

The Impacts of Deregulation of the Electricity Markets: A Comparative Study of International and Local Case Studies

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Abstract—The Energy sector plays a crucial role in promoting economic development and sustainability, and energy reforms are vital for achieving a sustainable economic growth. Within the energy sector, the electricity sector holds significant importance, and reforms in this sector can have considerable impacts on the broader economy of a country. This research paper aims to evaluate the impact of energy reforms on the electricity sector, specifically focusing on policies that promote competition, innovation, and technological advancements. Through a comparative analysis of international and local case studies from the USA, Ethiopia, Nigeria, India, Singapore, and Sri Lanka, this paper assesses the micro and macroeconomic effects of energy reforms on power pricing, power markets, electricity accessibility, innovation, and competitiveness. The historical development of state-owned electricity monopolies and their impact on competition, innovation, technological advancements, pricing, and service quality in the electricity sector is also examined. Furthermore, the study analyzes the role of government oversight and regulations in managing state-owned monopolies to ensure fair market practices. This research paper contributes to a more nuanced understanding of the complex relationship between state ownership and market competition in the energy sector. The findings of this study can inform policymakers and stakeholders in Sri Lanka and other developing countries on the potential benefits and drawbacks of expanding state-owned electricity monopolies in the context of ongoing energy sector reforms. Overall, this study provides insights for designing and implementing effective energy policies that promote sustainable economic growth and development.

Index Terms—Deregulation, Energy economy, power sector, policies, monopolistic structure

I. INTRODUCTION

The electricity and energy sector is composed of three primary functions: power production, transmission, and distribution. Historically, these tasks were overseen by a single, typically government-run, entity. However, the monopolistic nature of such firms has been criticized for hindering the price of electricity, service quality, and competition due to

limited provider options for customers [1]. In response to this issue, several countries have implemented government control and oversight of their electricity sectors, resulting in vertically integrated utilities that manage energy from production to delivery. Furthermore, regulations have been enacted to promote competition, ensure adherence to standards, and involve various stakeholders, with the aim of improving the energy sector and providing greater opportunities for private businesses to participate, potentially boosting the economy.

Conversely, deregulation seeks to reduce government supervision and control by eliminating or significantly altering state-level policies within the sector [2]. In recent decades, national and regional governments have implemented deregulation to lower energy prices, increase competitiveness, and address regulatory challenges.

The effects of deregulation on the energy sector have been extensively debated, with various studies yielding mixed results. Supporters of deregulation argue that it has opened up new opportunities for potential investors, increased competition, and made energy more affordable [3]. However, opponents of deregulation have raised concerns about the lack of compensation for utilities and business operations carried out during the regulatory period [4]. For example, some firms invested heavily in nuclear power facilities and long-term contracts in the oil, coal, and utility sectors, assuming that their investments were secure under the existing rules. Following the implementation of deregulation, these investors became apprehensive about the potential risks to their assets.

According to Rudnick [5], differences in international energy rates have prompted some regions to initiate the process of deregulating the electricity sector to compete with more reasonable prices and attract investments. Regulations have resulted in varying average energy rates in the United States, with prices in the Northeast exceeding 50% of the national

average, while rates in the Midwest and Northwest are significantly lower [6]. Technological advancements have also facilitated the liberalization of the energy sector, eliminating the advantages typically associated with large monopolistic providers and creating opportunities for smaller firms to compete. Various players, including government agencies, the private sector, market regulators, and customers, play crucial roles in regulating the industry for the benefit of all [7].

A. The role of technology in the energy industry's deregulation initiatives.

The energy industry has utilized technology as a crucial element in implementing deregulation initiatives and has been successful in defending its markets through various tactics. One of these tactics is the implementation of adaptable computer systems, which has led to lower operational and energy costs, improved tailored invoicing systems, and real-time electric power rates [7]. Reforms in the electricity industry have been brought about using various methods, including privatization, innovation, market regulatory reorganization, and energy rates. Most developed countries have adopted market-oriented changes since the 1990s, which have become case studies for other countries to adapt to their specific situations [8]. Market regulations have become the most widely used method worldwide, with many developing nations adopting quasi-monitoring systems to guarantee service excellence. The Independent Power Project (IPP) has become popular due to privatization, accounting for more than 40% of energy output in most nations [10]. Although privatization of electricity distribution has become more difficult for both established and emerging economies, privatized firms have high levels of efficiency and are managed through transparent financial reporting, meritocratic self-selection, and modern IT systems, which are monitored by more efficient public utilities [11]. The concept of governance has been central to political science, political geography, and public policy, with governance being defined as a continuous pattern of social relations between agents involving deliberate contact and efforts to order these interactions [9].

B. The importance of governance norms and policies for renewable energy and sustainable development.

Restructuring the energy sector is a common phenomenon worldwide, with various strategies being employed. While some countries, such as India, rely on state-owned, vertically integrated power utilities that monopolize the electricity market [10], others adopt both vertical and horizontal methods, with different firms generating and supplying power or implementing wholesale power markets to enable energy generators to offer their services to a wider variety of customers. Some nations utilize competition as a reform approach, resulting in more effective resource distribution and greater investment. However, providing improved incentives is essential to encourage new capacity investment in these countries [11]. Nonetheless, due to the structural, financial, and regulatory preconditions required in the energy sector, several nations

require assistance in implementing these changes.

Reforms in the power sector have proven beneficial for many countries, resulting in lower energy tariffs and increased private investment. However, governance norms play a crucial role in the energy industry's restructuring process. Such changes have significant impacts on various aspects of the energy sector, with differing political dynamics and significant differences at the national and regional levels. Renewable energy assistance policies have become critical for managing environmental issues while supplementing energy matrices in the growth and sustainability business. Sustainable development plays a crucial role in addressing social, economic, and environmental problems affecting human and natural systems, laying the foundation for effective human development.

This research paper aims to explore the impact of expanding State-owned electricity monopolies on the deregulation of electricity markets. The study will use a comparative approach to analyze case studies from both international and local contexts. The research will draw on a variety of sources, including academic literature, industry reports, and government documents.

The paper will begin with a review of the relevant literature on electricity market deregulation and State-owned electricity monopolies. This will be followed by a discussion of the methodology used to select and analyze case studies for the study. The main body of the paper will present the findings of the comparative analysis, which will explore the effects of expanding State-owned electricity monopolies on competition, prices, and innovation in the electricity market.

Finally, the paper will conclude with a summary of the main findings and their implications for policymakers and industry stakeholders. The research presented in this paper will provide valuable insights into the complex relationship between State-owned electricity monopolies and electricity market deregulation and will contribute to a deeper understanding of the challenges and opportunities faced by the electricity industry today.

II. CURRENT NATURE OF SOEES IN THE WORLD

The subcategory of State Owned Enterprises (SOEs) known as State Owned Energy Enterprises (SOEEs) is the focus of this discussion. SOEEs possess a unique infrastructure and are typically associated with the central government of a country. As such, they have their own marketing strategies, policies based on state law, and are subject to regulation by government-appointed authorities. Policy-making for SOEEs is heavily influenced by the government and related authorities, as SOEEs contribute a significant amount to national capital. In countries such as China, the proportion of national capital in the energy industry is often above 90%, and even up to 99% in certain industries. As such, the government plays a crucial role in authorizing policies and regulating SOEEs.

SOEEs are considered "Community Units" and policies must consider social welfare, social security, and social management. Such policies are often based on legal systems in various countries, and must also address issues such as market

failures, social objectives, and financial stability. However, after economic reform, most social burdens of SOEs are removed, allowing them to focus on the goal of profit-making. It is essential to ensure that the financial infrastructure of SOEs remains stable to prevent damage to public interests. Policies must clearly distinguish between the interests of executives and public interests. SOEs often integrate various products, and their interactions with other SOEs must be examined thoroughly. While SOEs are subject to the same laws and regulations as private companies, additional regulations exist to ensure transparency, accountability, and efficiency in their operations. Countries have their own mechanisms to regulate SOEs, and governance strategies are necessary to ensure healthy competition among similar SOEs [12].

SOEs have a significant impact on ecological systems, such as greenhouse gas emissions and abrupt climate changes. Governments must improve environmental protection laws and regulations in the energy sector to reduce negative externalities resulting from energy exploration, production, and consumption. Regulations governing SOEs vary greatly throughout the world and are influenced by factors such as the level of government involvement in the economy, political and legal systems, and government aims and objectives. The board of directors of SOEs plays a vital role in enhancing the organization's constitution, knowledge, management, and evaluation. State authorities are responsible for appointing professional executives with various stakeholders.

Energy market deregulation is a complex process that can have a significant impact on a country's energy sector. One of the advantages of deregulation is that it can create a more competitive market, which can lead to lower prices and increased efficiency. Additionally, deregulation has encouraged the development of new business models, such as renewable energy companies that sell electricity directly to consumers, bypassing traditional utilities [13], [14].

However, energy market deregulation also has potential drawbacks. One of the most significant risks is the possibility of market failure, which can occur when competition is insufficient to prevent prices from rising above fair market value. This can be especially problematic in markets with high barriers to entry, such as the oil and gas industry, where a small number of large companies may dominate the market. Furthermore, deregulation can result in price volatility, which can be difficult for consumers to manage. [15].

Another potential drawback of energy market deregulation is the loss of regulatory protections. For example, in countries where energy is considered a basic human right, such as many European nations, the government may have a responsibility to ensure universal access to energy. Deregulation can make it more difficult for governments to fulfill this obligation, as private companies may be less willing to invest in infrastructure in low-income or rural areas. Additionally, deregulation can weaken environmental protections, as companies may prioritize profit over sustainability.

A. Deregulation of the Electricity Market in the USA: Benefits and Impacts.

Deregulation of State-Owned Energy Enterprises paves the way for more competition, job creation, increased investment, improved access to energy and better consumer service. With the aforementioned intentions, the deregulation of the electricity market in the US started in the 1990s. This section aims to summarize the key events and trends relating to the deregulation of USA electricity sector and analyze the impact it had had on the stakeholders [15].

1978: The Public Utilities Regulatory Policies Act (PURPA) is approved, fostering competition in the electric sector and encouraging the development of alternative energy sources. 1992: the Energy Policy Act created the Federal Energy Regulatory Commission (FERC), and it was given regulatory authority over the wholesale electricity market [15]. Mid-1990s: a number of states start to liberalize their electrical markets, allowing consumers to pick their own provider and fostering competition between them. 1996: In order to foster competition in the wholesale energy market, the Federal Energy Regulatory Commission adopts Order No. 888, requiring utilities to grant open access to their transmission lines. 1997-1998: Several states pass legislation to restructure their electricity markets, separating the generation, transmission, and distribution functions of utilities. This allows for more competition in the generation sector, while transmission and distribution remain regulated. 1999-2000: Some states, including California, experience price spikes and shortages in their electricity markets, leading to concerns about the reliability of deregulated markets. 2005: The Energy Policy Act of 2005, which encourages the use of cutting-edge technologies in the electric industry and offers incentives for the development of renewable energy, is passed. 2020: Many states continue to operate in a deregulated market structure, with varying degrees of success and challenges. Some states have reversed course on deregulation, while others continue to move forward with market-based reforms [16].

There are several potential benefits to deregulating the electricity sector in the USA, as well as negative impacts. First, the benefits. Increased Competition: Deregulation can promote competition among electricity providers, which can lead to lower prices for consumers and greater innovation in the industry. In a competitive market, providers are incentivized to offer better services and lower prices to attract customers. Choice for Consumers: Deregulation can give consumers more choices when it comes to their electricity provider. Consumers can choose from a range of providers offering different rates and services, allowing them to find the provider that best meets their needs. Increased Efficiency: Deregulation can also promote efficiency in the electricity sector by allowing providers to focus on their core competencies. Providers can specialize in generation, transmission, or distribution, which can lead to greater efficiency in each sector. Economic Benefits: Deregulation can also have positive economic impacts by promoting job growth and encouraging investment in new

technologies. For example, deregulation can lead to increased investment in renewable energy and other innovative technologies. Innovation: Deregulation can also promote innovation in the electricity sector by encouraging providers to develop new technologies and services that can improve efficiency and reduce costs. Reduced Government Intervention: Deregulation can also reduce the need for government intervention in the electricity sector, which can lead to a more efficient and market-driven industry [17].

Although deregulation of the energy market in the USA was able to achieve some of the targets mentioned previously in some states, there have been a number of unfavorable effects as well. Such as: Higher Prices: In some states, deregulation has led to higher electricity prices for consumers, particularly during times of peak demand. This is due to the volatility of the wholesale electricity market and the lack of price controls. Lack of Investment in Infrastructure: Deregulation can also lead to a lack of investment in the transmission and distribution infrastructure, as utilities focus on maximizing profits rather than investing in long-term infrastructure improvements. Reliability issues: Deregulation may make it more difficult for electrical suppliers to maintain and upgrade their infrastructure and equipment, which can lead to dependability problems. Blackouts and other power outages may result from this. Market Manipulation: Deregulation can create opportunities for market manipulation by electricity providers and traders, leading to price spikes and other market distortions. Environmental Concerns: Deregulation can also lead to an increase in carbon emissions and other environmental impacts, as electricity providers may prioritize profitability over environmental stewardship. Consumer Confusion: Deregulation can create confusion for consumers, who may be unsure about how to navigate the complex electricity market and choose the best provider for their needs [16], [17].

The negative consequences of electricity deregulation in the USA highlight the importance of carefully balancing the benefits of competition with the need for strong regulatory oversight and investment in infrastructure and environmental protection. The introduction of electricity deregulation varied by state but typically involved the creation of new regulatory frameworks to oversee the competitive market. This often involved the separation of generation, transmission, and distribution functions, the creation of independent system operators to manage the grid, and the establishment of market rules and pricing mechanisms to facilitate competition among suppliers.

Several states in the USA have successfully deregulated their electricity sectors (figure 1). Some of the states where deregulation of electricity has been successful include:

Texas: Texas is often cited as a successful example of electricity deregulation. Since deregulation in 2002, the state has seen increased competition and lower prices for consumers.

Pennsylvania: Pennsylvania's deregulation of its electricity market in the late 1990s has led to increased competition and lower prices for consumers.

Illinois: Illinois deregulated its electricity market in the late 1990s and has seen increased competition and lower prices

for consumers as a result.

New York: New York has also successfully deregulated its electricity market [18], which has led to increased competition and lower prices for consumers.

Ohio: Ohio has seen success with the deregulation of its electricity market, with increased competition and lower prices for consumers.

New Jersey: New Jersey deregulated its electricity market in the late 1990s and has seen increased competition and lower prices for consumers.

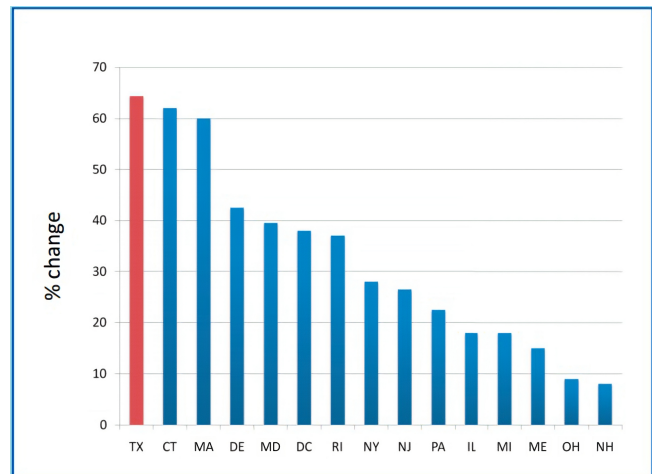


Fig. 1. Retail prices in regulated and deregulated states [16]

In contrast, several states in the USA have attempted to deregulate their electricity sectors, but not all of them have been successful. Some of the states where deregulation of electricity has failed include:

California: California's deregulation of electricity in the early 2000s led to a series of rolling blackouts and price spikes, which ultimately forced the state to re-regulate the industry in 2001.

Maryland: Maryland's attempt to deregulate its electricity market in the late 1990s failed to attract new competitors and ultimately led to higher prices for consumers. Montana attempted to deregulate its electricity sector in the late 1990s, but the effort was abandoned after the state's largest utility decided not to participate in the new market.

Nevada: Nevada's attempt to deregulate its electricity market in the early 2000s was abandoned after it failed to attract new competitors and led to higher prices for consumers.

Oklahoma: Oklahoma's attempt to deregulate its electricity market in the late 1990s was abandoned after a lack of interest from out-of-state providers and concerns about the impact on rural areas.

Texas: While Texas is often cited as a successful example of electricity deregulation, some critics argue that the state's deregulation efforts have not delivered on their promise of lower prices and increased competition. To further uncover the reasons for failure or success of electricity deregulation, the following two states are analyzed. California a state which is considered to have a failed deregulation and New York where

the deregulation is considered to be yielding the results desired [18].

The electricity deregulation in California failed in the early 2000s due to a combination of factors: **Market Manipulation:** Some energy companies, including Enron, engaged in market manipulation and price gouging during the early years of deregulation, which led to skyrocketing prices and rolling blackouts. **Inadequate Regulation:** California's electricity market was not properly regulated, which allowed energy companies to manipulate prices and engage in other anti-competitive practices. **Underestimation of Demand:** When California began deregulating its electricity market in the late 1990s, it underestimated the demand for electricity and did not have enough power plants or transmission lines to meet the needs of consumers. **Dependence on Spot Market:** California's electricity market relied heavily on the spot market, which is subject to price fluctuations and can lead to instability in the market. **Lack of Long-Term Contracts:** California did not have enough long-term contracts with power providers, which made it difficult to ensure a stable supply of electricity at predictable prices. **Political Pressure:** The deregulation efforts in California were driven in part by political pressure to lower electricity prices, rather than a careful consideration of the potential risks and benefits of deregulation [16], [17], [18].



Fig. 2. Residential Electric Price Increase, 1999 - 2007 Deregulated States with Retail Choice [16]

Electricity deregulation in New York was successful due to several key factors: **Strong Regulatory Oversight:** New York established a strong regulatory framework for its deregulated electricity market, which included oversight from the New York State Public Service Commission (PSC). This helped to prevent market manipulation and other anti-competitive practices. **Retail Choice:** New York's deregulated electricity market allowed consumers to choose their electricity supplier, which increased competition among energy companies and led to lower prices for consumers [19]. **Support for Renewable Energy:** New York's deregulated market supported the development of renewable energy, which helped to reduce greenhouse gas emissions and create new jobs in the state's clean energy sector. **Regional Coordination:** New York's electricity market is part of a larger regional grid, which allows for greater coordination between different states and ensures a more stable supply of electricity. **Long-Term Contracts:** New

York's deregulated market allowed for long-term contracts between power providers and electricity buyers, which provided stability and predictability for both parties. **Careful Planning and Implementation:** New York's deregulation efforts were carefully planned and implemented, with a focus on protecting consumers and ensuring a competitive market. Overall, the deregulation of the US energy market has been a difficult and continuous process involving a wide range of parties and variables. Concerns regarding dependability, environmental effects, and market manipulation have been balanced against the objective of fostering competition and lowering prices for customers [18], [19], [20].

B. Deregulation and Privatization in the Power Sector of India: Implementation, Impact, and Challenges

The Indian government started a number of reforms in the early 1990s to open up the energy industry to private actors and encourage competition. Deregulation, privatization, and liberalisation of the power industry were among the changes implemented. As part of this process, the government passed the power Act of 2003, which provided a legislative foundation for corporate involvement in the power business as well as an autonomous authority. Major steps in reforming actions have been taken place in India by the Government of India focused on deregulation will be analyzed in this study.

Most of the states began unbundling respective state Electricity suppliers. Together with that, tariff rationalization and corporatization of generation, transmission, and distribution sectors. Though it was implemented, the expected outcomes were not up to that standard unless the urban areas are affected by privatization at a minor stage [21]. Lack of positive expectations led Government of India to establish Central Electrical Regulatory Commission (CERC) together with State Electrical Regulatory Commission (SERC) in 19 states under the Electricity Regulatory Commissions Act, 1998. These institutions are accountable for the regulation of tariffs, advising the Central Government, Issuing licenses for any person for maintenance of the Inter-State transmission system etc.

Restructuring of the power sector happens under two standard models globally. They are Independent System Operator (ISO) and Transmission System Operator (TSO). Chadha and Lentil suggest a deregulated system based on ISO model [21]. Some states in India have implemented the restructuring systems based on different models in means of deregulation.

Orissa State: Orissa Hydro Power Corporation, Orissa Power Generation Corporation and Grid Corporation of Orissa owned the State Electricity Board in some time after the Electricity Reform Act (1996). It was the first SOE set to unbundling among all the states in India and Das, Nayak states that unbundling process was accelerated due to limited rural electrification along with an abundant supply of coal and hydro power sources [22]. Later Generation was privatized in 1998.

Delhi State: Being an urban area, Delhi was subjected to privatization in contrast to the other states. The Congress Government introduced the structural reform to offer customers a

quality service and a political advantage to the government in return [23]. Unfortunately, the consequences did not go as well as expected. Unaffordable tariffs and power costs led people into protests, breaking the bond between politics and electricity.

Gujarat State: Gujarat has been following a different approach unlike other states since the 1990s. State was able to maintain a healthy tariff with fewer liability. It had gone through a sequence of competitive elections till 1998[24]. Establishing a regulator parallel with unbundling has made their model so remarkable among other reforms. As Sareen mentioned the state's overall economic performance, an efficient regulatory commission that could challenge the claimed AT&C loss figures. Additionally, Gujarat is also a key supplier in Renewable Energy capacity.

Though SEB has been implementing deregulation operations in various contexts, some drawbacks are observed. As a result of a lack of standardization and coordination, which may cause an unstable supply of electricity. Competition among the multiple competitors causes for such cases. For instance, a survey shows 45% of customers were unsatisfied about their electricity supply due to voltage fluctuations and other technical malfunctions [21], [23]. More competition and lower prices are two benefits of deregulation, but inequality is another. Private businesses could put their own financial interests ahead of everyone else's access to inexpensive power, which might result in higher costs for low-income people. Comparing the Delhi and Gujarat scenario gives a perfect example. Deregulation can also result in a lack of supervision and regulation, which can open the door for fraud and abuse. Consumer interests may not always come first for private enterprises, and without enough regulation and inspection. As a critical review explains the reform initiatives implemented so far proves to be not effective enough in ensuring operational efficiency of the Indian power utilities, and needs new policies and regulatory interventions [24]. Power sector of India has been deregulated in different aspects using conceptual models and implementations that show positive initiatives as well as some flaws in the system.

The rise in private investment in the energy industry has been one of the most important effects of liberalisation and privatisation. Private companies have introduced new technology, increased efficiency, and increased rivalry, resulting in higher service quality and lower costs for customers. Private players' entry has also reduced the government's financial load, as private players are now investing in new electricity facilities and infrastructure. The shift to a more market-oriented energy industry, however, has not been without difficulties. Concerns about monopolies and anti-competitive practises have arisen as a result of the fast expansion of private actors. There have also been problems with electricity pricing, with private players frequently charging customers higher rates.

Furthermore, privatisation and deregulation of the energy sector have not resulted in a substantial rise in electricity supply throughout the nation. Many rural regions continue to have insufficient access to power, and there have been worries

that the emphasis on urban electrification has come at the cost of rural electrification. While the reforms have resulted in some positive changes, much more work remains to be done to ensure that the energy sector can satisfy the requirements of all Indians in a sustainable and equitable way.

C. The Renewable Energy Potential and Power Sector Reforms in Ethiopia.

Ethiopia is a promising African nation for renewable energy development, with vast potential in solar, wind, hydroelectric, geothermal, and bioenergy. Its waterways alone could generate over 45,000 MW, while wind power and geothermal resources have potentials of up to 1,350 GW and 10,000 MW, respectively. Ethiopia also has significant solar energy potential, with an average daily irradiance of 5.5 kWh/m²/day due to its proximity to the equator [25].

However, the technical and financial challenges in the electricity industry in developing countries have led to power sector reforms. In Ethiopia, inadequate generation and high transmission and distribution losses (23%) have resulted in rotational load shedding, interruptions, and poor power quality, which hinder manufacturing growth and access to electricity [25], [26], [27]. To address these issues, the Ethiopian

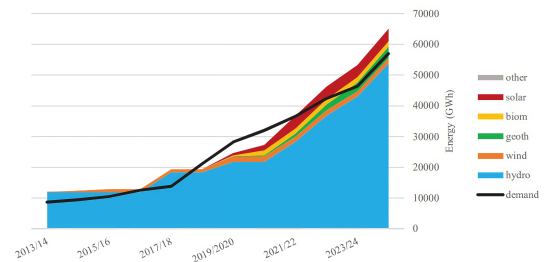


Fig. 3. Energy production and demand in Ethiopia [26]

government restructured the fully state-owned and vertically-integrated Ethiopian Electric Power Corporation (EEPCo) into two separate public enterprises in 2013: Ethiopian Electric Power (EEP), which focuses on generation, transmission, and wholesale of electricity, and Ethiopian Electric Utility (EEU), which is responsible for power distribution, sales, and customer services. The Ethiopian Energy Authority (EEA) was also established as the sector regulator. In 2017, the government launched the National Electrification Program (NEP) to provide universal access to electricity throughout the country by 2025. The NEP aims to connect 4.5 million households by 2022 through short LV service drops and metering, while the other 5.4 million households will be connected by 2025 through extending medium and high voltage lines. The remaining 5.7 million households will receive off-grid systems [27], primarily through stand-alone solar systems and mini/micro-grid network connections provided by the private sector. By 2025, the NEP aims for 65% grid connection and 35% off-grid supply. Private sector involvement, including independent power producers (IPPs), is critical to scaling up electricity supply in Ethiopia. The government has recognized

the importance of private sector engagement in power generation to meet investment and energy policies and ensure infrastructure sustainability.

To encourage private sector investment, the Government of Ethiopia (GoE) has begun to liberalize the energy sector and passed a Public-Private Partnership proclamation in 2018. However, the energy tariff remains a challenge for international investors and private power companies. The average flat rate tariff for electricity in Ethiopia is around 3 US cents per kilowatt hour, which was last revised in 2006 [15]. The low cost of electricity from hydropower and the government's commitment to funding the power sector have contributed to the lowest domestic tariff rate in Africa [28]. Although the generation cost from hydropower is about 9 US cents per kilowatt hour, the government provides a significant subsidy for electricity use in Ethiopia [29].

Despite significant reforms in Ethiopia's electricity sector, ongoing improvements are necessary to support the country's expanding economy and population. While the changes have resulted in an increase in energy production from 850 MW to 4,233 MW in a decade [30], the challenges of meeting rapidly increasing demand, potential issues with energy pricing, and concerns about the adequacy of reforms to support regional interconnection and power sector growth remain.

D. The Power Sector Reforms in Nigeria

In 2009, the Nigerian government created the Vision 20:2020 plan to transform Nigeria into one of the top 20 economies globally by 2020. The plan's goal was to make Nigeria a wealthy and internationally competitive country with a high standard of living for its people, which was to be achieved by implementing economic, social, and political changes, as well as investing in critical areas such as infrastructure, education, and health. To attain this objective, Nigeria needs to raise its per capita power capacity to 1000 W from the current average of 25 W, which requires significant investment in the power sector. Nigeria's per capita power capacity is far below that of the United States, which has the highest per capita power capacity of 2187.5 W [31].

Nigeria's electricity provision began in 1896 with two 60 W generating sets. Over time, various restructurings and reforms occurred to enhance the electricity supply. In 1999, the power sector began to unbundle, leading to the formation of the Power Holding Company of Nigeria (PHCN) and the implementation of the Electricity Act Cap 106, contained in the country's constitution [31], [32]. However, the period was characterized by poor power delivery, deteriorating power infrastructure, fixed electrical tariffs, inadequate investment in grid expansion, high levels of power theft, reduced economic activities, and various forms of corruption.

To address the shortcomings of the power sector, the National Integrated Power Project (NIPP) and Independent Power Project (IPP) were launched in 2004 to improve power generation in Nigeria. The Electric Power Sector Reform Act (EPSRA) of 2005, formulated through the National Electric Power Policy (NEPP), is considered the foundation for power

reforms in Nigeria. Its primary goal was to enhance power delivery in Nigeria. EPSRA introduced the unbundling of the National Electric Power Authority (NEPA) into six generating stations, one transmission company, and eleven distribution companies. Furthermore, the privatization of the generating

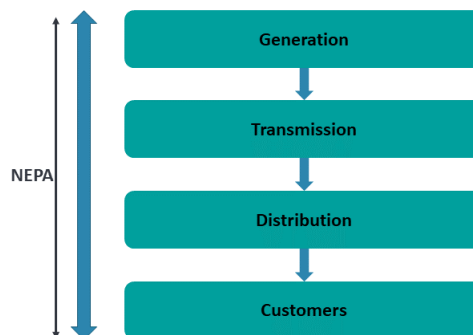


Fig. 4. Bundled power sector format in Nigeria

sector was fully implemented in 2008, while the Multi-Year Tariff Order (MYTO) was established in 2012 to allocate loads to distribution companies based on their capacity and transmission constraints. The Nigerian Electricity Regulatory Commission (NERC) plays a significant role in regulating the electricity industry in Nigeria by issuing licenses, ensuring compliance with market rules, and enacting pricing regulations to encourage competition.

Despite the unbundling and privatization of the power

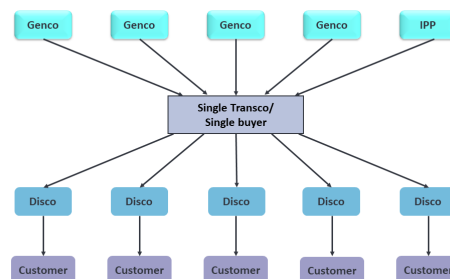


Fig. 5. Unbundled power sector format after deregulation in Nigeria

sector in Nigeria, there has not been a significant improvement in power generation proportional to the population increase. Over 60% of the population remains unconnected to the grid, indicating the need for more effective policies to bridge the gap between demand and supply. The power system structure after unbundling comprises Gencos, TCN, and Discos, as shown in Fig. 5. The generation, transmission, and distribution segments of the power sector need to be repositioned to attract more private investment, improve power availability, and promote healthy competition in the sector. Nigeria's power sector has experienced several major changes, including privatization and deregulation of the electricity business, aimed at improving the efficiency and dependability of the electricity supply while also encouraging private-sector investment in the industry.

E. Deregulation of the Energy Market in Singapore

In Singapore, the energy sector was once a government-owned, vertically integrated monopoly conducted by the Public Utilities Board (PUB). However, in a gradual process to ensure energy security and limit disruption, the electricity market was deregulated. The retail sector was initially kept under a single organization due to the economies of scale that could be obtained in a relatively small market like Singapore. [36]

In 1995, the electricity and gas sector functions were transferred to a state-owned enterprise, Singapore Power group (SP), with the intention of introducing competition to the market. Operational components were separated into five subsidiaries of SP, including power generation in Tuas Power, Senoko Energy, and PowerSeraya, and transmission and distribution functions, which were undertaken by Power Grid, while retail operations were allocated to Power Supply. Regulatory functions were still held by the PUB until 2001.

Singapore established a wholesale energy market through the Singapore Electricity Pool (SEP) in 1998. Trading between the sole retailer, Power Supply, and generation companies was facilitated by PowerGrid Ltd, which was the sole owner of the grid and administered system operations. Generators had to submit price and quantity bids in half-hour intervals to the SEP pool. [35]

In 2001, a new statutory board, the Energy Market Authority (EMA), was formed. Public shares in the enterprises were divested, and more generation and retail companies entered the market. The Energy Market Company Pvt. Ltd (EMC) was established to manage the wholesale market. PowerGrid remained the sole grid owner under the regulation of EMA. At this point, consumers with a maximum power requirement greater than 2 MW were given the ability to choose the retailer, and Power Supply Ltd was assigned the Public Electricity Supplier (PES) and supplied regular customers.

The New Electricity Market of Singapore (NEMS) was created in 2003, employing the Security Constrained Economic Dispatch (SCED) method along with Locational Marginal Pricing (LMP), as used in many markets in the USA. The market is managed by the Power System Operator, while Market Support Services Licensee (MSSL) handles billing, meter reading, and customer service. Studies have shown that the increase in competition in both wholesale and retail markets, evaluated using the Herfindahl-Hirschman Index (HHI), has led to a decrease in electricity prices. However, concerns have been raised about excessive competition resulting in overcapacity and causing losses to companies. [35].

III. EVOLUTION OF SOES IN SRI LANKA

State-owned enterprises was first developed in Sri Lanka during the Second World War to mitigate the lack of essential goods that were imported. State-owned enterprises in the energy sector, such as Ceylon Electricity Board and Ceylon Petroleum Corporation were established in 1960s. Such State-owned enterprises were considered to be natural monopolies. They were envisioned to provide products and services sufficiently to the entirety of the local market demand with the

possibility of exporting the excess. Products and services were presumed to be supplied at a minimum cost as opposed to a profit-oriented private organization [37].

However, as time progressed many public enterprises started exhibiting issues. It was observed that SOEs were facing a poor financial state due to inefficiency. The decline in quality of products and services and shortages could be attributed to their monopolistic status. SOEs were also struggling with political interventions in recruitment resulting in over-hiring. Their excessive reliance in government funds for investments hinder their growth. It was noted that SOEs were becoming a burden to the government. Several public enterprises were sold off during 1989 - 1993 period [37], [38].

A. Current Status of Energy SOEs in Sri Lanka

Ceylon Electricity Board (CEB) was formed in 1969 as a vertically integrated monopolistic enterprise, with the sole control of electricity production, transmission, distribution as well as handling retail supply. Reforms implemented to the electricity sector in 1983 created a state-owned enterprise by the name of "Lanka Electricity Company" (LECO). LECO is designated urban areas around Colombo to distribute power. Since 1996, Independent Power Producers (IPP) and Small Power Producers (SPP) are granted the opportunity to participate in power generation.

The Public Utilities Commission of Sri Lanka (PUCSL) is the regulating authority of the power sector. Electricity sector employs a single-buyer model. CEB is separated into divisions and they hold power sector licenses for generation (comprising 66% of generating capacity), one transmission license (containing 100% of all transmission) and all of bulk supply and four distribution licenses (containing 90% of power customers). However, divisions are not established as independent entities with financial and management separation [38].

Sri Lanka is currently in economic crisis and nation has declared itself bankrupt. Ceylon Electricity Board that exerts an undue burden on the financial state of the country, is expected to be reformed in the near future.[39]

During the first quarter of 2019, the 55 largest state-owned enterprises in Sri Lanka recorded losses exceeding 59 billion rupees, presenting a considerable challenge to public engagement in these entities [37]. The Ceylon Electricity Board (CEB), in particular, experienced the most substantial loss of 23 billion rupees and has consistently reported significant losses in previous years, including 14.5 billion, 45.7 billion, and 25 billion rupees in 2016, 2017, and 2018, respectively [38].

It is proposed in [39], to reduce macro-fiscal risks, it is essential to implement significant reforms and divestment of state-owned enterprises (SOEs). Some major SOEs, including CEB, have experienced significant losses in 2022 due to various factors such as weak financial management, below-cost recovery pricing, operational inefficiencies, and valuation losses on foreign currency denominated liabilities. These losses amounted to 4.1% of GDP. Immediate measures are

necessary to restructure key SOEs, improve governance, enhance government oversight, and prepare some for divestment. The introduction of cost-reflective pricing for electricity and fuel is a positive first step to reduce losses. It is crucial to restructure the balance sheets of CEB for the success of Sri Lanka's macroeconomic stabilization program.

B. Turnaround of Sri Lanka Telecom (SLT) as a state-owned enterprise and the potential for SOE reforms.

Sri Lanka's telecommunications industry is highly regarded for its quality, reliability, and affordable prices. With mobile penetration over 135%, the country has some of the lowest charges for mobile and internet services in the region. Sri Lanka Telecom, a state-owned enterprise, has become a major player in the industry since its reconstitution as a limited liability company in 1996. The sale of 25% of its shares to Nippon Telegraph & Telephone Corporation for \$225 million in 1997 was a turning point for the company, and its successful listing on the Colombo Stock Exchange in 2003 further strengthened its position. As of 2020, the government holds a 49.50% stake in Sri Lanka Telecom, with Global Telecommunications Holdings N.V. holding 44.98%, and the remainder held by other shareholders. The company's dividends amounted to approximately Rs. 947 million in 2020 and are expected to reach Rs. 1.4 billion in 2022 and beyond [40], [41].

The success of Sri Lanka Telecom as a State-Owned Enterprise (SOE) shows the potential of SOEs and how timely reforms such as divestiture can help the economy. The establishment of an independent regulator, the Telecommunications Regulatory Commission of Sri Lanka, played a crucial role in creating a competitive regulatory environment [41]. According to [39] The government should consider selling or divesting more SOEs while addressing stakeholder concerns. To progress on its post-COVID-19 recovery journey, Sri Lanka must implement ongoing reforms related to mergers and consolidation, corporate governance, pricing mechanisms, strategic direction, and financial accountability. These reforms not only improve government revenue but also release resources for productive income generation or asset creation by households and enterprises.

SOEs are essential for economic development, but they must function efficiently without financially burdening the state. To accomplish this, the government should undertake feasibility studies and contemplate selling some assets to domestic or international organisations. They should also reorganise SOEs without politicising them in order to guarantee long-term viability. Although these changes may necessitate unpopular policy measures at first, they can eventually result in SOEs that are fiscally viable and helpful. It is critical for the success of SOEs and the facilitation of economic development to transform them from "fiscal burdens" to "value creators" [41].

SUMMARY

In most countries, the electricity sector was once controlled by a single entity, and the success or failure of deregulating this industry has been a topic of extensive debate. To achieve

successful deregulation, several parties such as government agencies, private sectors, market regulators, and customers must play significant roles. Key factors such as technological advancements, governing norms, and sustainable development are crucial for successful deregulation. State Owned Energy Enterprises (SOEEs) must also balance the demands of profit-making, social welfare, security, and management.

Deregulation can lead to more efficient and innovative systems with lower prices, but it may also result in high prices for consumers and a lack of social and environmental responsibility, particularly in markets with high barriers to entry. Moreover, it can confuse customers due to market complexity and price volatility. Private entities typically lack interest in improving long-term infrastructure.

Successful deregulation largely depends on a robust regulatory framework, proper risk assessments, and competition. Deregulation may not be suitable for all areas and their specific requirements.

India's private players investing in the energy market have relieved the government of financial burdens associated with investing in facilities and infrastructure, but access to electricity in rural areas has not significantly improved. Ethiopia has deregulated its electricity sector to increase accessibility and capacity, but challenges remain, including meeting increasing demand, pricing energy, and ensuring adequate reforms to support regional interconnection and power sector growth.

Despite Nigeria's unbundling and deregulation of the electricity sector, no significant improvement in power generation and grid expansion has been observed. However, Singapore has successfully implemented deregulation in several stages over the years.

In Sri Lanka, the CEB controls the majority of the electricity sector, which remains a monopolistic SOEE. Despite separating into divisions, it has not been established as an independent entity and suffers from over-hiring due to political motivations, improper management, and substantial losses and debt, becoming a burden on the government. On the other hand, SLT can be seen as a successful example of a SOE turnaround in Sri Lanka, where the competitive regulatory environment created in the telecommunications sector played a significant role in their success.

CONCLUSION

The issue of electricity deregulation is a complex and multifaceted one, with both pros and cons to consider. Supporters of deregulation argue that it can increase competition, spur efficiency and innovation, and reduce government intervention, while opponents argue that it can lead to higher prices, decreased reliability, inadequate regulation, increased complexity, and unequal access.

Ultimately, the success of electricity deregulation depends on the specific policies implemented, the conditions of the energy market, and the regulatory framework in place to protect consumers and ensure a fair and competitive market. While some states in the United States have successfully deregulated their electricity markets, others have faced challenges and

experienced negative consequences. It is important for policymakers to carefully consider the potential risks and benefits of electricity deregulation before implementing such policies and to ensure that appropriate regulations and safeguards are in place to protect consumers and promote a fair and competitive market.

In Sri Lanka, the viability of electricity deregulation depends on various factors, including the current state of the country's energy sector, the level of competition among energy providers, and the regulatory framework in place to protect consumers and ensure a fair and competitive market. Currently, the state-owned Ceylon Electricity Board (CEB) dominates Sri Lanka's electricity sector, generating and distributing most of the country's electricity. While some attempts have been made to introduce private sector participation in the energy sector, the CEB remains the primary player in the market.

For electricity deregulation to be viable in Sri Lanka, there would need to be a significant increase in the level of competition among energy providers, as well as a strong regulatory framework to protect consumers and ensure a fair and competitive market. The government would also need to invest in infrastructure and modernize the energy sector to attract private sector investment.

Overall, while electricity deregulation may be a viable option for Sri Lanka in the long term, it would require significant investment and regulatory reform to be successful.

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