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# PRIMER ON THE IMPACT OF ELECTRICITY TARIFF REFORMS ON INFRASTRUCTURE INVESTMENT AND ECONOMIC DEVELOPMENT



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# PRIMER ON THE IMPACT OF ELECTRICITY TARIFF REFORMS ON INFRASTRUCTURE INVESTMENT AND ECONOMIC DEVELOPMENT

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## List of Acronyms

CAPEX	Capital Expenditure
GDP	Gross Domestic Product
GHG	Greenhouse Gas Emissions
IPO	Initial Public Offering
NARUC	National Association of Regulatory Utility Commissioners
OPEX	Operating Expenditure
RAB	Regulated Asset Base
USAID	United States Agency for International Development
WACC	Weighted Average Cost of Capital

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This primer was developed in partnership with the National Association of Regulatory Utility Commissioners (NARUC) with the generous support of the United States Agency for International Development (USAID). It is one in the series of various primers on cost-reflective tariffs and will be incorporated into a larger comprehensive guide on tariff settings, the Cost-Reflective Tariff Toolkit.

## **About the Author**

VIS Economic & Energy Consultants is an international consultancy providing specialized economic and regulatory advice to energy sector clients. VIS is based in Athens, Greece, and its current operations span Europe, Eurasia, Middle East & North Africa, Asia, and Sub-Saharan Africa.

The in-house staff of VIS combines specialist sectoral and service expertise, gained through extensive involvement in consulting projects, with a strong project management record. Experience transcends the biggest part of the energy sector (e.g., power, natural gas, oil, renewable energy and energy efficiency, alternative fuels), having worked in numerous consulting and technical assistance projects financed by public and private clients.

VIS has supported clients for the formulation of tariffs for regulated networks, development of energy pricing models, market codes and regulations, market reviews, economic and financial evaluation of infrastructure projects, feasibility studies, privatization and restructuring of utilities, and development of strategy and business plans for utilities.

Energy clients and beneficiaries in international projects VIS has worked for include USAID, NARUC, the World Bank, the IFC, the European Commission (DG-Energy, EuropeAid), the European Investment Bank (EIB), the Millennium Challenge Corporation (MCC), LuxDEV, and the European Agency for Coordination of Energy Regulators (ACER).

## 1. Introduction

With funding support from USAID, NARUC has developed a Cost-Reflective Tariff Toolkit aimed at supporting policymakers, regulators, and utilities on the design and implementation of cost-reflective tariffs, inter alia through effective engagement of the public and of key stakeholders in the decision-making process. The Toolkit consists of several short primers that provide practical information and guidance to utility service regulators in countries with emerging economies on how to address specific elements and topics of cost-reflective tariffs.

This primer is the final primer in the Toolkit, and discusses the impact of electricity tariff reforms on a country's economic development. The implementation of cost-reflective tariffs, based on sound economic principles, ensures that the appropriate incentives are in place for attracting investments in the sector, as well as for safeguarding the financial viability of the electricity sector. The adoption of non-cost-reflective tariffs has wide and deep ramifications ranging from an underinvestment in the necessary assets to an increase in government debt and a negative impact on the country's overall economic competitiveness (through non-efficient allocation of productive resources).

Distortional pricing signals do not incentivize energy efficiency improvements, and act counter to stated climate policies and targets on greenhouse gas (GHG) emissions. As an example, an industrial customer may be less incentivized to invest in modern energy efficiency measures if the price of electricity is below cost. Similarly, but on the other end of the spectrum, a large industrial customer, necessary for base load consumption, may decide to go off-grid altogether or relocate to a neighboring country if the price of electricity is quite high due to a subsidy to other consumer classes. Therefore, regulators have a crucial role in ensuring economic sustainability for the regulated entities and fairness regarding the revenue recovery from each customer category.

### 1.1. Objective

The main objective of this primer is to discuss the importance that electricity tariff reforms toward cost reflectivity have on electricity sector development and the economic growth of a country.

### 1.2. Scope

This primer covers all crucial aspects regarding the implications of tariff reforms on the economy. The analysis starts with explaining the role of the power sector in a country's economy. The benefits of cost reflectivity for the electricity sector and the economy are analyzed. Electricity pricing methods enabling electric utilities to recover their costs, as well as the prerequisites for the implementation of cost-reflective tariffs in practice, are discussed. The primer then builds on the importance of cost reflectivity, to discuss the transition toward cost-reflective pricing. Key recommendations for attaining a regime that enables the application of cost-reflective electricity tariffs are provided.

### 1.3. Organization

The primer is organized as follows:

**Section 2:** Electricity and economic development

**Section 3:** The benefits of cost-reflective pricing

**Section 4:** Transition toward cost reflectivity

**Section 5:** Recommendations for tariff reforms

**Section 6:** Final remarks

## 2. Electricity and economic development

Electricity is an essential factor for production and economic growth and its causal relationship to GDP has been established in multiple studies.<sup>1</sup> The share of the electricity sector in total value added is relatively small (2-5%), but its contribution to sustained long term growth is significant.<sup>2</sup> For developing countries, the power sector may have a slightly higher share to a country's gross domestic product (GDP), and it is a key determinant for the development of the country's major industries.<sup>3 4</sup>

In Tajikistan, for instance, the power sector accounts for about 7% of GDP, while at the same time electricity constitutes a key input for the country's two largest exported commodities – aluminum and agriculture – which together account for around 20% of Tajikistan's annual GDP and 50% of its exports.<sup>5</sup> Therefore, a strong electricity sector, ensuring reliable electricity supply, is a prerequisite for Tajikistan to develop its export market.

Electricity pricing has a horizontal and structural role in the operation of the economic system as it affects industrial production costs, households' disposable income, and industrial competitiveness. Reliable electricity supply is conducive to the development of a good business environment and a major enabling factor toward the development of a complex economy. The emergence of a viable micro-, small-, and medium-size enterprise sector relies on a stable supply of energy.

Poor performance of the power sector due to underinvestment may lead to power outages that can significantly increase the production costs of firms (cost of backup generators/ fuels etc.) and reduce disposable income for consumers through high energy bills. Empirical evidence shows that economic growth in many developing countries has been significantly hampered by power outages. According to the World Bank's Enterprise Survey, 46.1% and 40.6% of companies on average in South Asia and Sub-Saharan Africa, respectively, identify unreliable or lack of electricity as a major obstacle in doing business.<sup>6</sup>

The dependence of the economic system on electricity is expected to increase further in developed countries as well. For example, large energy intense sectors (which play a significant role in attaining decarbonization targets) will deepen the dependence on electricity as an energy source. Electric cars and electric heating and cooking appliances are expected to replace fossil fuel-based technologies. Megatrends such as automation and digitization are expected to further increase the demand for

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<sup>1</sup> "Electricity consumption and economic growth in China," *Energy Policy*, Volume 32, Issue 1, January 2004, Pages 47-54.; "Electricity consumption – growth nexus: The case of Malaysia," *Energy Policy*, Volume 38, Issue 1, January 2010, Pages 606-612; "Electricity consumption and economic growth in South Africa: A trivariate causality test," *Energy Economics*, Volume 31, Issue 5, September 2009, Pages 635-640; "The causal relationship between electricity consumption and economic growth in the ASEAN countries," *Energy Policy*, Volume 34, Issue 18, December 2006, Pages 3573-3582; "The relationship between GDP and electricity consumption in 10 Asian countries," *Energy Policy*, Volume 35, Issue 4, April 2007, Pages 2611-2621.

<sup>2</sup> The range refers to different countries for a period from 1995 to 2017 using a selection of datasets for the year 2014 based on the GTAP (Global Trade Analysis Project) v10 dataset available at <https://www.gtap.agecon.purdue.edu/>, EU-KLEMS (1995-2017) available at <https://euklems.eu/download/> and WIOD (2000-2014) available at <https://www.rug.nl/ggdc/valuechain/wiod/wiod-2016-release>.

<sup>3</sup> Schramm, Gunter. "Electric Power in Developing Countries: Status, Problems, Prospects." Energy Development Division, World Bank. 1990.

<sup>4</sup> Yu, Zhongdong. et al. "The Effects of Electricity Production on Industrial Development and Sustainable Economic Growth: AVAR Analysis for BRICS Countries." *Sustainability*, 11, 5895. 2019.

<sup>5</sup> "Macro-Economic Impact of the Power Sector." *Taj Hydro*. <http://tajhydro.tj/en/macro-economic-impact-of-the-power-sector/>.

<sup>6</sup> "Infrastructure." World Bank. <https://www.enterprisesurveys.org/en/data/exploretopics/infrastructure>.

electricity.<sup>7</sup> This increasing trend indicates that the link between electricity and economic growth will grow stronger although at a different pace across countries.

Power companies and utilities need to invest in infrastructure necessary for delivering reliable electricity. Financing the transition in both developing and developed economies is proving challenging with public funding not being sufficient to support this transition without the engagement of private capital.

Challenges relating to raising capital for financing investments are always an issue for regulated and non-regulated electricity companies. Funding investments from the market demands the payback period and return for the capital invested to be both predictable [when investors will get back the invested capital] and attractive [return/risk ratio higher than competing investment opportunities].

In some countries, it is the case where power companies and utilities that are state-owned may receive low-cost funding, government support (e.g., guarantees), direct subsidies, and exemptions from antitrust enforcement and insolvency regulations. This is an artificial low-cost financing which usually would not be available otherwise (i.e., in the case when the same utility would raise capital from the markets). Artificial low-cost financing provides a distorted economic signal not allowing the utility to optimize investments.

On an institutional level, a sound regulatory regime that is overseen by an independent regulator is necessary to inter-alia ensure that end-users receive services of a certain quality, which is linked to how well or not the utility performs. Strong institutions safeguard the operation of the authority and ensure smooth implementation of policies. Independent regulatory oversight is essential for ensuring a strong power sector that can enable sustainable economic growth.

The level of independence of the regulator as well as the extent to which state-owned utilities are obliged to align themselves with the regulatory rules and incentives determine the effectiveness of regulation of state-owned utilities. Literature and empirical evidence show that private power companies respond more effectively than state-owned utilities to regulatory obligations related to, for example, the reduction of technical and commercial losses, the investment incentives associated with rate of return, etc.<sup>8</sup>

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<sup>7</sup> The role of electricity in future energy and economic systems is expected to grow significantly despite energy efficiency improvements, electricity consumption is expected to grow significantly over the next decades – depending on climate and other energy policies, it can grow more than 50-100% globally from current levels).

<sup>8</sup> Rodriguez Pardina, Martin; Schiro, Julieta. "Taking Stock of Economic Regulation of Power Utilities in the Developing World: A Literature Review." Policy Research Working Paper; No. 8461. World Bank. 2018. <https://openknowledge.worldbank.org/handle/10986/29890>.



### 3. The benefits of cost – reflective pricing

#### 3.1. Pricing and regulation

##### Cost Reflectivity

Electricity tariffs should ensure that revenues collected recover all the prudently<sup>9</sup> incurred costs of the regulated activities. Electricity pricing should be reflective of costs incurred to produce it, transmit it, distribute it, and supply it. The tariffs should capture generation costs (fuel costs including the exposure to exchange rate fluctuations, inflation, and all operational and capital costs), transmission and distribution network costs, and supply costs so that consumers pay the full cost of the service they consume.

Pricing should be reflective of costs incurred. In practice, however, it is often the case that electricity is mispriced by utilities. There are two common underlying factors observed in most mispriced situations that are worth noting. The first one is the market structure (monopoly vs. liberalized), and the second is the design and implementation of the regulatory regime.

##### Market structure (monopoly vs. liberalized market)

When the full electricity supply chain is a single monopoly, all activities and respective pricing are regulated to protect, on one hand, the users of the service from rent extraction by the utility and, on the other, the utility from underpricing its product, thus going out of business.<sup>10</sup> As portions of the electricity supply chain gradually open to competition (generation and supply), the products and services offered by the liberalized portions are priced by the market (price-optimized by competition).

The remaining portions of the supply chain, namely transmission and distribution network services, have the characteristics of a natural monopoly. Thus, pricing for such monopoly services must be “appropriately set” by the utility regulator as a necessary counterweight to the absence of competitive market forces.<sup>11</sup>

##### Regulation as an essential balancing mechanism

The regulator’s job is to limit the power of the monopolistic segments of the electricity supply chain, ensuring that this is done in a cost-reflective manner. It is also important to protect and improve the welfare of both the consumers and the network operators. Protection of welfare can be assessed in terms of consumer surplus, service availability and reliability, operator profitability, and innovation level.

Regulators should determine cost-reflective tariffs considering that consumers should be charged in accordance with how much their electricity consumption costs the system and they should not be charged anything less or more. At the same time, utilities, should be able to recover their costs for the service they provide and earn a reasonable return on their assets.<sup>12</sup>

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<sup>9</sup> “Prudence” in this case is a term of art applied by regulators to utility investment and other expenditures after the fact to determine whether these expenses may be included in the rate base. In many cases, regulators pre-approve major investments, financings (e.g., bond issuances or bank loans), and multi-year contractual commitments such as power purchase agreements.

<sup>10</sup> The power sector was considered as a natural monopoly as the grid (transmission and distribution) and generation usually were owned by the same (public) company.

<sup>11</sup> The mission of a utility regulator is to ensure that the public receives reliable utility service at a reasonable price, and the regulated utility receives revenues that are sufficient to cover (i) its prudently incurred expenses and (ii) a reasonable return on its prudently incurred investments.

<sup>12</sup> The “reasonable profit” is a percentage return on the regulated asset base (RAB) of the utility, and this is calculated by multiplying the WACC on the RAB. Given that the WACC is subject to various context driven parameters such as the risk-free rate of the country, the cost of debt, cost of equity etc., the level of return will vary between utilities in different

Regulators have a difficult task in bridging two conflicting objectives. On one hand, the consumer wants to pay the least cost for the best possible electricity supply service, while on the other hand, the utility wants to maximize its profits.

If the market structure and the regulatory principles are as described above, then the design and implementation of the regulatory regime and tariff methodology become the main factor determining end-user prices. This is discussed in detail in the following section.

### **Regulation and end-user tariff design methods**

From the viewpoint of tariff design, the two elements that should be reflected in the tariffs are (i) **equity**, which means that the recipients of the service should pay for the costs incurred by their consumption, ruling out cross-subsidies among consumers, and (ii) **pricing efficiency**, which means that the charges made by the operator should be as close as possible to the marginal costs incurred to provide the service.<sup>13</sup> Note that while marginal cost pricing is seen as desirable, most tariff regimes worldwide set prices based on average costs.

The two major methods for setting the revenue requirement and therefore tariffs by the regulators are cost of service regulation and incentive-based regulation.<sup>14</sup>

In **cost-of-service regulation**, the tariffs charged by the company are authorized by the regulator, and the whole process can be segmented into two parts:

- (i) The determination of the required revenue by the company that covers all its operation costs, investments, depreciation of assets and reasonable return.
- (ii) The structure and determination of the tariffs for the different customer classes (households, commercial, industrial, street lighting, transportation, etc.) that will recover the incurred costs on an equitable basis (as mentioned before) and sum up to the required revenue.

In the case of **incentive-based regulation**, the tariffs are set by incentivizing the utility to lower its costs through operational optimization and whatever efficiency gains are made to be shared between the utility and its customers. There is a long-term agreed path covering a full four-year (sometimes five-year) regulatory period, where the utility agrees to a target for lowering costs and, if attained, keeps the extra revenues. The starting point for incentive-based regulation is a cost reflective tariff, where the regulator perceives both the potential for greater efficiency and the likely responsiveness of the utility to the incentive approach.

The target for the subsequent period sets as a baseline the closing/previous period attained performance, thus incentivizing the utility to constantly improve. Of course, there is a plateau and the new performance targets set should always consider that there is a limit on how efficient an operation can become. Under incentive-based regulation, there are two basic schemes that could be followed: the revenue cap scheme and the price cap scheme.

In addition to the tariff level, regulators set the rules and procedures under which tariffs are modified and updated. An automatic cost pass-through mechanism can be defined by the regulator so that utilities can cover costs that are out of their control, including changes in fuel prices, inflation, and exchange rates. This mechanism can save utilities from creating a deficit in case of price hikes, while if prices drop, end-users can reap the benefit.

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contexts. WACC estimation is analyzed in the primer "[A Cost of Capital and Capital Markets Primer for Utility Regulators](#)" developed by NARUC.

<sup>13</sup> Cost-reflective tariffs are also seen "as a means of ensuring greater social equity in the mass market, by reducing the largely invisible cross-subsidies embodied in flat-rate tariffs." (Hobman, E. V. et al. "Uptake and usage of cost-reflective electricity pricing: Insights from psychology and behavioural economics." *Renewable and Sustainable Energy Reviews*. Volume 57, 455-467. 2016.). However, attaining cost reflectivity and reforming a situation where there is a tariff deficit is challenging with difficulties on several fronts (see Section 5).

<sup>14</sup> Cost-reflective tariff design is analyzed in the "[Primer on Rate Design for Cost-Reflective Tariffs](#)" developed by NARUC.

It is evident from the above that the relationship between market structure, regulation, and pricing method is crucial in setting the context for cost-reflective prices to be implemented. It is very important to note that developing a cost-reflective tariff does not lead to a higher or a lower tariff.<sup>15</sup> Rather, it is simply setting a fair and accurate electricity price that builds the confidence of all key stakeholders (e.g., consumers, utilities, and investors alike) in the system.

### **3.2. The importance of cost reflectivity for the power sector**

Having established what cost reflectivity is and what the underlying preconditions [market structure, regulatory framework, and tariff design] are for attaining cost reflectivity, it is significant to identify the impact on the power sector itself. This is of particular importance given the large investments that the sector requires in meeting both demand and environmental objectives (i.e., investments driven by specific energy and climate policy targets).

There are four major power sector areas that accurate cost-reflective pricing can help optimize as opposed to when pricing is not cost-reflective. These range from the corporate / utility level financial health all the way to support for policy attainment goals (e.g., environmental targets). More specifically:

#### **Financial performance**

When costing is below recovery level, the amounts that are billed to consumers do not sum up to the revenue required by the utility to cover its operating expenditure, its capital expenditure, on existing and future assets as well as environmental externalities. Therefore, the utility will not be attaining financial viability, with varying degrees of severity for its [utility's] operation and survival.<sup>16</sup>

The tariff deficit that is created due to underpricing by state-owned utilities can then burden public budgets and divert financial resources from other more efficient uses. An electricity tariff deficit also leads to underinvestment in the sector that in turn results in a utility's operational inefficiency. The impact of a tariff deficit can create a negative feedback situation where poor operational performance and poor quality of service results in declining willingness to pay, thus accelerating the deterioration of the utility's financials.

The repercussions of operational inefficiency can be severe, and while governmental support through subsidies, with all their problematic consequences (see Section 4.2), could temporarily offset for the lack of operational efficiency, there are cases where even this type of support is not enough. The result could be that final tariffs can be both very high and still not cover the incurred costs, representing an extreme form of inefficient resource allocation.

In most developing countries, the state-owned power utilities show poor financial performance due to inter-alia under-pricing (other reasons include uncollected revenue and high commercial and technical losses). The result is to rely on the public budget to cover their financial gap or quasi-fiscal deficit, as it is called.<sup>17</sup> In cases where the tariff deficit that is created due to underpricing is not covered immediately through governmental support, the liabilities of the utility will continue to accrue – considering the escalating interest payments, debt installments, etc., that will be added up, a government bailout may be the inevitable consequence in the end.

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<sup>15</sup> There are many exogenous factors influencing the end-price of electricity in a market ranging from the technology employed for its production to its local availability [imports vs no imports] to taxation.

<sup>16</sup> The “ladder” of financial viability consists of six levels; Level 1: Utility does not cover existing OPEX; Level 2: Utility covers at least existing OPEX; Level 3: Utility covers existing OPEX plus concessional financing costs on existing assets; Level 4: Utility covers existing OPEX and full CAPEX for existing assets; Level 5: Utility covering efficient OPEX and full CAPEX on existing and future assets; Level 6: Utility covers efficient OPEX and full CAPEX on existing and future assets plus environmental externalities.

<sup>17</sup> Huenteler, Joern et al. “Cost Recovery and Financial Viability of the Power Sector in Developing Countries: A Literature Review.” Policy Research Working Paper; No. 8287. World Bank. 2017.  
<https://openknowledge.worldbank.org/handle/10986/29077>.

### **Investment financing**

In the competitive segments of the supply chain (i.e., generation and supply), the market determines the prices and subsequent profitability. On that basis, private investors choose to enter the market and invest or not. In the case of transmission and distribution networks, which are natural monopolies, grid investments are driven by the system's technical needs and mandated operational improvement.<sup>18</sup> Financing the necessary investments can be sourced from the tariff itself or by raising funds from capital markets.<sup>19</sup> For a natural monopoly to go public and raise funds to finance its investment program, transparency, cost reflectivity, and regulatory certainty are key elements to attract potential investors to buy its stock.

When cost-reflective tariffs are implemented, private and public utilities can raise capital and expand their generation, transmission, and distribution infrastructure. Investors will have faith in the system that the terms of their investment will not change, and that they will be able to make the expected return. An enabling environment for new investments will be conducive to countries facing power supply problems.

When tariffs are set below cost, incentives will not be present for potential investors. As an example, the Regional Electricity Regulators Association has identified that the electricity supply challenges in Southern African Development Community are due to insufficient investments in generation and transmission infrastructure. This is attributed to below cost tariffs that do not enable investors to recover all their costs, and thus do not provide adequate incentives to promote new investments.<sup>20</sup> An unattractive environment for investment can inhibit electrification access by leaving parts of the population without electricity and/or with substandard supply service.

### **Optimization of resources**

Cost-reflective electricity prices combined with performance efficiency targets drive productive capacity toward long term sustainable growth options as they do not distort economic agents' decisions. Under this context, utilities recover their revenue required enabling them to maintain their current assets, extend their lifetime, and increase their performance. At the same time, they can invest in modernizing their equipment to attain performance efficiency targets.

### **Rationalization of consumption**

Cost-reflectivity ensures that consumers are provided with the correct price signals and, thus, do not under- or over-use their electricity service. When tariffs are set below cost, it is considered a signal for consumers to consume more, thus, putting extra pressure throughout the electricity supply chain (generation, transmission, and distribution system). Extra pressure translates to unnecessary investments in generation and networks. This can create a situation where new capital is constantly required for investments, leading to either an unsustainable debt level or, if no investments are made, a deterioration in the quality of electricity service.

Optimal energy use results in moderating peak consumption. This will reduce the potential negative environmental externalities from over consumption and decrease pollution and other environmental impacts, such as groundwater over-extraction and greenhouse gas emissions.

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<sup>18</sup> This implies an incentive-based regulatory regime.

<sup>19</sup> System users will pay for it.

<sup>20</sup> "Implications of migration to cost-reflective tariffs in Eswatini's electricity sector." Eswatini Economic Policy Analysis and Research Centre. 2019.

## 4. Transition toward cost reflectivity

The previous chapter was dedicated to cost reflectivity and how this is beneficial for the power sector, the economy, and the society as whole. However, migrating from a distortive pricing regime to a cost-reflective tariff system is not easy, and the transition is subject to addressing institutional barriers requiring reforming.

### 4.1. Market structural reforms

The institutional backdrop on which the power sector operates is very crucial to any transition taking place. This means that it is more probable that structural reforms requiring political will and backing are needed. The World Bank reported that cost recovery was on average higher in systems with an independent regulatory authority, and where the power sector had undergone vertical unbundling, allowing a higher share of private sector participation, and more competition in the retail/supply market segments.<sup>17</sup>

Therefore, as a first step, structural reforms include the separation of functions to different institutions – policy and planning assigned to the energy ministry, regulatory functions assigned to an independent regulator, and power service provision assigned to the utility.

The second step is the separation of the utility's management from the ministry and the government marking its corporatization. This means that the utility is managed like a private entity although the majority (or all) of its shares are still owned by the state. It should be noted that public utilities usually lack the governance and financial discipline that private entities exhibit, and therefore corporatization is crucial. The accounting and auditing practices that they follow differ; ninety percent of private utilities produce their financial accounts in accordance with international standards, while the respective percentage for public utilities is forty-two percent.<sup>21</sup>

High quality financial reporting by a utility provides the data of the utility's financial transactions, assets, and liabilities. This will enable a utility to calculate its cost for providing service, and a utility regulator to review and adopt/approve a cost-reflective tariff. The combination of utility corporatization and independence of regulator are important for the utility's performance improvement.

Following those structural changes at the level of institution and corporation, a third step is market reforms starting with the vertical unbundling and separation of monopolistic activities of the electricity supply chain (i.e., transmission and distribution) from those that can be competitive (e.g., generation and supply). Vertical unbundling has been shown to be a necessary factor in increasing transparency as well as improving governance in the sector. Both transparency and governance are required preconditions to attract private capital, given that the transfer of risks involved to the private sector demands openness and predictability, which are both much harder to attain with a vertically integrated monopoly.<sup>22</sup>

The natural progress in terms of market reforms when vertical unbundling has been attained is to open the generation and supply activities to competition (horizontal unbundling) and at the same time to establish wholesale and eventually retail markets. Cost reflectivity in this case is determined and monitored only in the network segments of the sector given that the competitive portions (if functioning properly) do reflect all their costs in their pricing to the consumer.

A real case of successful reform is Peru, where the power sector has undergone full unbundling enabling greater private sector participation and the operation of a wholesale power market.<sup>21</sup> A large

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<sup>21</sup> Foster, Vivien; Rana, Anshul. "Rethinking Power Sector Reform in the Developing World." World Bank. 2020. <https://openknowledge.worldbank.org/handle/10986/32335>

<sup>22</sup> "Revisiting Policy Options on the Market Structure in the Power Sector." Energy Sector Management Assistance Program (ESMAP). World Bank. 2011.

share of the energy consumption (equal to 44% of national consumption) is sold in the Peruvian wholesale market, with transmission and distribution tariffs designed to be fully cost-reflective.<sup>23</sup>

## 4.2. Resource (mis)allocation effects

### 4.2.1. Subsidies

The most common form of electricity price distortion comes from subsidies. Subsidies hide the true cost of producing, transmitting, distributing, and supplying electricity. Removing the barrier of subsidies toward the transition to cost reflectivity is not straightforward and has proven challenging to several countries. Subsidies can be explicit, implicit/indirect, and can be funded directly from taxpayers' money or be in the form of inter-customer group transfers (cross subsidies).

Explicit subsidies refer to the budgetary expenditure that has the effect of offering a product and/or service at a price below cost.<sup>24</sup> There are other subsidies that are implicit but still produce the same effect, that of offering a product and/or service at below cost. Examples of such implicit subsidies are the ones relating to market price support as well as uncollected revenue (foregone revenue), where state-owned companies under-collect (willingly or not) the billing charges.<sup>25</sup> Uncollected revenue as a "social policy" measure is particularly prominent in publicly provided services by state-owned companies such as electricity, water, and heat.

A common misconception is that either direct or indirect subsidies are related to cash (provided or foregone). However, a significant number of subsidies come in the form of reallocation of risk by having the government guaranteeing company debt that otherwise would have been very expensive to get or would not be possible to get at all.

In countries where the pricing of electricity is below cost recovery level, thus creating tariff deficits (Section 3.2), electricity subsidies can be financed by directing public spending. These funds could have been used for covering needs in other sectors (e.g., health, education), or could be funds borrowed by the government for this precise financing thus putting extra pressure on the sustainability of the country's public debt. A financially viable and sustainable power sector can free this public money for spending to address other social needs or investments with a higher multiplying effect to the one electricity sector subsidies have.

For the electric utilities themselves, subsidies can also be detrimental. It is quite common for industrial tariffs to subsidize residential ones to the detriment of the industrial clients. This could lead to a situation where large industrial consumers might choose to go off-grid and self-power, taking the necessary base load consumption out of the system and thus reducing mostly needed base revenue of the utility. Therefore, subsidies can negatively affect utility's investments, maintenance and operations, payroll, etc.

Govinda et al (2017) examined the impact of the removal of subsidies on electricity prices on Bangladesh's economy.<sup>26</sup> They found that the short-term impact of increasing electricity prices is counterbalanced by the proper recycling of budget revenues. In particular, they found that subsidies may distort the optimal allocation of a country's resources and direct economic growth to less dynamic/efficient pathways.

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<sup>23</sup> "Private Sector Participation in Electricity Transmission and Distribution: Experiences from Brazil, Peru, the Philippines, and Turkey." Energy Sector Management Assistance Program (ESMAP) knowledge series, no. 023/15. World Bank. 2015. <https://openknowledge.worldbank.org/handle/10986/22750>.

<sup>24</sup> Includes tax breaks.

<sup>25</sup> For example, protective measures for domestic producers by increasing import tariffs and thus hurting competition.

<sup>26</sup> Timilsna, Govinda et al. "Economy-Wide Impact of Electricity Price Increases in Bangladesh: A CGE Analysis." World Bank. 2017. <https://openknowledge.worldbank.org/handle/10986/30631>.

In cases where the electricity tariff deficit is high, the government debts from subsidizing state-owned electricity companies (quasi-fiscal deficit) can be very significant with specific excise taxes to be usually put in place to cover for this deficit.

From the end-user standpoint, the application of subsidies is always attached to several conditions such as electricity consumption. However, the conditions on their own do not guarantee that the application correctly reaches the targeted groups. For instance, the lifeline block tariff (subsidized level of consumption), which is applied horizontally, does not distinguish whether the recipient is in actual need of the subsidy or not.

An issue with the increasing block tariffs is that they tend to be more effective in countries with high electricity access rates of poor/vulnerable households. Obviously, poor households that are not connected to the electricity grid, cannot benefit from such subsidy form. Another reason that is mostly encountered in Africa concerns the fact that vulnerable households share connections to afford the initial connection charges, which results in increased overall electricity consumption.<sup>17</sup>

Therefore, these groups are excluded from the benefits of lifeline block tariffs. These subsidized tariffs do also benefit customers that are not vulnerable since they apply horizontally without any real means testing. Vulnerable support schemes based on non-means tested systems tend to not benefit the intended target groups and at the same time burden the utility or other consumer groups (in case of cross subsidies).

Cross-subsidization is also a widely used type of subsidy. This is the practice of charging some customer groups above the cost of service provision while charging others below the cost of service provision. The reason for doing so is mostly social, relating to very low-income households or, in some instances, economic to enhance competitiveness of non-residential customers.

A recent study by the World Bank<sup>27</sup> on the electricity tariffs structures used in different markets showed that from a pool of 65 countries, in over 60% of the countries, industrial customers pay more per kilowatt hour (kWh) than residential customers, and in 80% of the surveyed countries commercial customers pay more than residential customers.<sup>28</sup>

It could be argued that a significant number of industrial customers imposes lower costs to the system than the residential customers since they are connected directly on the transmission grid, and, thus, the per unit cost in theory should have been lower. Following the same line of reasoning, it could be said that both commercial and residential customers do impose similar costs, since both connect to the distribution grid. Finally, it is notable that in almost all cases surveyed, the customers in the agricultural sector pay the least of all other categories (it is the most subsidized consumer category).

Moving with structural reforms that transcend institutions, utilities, and the market itself, along with subsidy removal, constitute a necessary condition for the attainment of cost-reflective tariffs. This is important for the viability of the sector and the maximization of welfare through a more optimal allocation of resources.

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<sup>27</sup> Foster, Vivien; Witte, Samantha. "Falling Short: A Global Survey of Electricity Tariff Design." Policy Research Working Paper; No. 9174. World Bank. 2020. <https://openknowledge.worldbank.org/handle/10986/33417>

<sup>28</sup> Seven high-income countries, 35 middle-income countries and 23 low-income countries.



## 5. Recommendations for tariff reforms

Tariff reforms toward costs reflectivity ensure the long-term growth and sustainability of the electricity sector. However, the pace of the transition should be adjusted according to the specific characteristics of the power sector, the market structure, and the broader policy objectives, including any environmental concerns.

The true cost of service level is affected by investments in the power sector, and firms' production and operation costs. Tariff levels encompassing the full cost of service for electricity also consider scarcity of infrastructure resources (available capacity) to optimize resource allocation in the electricity system.

Several crucial elements must work in unison for a successful reform toward a cost-reflective tariff regime. More specifically:

- A sound regulatory regime that is overseen by a capable and **independent regulator** is necessary to support the reform in terms of market structure and to ensure that the context in which the electricity utilities operate is a **fair playing field** for all parties. Strong institutions safeguard the operation of the authority and ensure smooth implementation of policies.
- Vertical unbundling and corporatization have been shown to be conducive in increasing **transparency** as well as improving **governance** in the sector. Both transparency and governance are a required precondition to attract private capital, given that the transfer of risks involved to the private sector demands transparency and predictability which are both much harder to attain with a vertically integrated monopoly.<sup>22</sup>
- The electricity **pricing method should be applied meticulously**, meaning that the true costs are identified and recorded throughout the electricity supply chain (including negative environmental externalities) and the respective revenues are accurately and transparently apportioned to each of the supply chain links.
- The design and implementation of cost-reflective pricing should be facilitated by 'appropriate' **consumer response**. Studies have shown that taking into consideration the cognitive biases and psychological factors of economic agents during the design phase of tariff reform and properly communicating the objective of the reform will increase the likelihood of successfully implementing the reform.<sup>29</sup> Therefore, a crucial element in any reform is to communicate the upcoming tariff changes, the foreseen implications, and mitigation measures that are to be employed to address important negative externalities.
- Subsidies and cross-subsidies should preferably be eliminated. Subsidies distort both the production and consumption of electricity and divert resources from their optimal use. The same applies to taxation policy on energy and how this should be treated in a way that does not hamper growth. Policy makers should address groups that are severely affected by reforming the tariff regime — most often than not the low-income groups — and implement an independent external mechanism for compensation. To address affordability concerns, targeted measures, such as individual meter installations, prepaid metering to eliminate disconnection and reconnection charges, etc., should be implemented to support vulnerable groups.

Tariff reforms and the transition to cost-reflectivity may not progress as expected and initially planned. There are examples of countries that achieved important milestones of cost recovery, but made steps backwards due to conditions that could not be controlled by the utilities, such as droughts in Sub-Saharan Africa, inflation in India, exchange rate devaluations in Indonesia, and unpredictable changes in the available energy imports from neighboring countries in Botswana.<sup>17</sup>

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<sup>29</sup> Hobman, E. V. et al. "Uptake and usage of cost-reflective electricity pricing."



The external environment is always fluid and thus rapid reaction might be required at times as witnessed in the European Union (EU) in October 2021 with extreme post COVID-19 energy price hikes.<sup>30</sup> This does not however, change the EU's foundational principle and practice of pricing energy at cost-reflective levels.

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<sup>30</sup> "Communication from the Commission to The European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions." EUR-Lex. October 2021. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0660&from=EN>

## 6. Final remarks

There is a strong link between electricity prices and growth/sustainability of the power sector. This is a complex relationship based on multiple factors. The benefits of the transition to cost-reflective pricing are long-term. Addressing how to migrate from a non-cost-reflective level to cost reflectivity requires a detailed strategy that considers the challenges ahead.

The strategy should balance plausibility based on context (such as the current structure of the economy, socioeconomic implications, sector investment needs and the need to attract private capital, capacity to design and implement mitigation mechanisms and measures) vis a vis economic rationale, with cost reflectivity always being the ultimate target.

The development and application of cost-reflective tariffs, based on sound economic principles, is of crucial importance for ensuring that appropriate signals and incentives are in place for attracting necessary investments in the electricity sector, as well as for safeguarding the financial viability of energy utilities and the whole sector.

The migration to cost-reflective prices is challenging, demanding detailed planning and sound execution to mitigate negative impacts and communicate the benefits, ultimately creating an attractive backdrop for private capital investments. Migration needs to be gradual to inform participants and investors in a timely manner and to minimize the risk of stranded assets.

This primer highlights the important role electricity has on economic development and its status as a commodity with respect to special regulatory needs. Pricing electricity can be complex, but the main principles are few and simple. So are the main alternative pricing approaches, which are used when determining electricity tariffs that recover all the incurred costs of the regulated activities, thus sending the right economic signals.

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