sup>lt;sup>3</sup>Efficiency was addressed in 1996-97 in the U.S. in the State of California through a mechanism that is parallel to the power sector reform structure. In New Zealand efficiency has been addressed both internal to reform (via a mandate to publicly-owned utilities) and external to reform (through policy for government-funded efficiency programs).

• future electricity prices are relatively predictable.

For *private energy services providers*, reform features that encourage an energy efficiency market include:

- price signals that are predictable and reflect true costs of service;
- an unrestricted business environment for offering new forms of energy services;
- access to customer information for marketing purposes;
- retail energy competition; and
- market rules that allow the same firm to offer both supply- and demand-side energy services.

## By Type of Power Market Reform

The single characteristic of *retail competition* provides one of the most distinguishing characteristics affecting power sector interest in energy efficiency. Tables 3 and 4 display profiles of reform model features that either discourage or encourage efficiency under two sets of reforms -- the first without retail competition (whether under commercialization, privatization, unbundling, or wholesale-only competition reform schemes) and the second with a retail competition model.

### Table 3. Non-competitive Retail Power Market

Features which **discourage** efficiency include:

- an unbundled structure
- price cap regulation
- absence of regulatory requirement for efficiency
- cross-ownership between generation and distribution entities
- heavy competition among generators that drives down power prices
- either a low retail power prices or little change from pre-reform prices

Features that tend to encourage energy efficiency are:

• vertical integration with generation, transmission, and distribution marginal costs born by one entity

- removal of price subsidies
- price regulation that minimizes the total revenue gained from increased sales
- regulated efficiency performance requirements and surcharges on all suppliers
- independent ownership between generation and distribution functions (where unbundled)
- no or little supply competition
- high retail prices or
- a noticeable increase in retail prices from pre-reform levels

Two observations merit note. First, many of the "discouraging" features for efficiency, such as price competition, low or lowered prices, and an unbundled structure, are *exactly* the features that most economists and reform specialists would argue are the fundamental principles in power sector reform objectives. This is not to say these are undesirable -- just that they can have an effect that slows down the rate of investment in end use efficiency. If so, some mitigating actions might be warranted.

Second, the "encouraging" features of a non-competitive retail market can be completely opposite the "encouraging" features for a competitive retail market (as in the case of the numbers of

competing suppliers). Thus *it is not the features themselves*, but how they function in a larger reform model, that determines the degree of incentive for efficiency. If it is public policy to encourage efficiency, the *reform mechanisms or other initiatives will have to be customized to address efficiency in the specific reform model chosen, and its regulations.* 

### **Table 4. Competitive Retail Power Market**

Features which discourage efficiency include:

- competition primarily based on price
- concentrated ownership of generation and energy supply entities
- a limited number of suppliers

Features which can encourage efficiency are:

- competition regulated on the basis of service, and not price
- <sup>a</sup> varied ownership of and between generators and power suppliers
- allowance of dual business lines or joint ventures between power suppliers and services firms
- greater numbers of power suppliers that need to differentiate themselves

#### **General Business Market Conditions**

Even if power sector reforms were to reduce the size of the efficiency gap, significant barriers to achieving potential efficiency improvements will remain regardless of which reform model is chosen. Totally independent of the power sector reform structure and operating rules, the general business climate also determines the degree to which economic levels of energy efficiency will be achieved. Market factors that encourage efficiency actions include market presence of multi-national corporations, networks of equipment distributors with buying power, after-market technical support, presence of ESCO services (possibly nurtured by previous government efforts), good technical educational programs, consumer credit facilities, and low import duties on all or efficient equipment. Other factors that can help or hurt the development of this market include comparative information on technology performance and professionals, perception by vendors of the potential market, and the general culture for entrepreneurial initiatives.

To overcome or reduce some of the residual market barriers, some public policy initiatives may be necessary. Two ideas prompted by the case studies were:

- Legal and business enabling initiatives to support market-based efficiency
- Attention to financing mechanisms that can support efficiency services in the public interest, ESCO business start-up or incubation, and credit facilities to manage the higher first-costs to consumers of energy efficient products.

#### **Forms of Government Intervention**

Significant barriers to achieving potential efficiency improvements will remain despite the type of power sector reform, and government intervention may be desired. Referring back to Figure 1, the societal objective is to enlarge the amount of efficiency potential tapped by the external agents, to some point of optimum cost-effectiveness. The extent to which government policy or regulatory interventions are warranted to reduce the efficiency gap depends on several factors, including the cost

of closing the gap, the competition for public resources, and the size of the benefits expected from realizing more of the efficiency potential.

The case studies provided two lessons on this issue:

- The restructuring deliberations should include a policy assessment of the merits of possible transition or longer-term public initiatives for efficiency
- If efficiency is to have a seat at the table, there need to be strong constituencies and public support that includes visibility, coalition-building, development of marketing consortiums or branding strategies by manufacturers and suppliers, relevant authority for government agencies, and consideration of energy codes and standards for new buildings, appliances, and equipment

# **Illustrative Models for Addressing Energy Efficiency in Power Sector Reform**

Government policy to support energy efficiency can occur in two ways – up-front as an integral issue in deliberations on the reform structure and its rules or as a parallel issue outside the reform structure itself. These choices are represented by Figure 2, while examples of the regulatory and policy options available to promote efficiency under different reform models are summarized in Tables 5 and 6.





Table 5 summarizes some of the initiatives that could be considered *internal* to reform under each of three generic reform models.

Table 6 presents examples of initiatives that could be undertaken *external* to reform under each of four intervention strategies (voluntary information, market transformation, public investment, codes and standards). Any of these initiatives could be viewed as short-term (while waiting for a selfsustaining market), transitional public facilitation of deeper market transformation (short-to-medium term), or longer term publicly-funded activities (where markets are not expected to materialize). The time frame will depend on the size of the efficiency gap, importance of narrowing this, and the relative development of the market and infrastructure. In all cases, the initiatives should be selected and designed to overcome specific, identified market barriers.

Reform Rule	#1 Bundled, Commercialized Model	#2 Unbundled Model, No Rotail Competition	#3 Unbundled Model, With Poteil Competition
Connection	Deminer clanzed Model		with Ketall Competition
Generation	including DSM resource options	Allow generators to enlist end users in load management	Allow agreements across G/T/D to capture benefits of EE & load management
Distribution	Require utility load management to minimize G/T/D capacity investment	Require distributors to analyze load management impacts on capacity, and justify capacity investments	Require capacity and TOU elements in tariffs
Retail power supplier	not applicable	Allow distributors or power suppliers to offer (for-profit) EE services	Permit DSM to compete with resource acquisition
Wholesale supply competition	Permit DSM to compete with IPP contracts	Permit DSM to compete with G/T resources	Encourage longer term supply/ service contracts that can to amortize energy efficiency services
Power expansion plans	Require IRP or equivalent	Require distributors to consider EE and DSM in least cost supply purchase and investment plans	Require distributors to file IRP plans that consider EE and DSM
Retail tariffs	Increasing blocks Eliminate subsidies TOU pricing	If retail prices regulated: increasing blocks, eliminate subsidies, use TOU prices, structure tariffs to minimize gain/reward from new kWh sales. If prices not regulated: market will dictate prices	If prices regulated: increasing blocks, eliminate subsidies, use TOU prices
Cost recovery for EE/ load management	Allow recovery of approved expenses, possibly with profit incentive	If retail prices regulated: Allow recovery of approved expenses, possibly with profit incentive. If not regulated: May recover via wires charge or account charge	If prices regulated: Allow recovery of approved expenses, possibly with a profit incentive If not regulated: May recover via wires charge or account charge
Energy Efficiency	Require utilities to offer specified EE services	Require retail competition on basis of service, not price.	Promote idea of suppliers' offering free or low-cost services bundled with power supply contracts.
Load management	Require TA to customers on TOU, load management at recovered expenses	Apply price caps and time and location-based charges to T&D. Promote wholesale power contracts with TOU terms	Apply price caps and time and location-based charges to T&D. Promote wholesale power contracts with TOU terms.
Customer service	Require utilities to offer free public information on EE	Require distribution companies to supply free public information on efficiency	Require all retail suppliers to offer free public information on EE
Financing mechanisms	Encourage utilities to offer or arrange customer EE leasing or loan programs	Shareholder/owner funds may be used to support competitive services.	Shareholder/owner funds may be used to support competitive services.

Table 5. Regulatory Options for Addressing Energy Efficiency Within Reform Models

## A Hybrid Strategy is Most Likely

A hybrid approach may be the best solution to promoting efficiency within and external to power sector restructuring. Experience across the case study countries suggests that regardless of the power reform model used, a hybrid strategy eventually unfolds, combining three elements:

*Competitive service* offerings under reform models and rules that permit power suppliers, distributors, and/or private energy service companies to provide commercially viable and profitable services (typically to large or medium-size customer segments and for well-established, common technologies).

*Market transformation* services guided by collaborative constituencies that build greater efficiency market participation by power companies, equipment vendors, customer segments and/or technologies that do not yet meet the market hurdle for commercial viability.

*Public purpose efficiency programs* supported by government taxes, "wire charges", or electric account fees that pay for general public information and implementation services that have a public benefit, but no possibility of commercial viability. Examples are energy information centers and public funding of efficiency for low income or senior households.

Initiatives	Voluntary	Market	Public	Codes &
	Information	Transformation	Investment	Standards
Information &	Public campaigns	Joint programs,	Targeted	Public relations
Awareness	Workshops	funded by power &	community	to support
		product vendors	promotion	implementation
Technology	Promotion	Demonstrations	Direct installation	Privately-
Promotion			of no/low cost	advertised
			items	compliance
Innovation	Market-driven	Design competitions	Group buying high	Standards set
		Life-cycle costs	efficiency	ahead of product
			products	designs
Labeling &	Appliance energy	High performance	none	Permit for
Branding	use information	branding		minimal
	labels			compliance
Education	Energy audits	Model performance	EE included in	Training for
		contracts	school curriculum	professionals
<b>Risk Reduction</b>	none	Private certification	Government	Materials
			certification	qualification
Financing	none	Dedicated	Tax credits,	none
		investment funds	grants, no-interest	
		with guarantees	loans	

#### Table 6. Sample Initiatives External to Reform, Under Alternative Intervention Strategies

There is little doubt that some amount of the efficiency gap will remain in the wake of power sector reform. Each country will face different circumstances, and thus will need to address a series of questions to help determine first, whether to address efficiency in selecting the type of reform structure, strategies or rules that can minimize negative effects on efficiency; and second, steps to reduce market barriers to achieving more of the efficiency potential. Such a decision process is outlined in the full report on which this paper is based.<sup>6</sup>

<sup>&</sup>lt;sup>6</sup> For further information and guidance on the steps outlined here, please refer to Hagler Bailly Services (1998c), prepared for USAID.

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