

How to Regulate Energy: Corporate Governance and Energy Transition

Giovani Ribeiro Loss^{1,2}, Edmilson Moutinho dos Santos¹

¹Institute of Energy and Environment, University of São Paulo, São Paulo, Brazil

²Infrastructure and Energy Practice at Mattos Filho, São Paulo, Brazil

Email: giovani.loss@mattosfilho.com.br, edsantos@iee.usp.br

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Abstract

The objective of this study is to propose alternative structures for the regulation of electricity and, consequently, for the whole energy sector, taking into account new variables posed by the energy transition. This article is grounded mainly in scholarly literature from law and economics, corporate law, regulatory law and collective action theories, but places them in a new perspective with the support of ESG and energy transition literature. The main methodology adopted for this study was review and discussion of scholarly work. The results obtained indicate that the traditional models proposed to deal with electricity regulation are insufficient to address new challenges brought by energy transition, and propose a new, innovative model based on a shared-ownership structure. The study's implications are significant for policymakers, private agents and for governmental agents in the energy sector. The regulatory model proposed has implications for the relationship between the general public and the directions of energy policy and governance. This study contributes to the literature by proposing an innovative regulatory model, which was built upon previous studies in the fields of energy regulation, corporate governance and collective action.

Keywords

Energy Regulation, Shared-Ownership, Energy Transition, Corporate Governance

1. Introduction

The question on “Why regulate utilities?”, made by Demsetz in his influential 1968 article, was answered in different ways by several authors, but the discussion between those in favor of regulation and those in favor of deregulation of public utilities seems to find no end.

Although it is unquestionable that the regulation of public utilities, including electricity, forces governments to confront market failures such as externalities, destructive competition, monopolization and scarcity, some Professors, [Posner \(1974\)](#) for example, believe that market forces are strong enough and that no regulation results in more benefits than costs to society.

Who is right in this debate? Our answer brings a different point of view from what has been discussed over the years. In our understanding, the polemic question made by [Demsetz \(1968\)](#), almost 40 years ago, was and still is technically wrong.

Even though there are common characteristics shared among public utilities or energy sources, our understanding is that any general rule that aims to establish the intensity, extent and structure of the relation between government and public utilities or energy sources is inevitably wrong, particularly for not considering specific characteristics of each industry within the public utility and energy concept.

The players of the industry, the way the trades are made in the relevant market, the stage of evolution of the infrastructure involved and, in some circumstances, other subjective matters, like the jobs created by the industry to the society, are issues that must be considered in the definition of the relation between government and public utilities or energy sources.

In our point of view, if these factors are considered, the answer for an efficient regulatory model of public utilities and energy sources in big countries, such as the United States, would certainly involve diversified structures, i.e., different structures applying to the same public utility or energy source in different locations of the same country, state or municipality, resulting, nevertheless, in one efficient model of public utility regulation or energy regulation for the country in harmony with the analysis of the detailed case.

In this article, we emphasize the regulation of the electricity industry, as a starting point to a debate about the overall energy regulation (including all forms of energy, renewable or not). As discussed by [Joskow and Tirole \(2006\)](#), special physical characteristics of electricity and electric power networks lead to market failures that are unique to this market.

The energy transition brings new light to the electricity regulation discussion and to the overall energy regulation. As explained by [Andrews-Speed \(2015\)](#), energy transition needs government intervention, because it is costly and driven by the need to address the long-term public external cost of energy use rather than deliver a short-term private benefit. Markets by themselves will be unable to deliver the required behavioral changes in the time required.

Energy transition inserts the issue of climate change in the debate about electricity regulation, highlighting other unique market failures that this sector is subject to. Regulating climate and related activities essentially means managing the use of the atmosphere.

Traditionally, as explained by [Parenteau \(2023\)](#), the atmosphere has been con-

sidered a public good due to its non-rivalrous and non-excludable nature. However, it has recently been described as a common-pool resource (CPR), which is non-excludable but rivalrous, because climate scientists now recognize a limit to the amount of greenhouse gases (GHG) the atmosphere can tolerate. Consequently, when one actor emits GHG, it reduces the remaining available GHG capacity for others (Herber, 1991).

Regulating the use of both public goods and common-pool resources (CPRs) is highly challenging. Their non-excludability means that actors can benefit from their use or supply without contributing or incurring costs, leading to the free-rider problem where costs are externalized, and benefits are internalized.

Collective action theory, grounded in game theory, suggests that individual actors lack incentives to pay for public goods or control their provision and the use of CPRs. This often results, as indicated by Mancur (1965), in no cooperation or cooperation that leads to a sub-optimal Nash equilibrium under-provision of public goods and overuse of CPRs. This issue, known as the ‘tragedy of the commons’ or “Hardin’s dilemma”, after Hardin (1968), highlights the misalignment of interests, making the regulation of public goods and CPRs a central issue in modern economic theory (Mankiw, 2017).

Traditional collective action theory suggests that efficient cooperation between private actors in such scenarios requires either the establishment of well-defined property rights over the common resource, where, under certain conditions like low transaction costs, private actors could autonomously organize and achieve a Pareto-efficient allocation of these rights regardless of their initial distribution, as famously proposed by Coase (1960), or a centralized, “Leviathan-style” authority to coordinate the provision of public goods and the use of CPRs (Chow, 2012; Ostrom, 2009). Consequently, a significant body of literature has attributed the failures of climate action to the challenges posed by collective action theory (see Esty, 2008; Esty & Moffa, 2012; Paul, 2007; Pendergraft, 1998).

In other words, the emergence of climate issues and the need for energy transition are reshaping the discussions on electricity regulation and all other sources of energy away from self-regulation and private ordering acting alone and towards the need for governmental intervention to help spur the transition.

The issue to be raised, therefore, is not really why regulate electricity, but how to regulate it, i.e., what should be considered the most efficient way to the relation between government and energy industry, based on the inherent characteristics of the basic commodity or essential service involved, taking into account also the players, the market, the stage of evolution of the infra-structure, energy transition and, under specific circumstances, subjective matters.

If, in fact, as explained by Stigler in his classical 1971 article, there is a scheme of demand and supply of regulation, we must assume that in an optimal situation these demands and the power of the demanding groups should contrast, resulting in different types of supply, sometimes attending the demands and sometimes not, even within the same industry, but in different locations.

Downs (1957) and Peltzman (1989) agree somewhat with this understanding, as they explain that none of these demanding groups has exclusivity in the supply of regulation. Regulation of public utilities, including electricity, consequently, should not be considered homogeneous, but heterogeneous, responding to the necessity of the society, according to the imposition of the facts.

Under this perspective, discussions like “The case of electricity”, by Stigler & Friedland (1962), “Competitive Electricity Markets and Investment in New Generating Capacity”, by Joskow (2006), and many others, are extremely important to the extent they bring instruments to be used in the regulation of the electricity industry and the overall energy industry. However, there is no general regulatory solution to the market failures of the electricity or the energy sector.

Therefore, our proposal is to offer a new regulatory structure particularly interesting to discussions on the regulation of the energy sector, taking into account the energy transition. This structure, here named shared-ownership, could play an important role for government intervention, resulting in more benefits, than in costs to the society.

For the purposes of this article, “shared-ownership” refers to a corporate governance structure in which the state acts simultaneously as minority shareholder and regulator within strategic energy firms, most commonly in electricity utilities. Unlike state-owned enterprises (SOEs), where the state has controlling or majority ownership, or investor-owned utilities (IOUs), where ownership is primarily private, shared-ownership models deliberately balance private investment with public interest by granting the state a formal, though non-controlling, equity stake and governance role.

As explained in more details in Section 7, shared-ownership aims to combine the market efficiency of private ownership with the long-term policy alignment and accountability of public oversight, while avoiding the pitfalls of excessive political interference or underinvestment typical of other models.

Feature	IOUs	SOEs	Shared-Ownership
Ownership	Private Investors	State (majority or controlling stake)	Private Investors + State (minority stake)
Decision control	Board and shareholders	State officials	Board, including state officials
Regulatory Role	Regulator separate from the firm	State is the regulator and owner	State has the dual role of regulator and minority shareholder

Section 2 explains why electricity regulation is the basis for our discussion about energy regulation. Section 3 of this article clarifies the most important difficulties

in regulating the electricity market, including why the focus of these discussions should be reconsidered, and Section 4 addresses how the United States applies the structures of regulation to regulate its electricity market. Section 5 describes the rationale of the ownership of the firm in the electricity market and analyzes the cost of ownership in this market, including the incentives for equity or debt.

Section 6 discusses the allocation of decision power in electricity firms in face of residual claims and managerial incentives, considering the rate-of-return, the ownership structure and the sunk costs in public utilities and how it affects energy transition. Section 7 explains the basis for the shared-ownership structure and the effects of this structure on agency costs, ownership of the firm, cost of ownership, allocation of power and managerial behavior and, therefore, on energy transition.

Finally, in Section 8, this article concludes that the shared-ownership is a feasible alternative to energy regulation and that this structure should be applied during the next decades to support the development of this industry under the energy transition scenario.

2. Electricity Regulation vs Energy Regulation

Electricity regulation and energy regulation are related but distinct areas within the broader field of energy policy and law. While the focus of electricity regulation is specifically on the generation, transmission, distribution, and sale of electricity, energy regulation covers all forms of energy, not just electricity, including oil, gas, coal, nuclear, renewables, and fuels.

Therefore, electricity is one subset of energy regulation, with many statutes overlapping between the different forms of energy, for example, rules about carbon emissions affect both electricity generation and transportation fuels.

Within the United States energy regulation ecosystem, oil and gas regulation came first, with state-level rules emerging in the late 1800s, decades before formal electricity regulation was established at either the state or federal level. However, electricity is regulated more tightly due to its role as a natural monopoly (especially at the distribution level), with a stronger presence of public utility oversight.

The discussion about electricity regulation in the United States gave rise to a significant portion of modern regulatory theory in economics, especially in the context of natural monopolies, rate of return regulation, and public utility models.

While electricity markets and transmission are overseen by the Federal Energy Regulatory Commission (FERC), i.e., there is no single, unified federal agency that comprehensively regulates the entire oil and gas industry from wellhead to consumer. In the United States, oil and gas, coal, and mining industries are regulated primarily for safe and environmentally responsible extraction, rather than for on-going price or market-structure controls such as electricity.

Although the prevailing body of regulatory theory has developed primarily around the electricity industry, recent transformations reveal to us that oil and gas and electricity industries are increasingly interconnected (Hall & Shakya, 2019). This is even more realistic in context of other countries than the United States,

where oil and gas regulation is often centralized, similarly to electricity.

Traditionally, oil and electricity sectors have operated under separate regulatory frameworks, reflecting their distinct infrastructures, markets, and technologies. However, the global push toward decarbonization, the rise of electrification, and the emergence of cross-cutting technologies are breaking down these silos. Increasingly, regulators are being called upon to coordinate across sectors to ensure a coherent, efficient, and equitable energy transition.

Since both oil and electricity are major sources of greenhouse gas emissions, effective regulation must address their combined impact. Regulators must now collaborate to manage a coordinated reduction of emissions across both sectors, ensuring that efforts in one area do not inadvertently undermine progress in the other.

The electrification of traditionally oil-dominated sectors, especially transportation and heating, is a core strategy in many decarbonization plans. As electric vehicles (EVs) and heat pumps replace gasoline cars and oil furnaces, the electricity system must expand and modernize. This transition requires synchronized regulation, where oil regulators manage declining fuel demand and associated infrastructure, while electricity regulators plan for new load profiles and system resilience.

Infrastructure convergence is another driver of integration. New energy systems, such as EV charging networks, hydrogen production, and energy storage, often span both oil and electricity domains. For example, green hydrogen can be used in transportation and industry, displacing oil-based fuels while relying on clean electricity for production. Coordinated regulation is required to manage interconnected infrastructure development, investment incentives, and safety standards.

Tools like carbon pricing, fuel taxes, and renewable energy subsidies now impact both sectors. Poor alignment between oil and electricity regulation can lead to market distortions or policy inefficiencies, such as double-counting emissions or favoring one sector over the other. As these tools become more prevalent, regulators must work together to harmonize market signals and ensure a level playing field.

The energy transition must maintain a reliable supply of energy while changing its underlying sources. For sectors that cannot be easily electrified, such as aviation or heavy-duty transport, oil regulation must adapt without creating vulnerabilities. Simultaneously, the electric grid must remain stable as variable renewable sources increase. Co-regulation helps balance system-wide energy security.

The shift away from oil and toward electricity may disproportionately affect certain communities, such as oil industry workers or low-income households facing higher energy costs. Coordinated regulation can ensure a just transition, where tariff structures, subsidy reforms, and retraining programs are aligned to support social equity.

As the energy landscape continues to evolve, energy regulatory frameworks are

becoming more integrated, collaborative, and forward-looking. Failing to do so risks inefficiencies, policy conflicts, and missed opportunities in the journey toward a sustainable and secure energy future.

That's why discussions about the effects of energy transition over electricity regulation are the basis in this article for a broader discussion on the impacts over the overall energy regulation.

3. Regulating the Electricity Industry

What is difficult about regulating the electricity industry? For many decades the answer to this question has been focused on the problem of natural monopoly versus competitive prices.

[Stigler and Friedland \(1962\)](#), for example, demonstrate the ineffectiveness of discretionary regulation of natural monopoly prices and argue that the individual utility system does not include long run monopoly power, as it faces competition from other energy sources, and, therefore, its industrial (and hence many of its domestic) users may move to other sources of goods or services overtime.

[Demsetz \(1968\)](#), by his turn, sustains that discretionary regulation is unnecessary because the government can emulate competition by awarding a concession of limited duration to the bidder who offers the lowest price and best service.

Again, we have different points of view from the classical authors. In our opinion, before answering about the difficulties of regulating the electricity industry we should first understand which characteristics we (customers) want from electricity.

This is a simple question, but with great consequences. Basically, the common response in the past was that we wanted low prices and continued/reliable supply. As we were able to reach these targets the domestic electricity customers would be happy and the industrial/business customers would be able to exercise their commercial interests. The issue became more complex, however, when energy transition was added as a public interest goal. Thus, the point now is: how can we get low prices, continued/reliable supply of electricity and guarantee energy transition in the long-term?

[Stigler and Friedland's \(1962\)](#) response to our demand is that free market in the electricity industry will result in competitive prices under natural monopoly. [Demsetz's \(1968\)](#) opinion is that competition for the market, rather than competition in the market, can guarantee low prices. Ok, but what about energy transition?

Apart from whether we agree with these authors, they did not consider energy transition as one of the main objectives of electricity regulation, simply because by the time they responded to this question, energy transition was not a matter under discussion.

In our opinion, energy transition should be considered as important as low prices and continued/reliable supply in the regulation of the electricity industry. In fact, there is a potential tradeoff between the desirable goals of low prices and

continued/reliable supply. A customer should be willing to tolerate some supply uncertainty if the price was low enough, or, the opposite, should be willing to tolerate a higher price if there is a higher level of supply certainty.

However, considering public interest, energy transition as a goal is no longer something we should be able to trade, simply because it is a value that creates a great level of cost and risk to the future of society and, therefore, it is unnegotiable. This, of course, does not mean that there are no tradeoffs in the decisions involved in energy transition, such as its pace or manners to promote it, but rather to stress that the transition itself cannot be negotiated.

Inserting energy transition in the discussion changes some key aspects of the regulatory landscape. Firstly, because, from an Environmental, Social and Governance (ESG) standpoint, much of the regulation now produced is in the form of self-regulation, by private parties or by non-governmental bodies such as the Task Force on Climate-related Financial Disclosures (TCFD) or the International Financial Reporting Standards (IFRS) (Elliot et al., 2023). This means that any energy regulatory policy that aims to tackle climate change will have to interact in one way or another with these non-state rules, as explained by Black (2001, 2002).

Second, because, considering the relevance of private ordering in the ESG context, many Professors have been abandoning the idea that discretionary regulation can, alone, direct the regulatory trends of the sector or even tackle its biggest problems (Ho & Park, 2019; Michaels, 2005; Swenson, 2018). Some form of public-private cooperation, thus, will have to exist.

Furthermore, it is worth emphasizing the growing body of literature that critiques ESG-based self-regulation for its limitations in achieving genuine transformation. For instance, Brammer, Jackson, & Matten (2012) suggest that ESG practices can become decoupled from substantive outcomes, serving symbolic purposes rather than aligning incentives. Greenwashing and performative governance remain core risks, especially when public accountability mechanisms are weak.

The difficulty of regulating the electricity industry (and the overall energy industry), therefore, must be reconsidered. Natural monopoly versus competitive prices is one of the points of debate, asymmetric information/sunk costs versus continued/reliable supply is another, but energy transition is the last piece of the puzzle.

In fact, it is important to note that many influential authors and scholars have discussed how the energy transition, particularly the shift toward renewable energy, decentralization, and decarbonization, impacts electricity/energy regulation.

Pollitt (2008), for example, discusses the need for regulatory frameworks to adapt in response to climate change and the evolving energy landscape. Neuhoff, Richstein and Kroger (2023) highlights a shift from the traditional energy trilemma, balancing affordability, cleanliness, and security, to an “energy quartet”. This new framework incorporates a fourth dimension, reflecting the complexities introduced by the accelerated transition to climate neutrality and recent energy

crises.

4. United States' Electricity Regulation Model

The regulation model of electricity industry adopted by the United States is an example of diversified structures trying to address natural monopoly versus competitive prices, asymmetric information/sunk costs versus continued/reliable supply and most recently energy transition.

The discretionary regulation performed by the FERC works in the formation of prices through the approval of rates for sales of electricity and transmission in interstate commerce for jurisdictional utilities, power marketers, power pools, power exchanges and independent system operators and through the review of rates set by the federal power marketing administrations.

This discretionary regulation of prices is supported also by the state ownership of electricity utilities, through the yardstick regulation. In the United States, electricity is generated by a mix of entities, including IOUs, publicly owned utilities (POUs), cooperatives, and independent power producers (IPPs).

In 2022, according to Edison Electric Institute, IOUs accounted for approximately 34.7% of total United States electricity generation, producing about 1,470,748 gigawatt-hours (GWh). POUs, which include federal-, state-, and municipal-run utilities, contributed about 9% to the total United States electricity generation. Rural electric cooperatives, which are not-for-profit member-owned utilities, generated approximately 4% of the nation's electricity. IPPs, which are entities that generate electricity for sale to utilities and end users, were responsible for about 46.9% of the total United States electricity generation in 2022, totaling 1,990,850 GWh.

The reliability of the electricity supply, by its turn, is addressed by the Energy Policy Act of 2005. This act provides tax incentives and loan guarantees for energy production of various types, supporting investments in new generating capacity and minimizing sunk costs.

The ongoing energy transition has significantly influenced electricity regulation across federal, state, and local levels in the United States. The first important statute to address the issue was the Public Utility Regulatory Policies Act (PURPA), which aimed to increase production of renewable energy like solar and wind by allowing non-utility regulations to provide power to the grid and deregulate key parts of the sector. Energy transition was also recently dealt with by the Energy Act of 2020. The Energy Act modernizes and refocuses the Department of Energy's research and development programs on the most pressing technology challenges, including clean energy, carbon capture, and enhanced geothermal.

Furthermore, the Inflation Reduction Act (IRA), which passed in 2022, contains significant resources (nearly \$370 billion) in the form of grants, loans and incentives directed to the production of green energy and the establishment of a renewable industry production chain in the United States, including for fuels such as hydrogen.

Although President Trump's administration has initiated actions to roll back key components of the IRA, aligning with his campaign promises to dismantle climate-focused policies, this Act remains as a centerpiece of the promotion of the energy transition of the grid and of the transportation sector in the United States (Mirza et al., 2023). Its main goals are to cut greenhouse gas emissions, boost domestic clean energy production, and accelerate the United States transition to a low-carbon economy.

The integration of renewable energy requires substantial upgrades to the national grid to handle decentralized and variable power sources. Legislative proposals like the Big Wires Act aim to enhance interregional transmission capacity, facilitating efficient distribution of renewable energy and improving grid reliability.

To expedite the deployment of renewable energy projects, regulatory reforms have been introduced to streamline permitting. The proposed Energy Permitting Reform Act of 2024 seeks to simplify the approval process for both fossil fuel and renewable energy projects, addressing delays that hinder infrastructure development.

In addition, FERC has issued orders to integrate renewable energy into wholesale electricity markets. For instance, Order No. 2222 allows distributed energy resources, such as rooftop solar panels and battery storage, to participate in these markets, promoting competition and innovation.

The energy transition has highlighted conflicts between state-level clean energy initiatives and federal regulations. States implementing aggressive renewable energy policies sometimes face challenges aligning with federal market rules, leading to discussions on harmonizing policies to achieve decarbonization goals effectively.

The variability of renewable energy sources has prompted a reevaluation of ancillary services, which are support services essential for maintaining grid stability. Both the United States and Europe are exploring market design changes to accommodate high levels of renewable energy, ensuring reliability and efficiency in power systems.

The Environmental Protection Agency's finalized greenhouse gas standards for power plants, encouraging the adoption of cleaner technologies and impacting investment decisions within the electricity sector.

In summary, the energy transition has led to comprehensive regulatory changes in the United States aimed at modernizing infrastructure, streamlining project development, integrating renewable energy into markets, resolving policy conflicts, redesigning market mechanisms, and enforcing environmental standards to support a sustainable and reliable electricity system.

While much of the analysis draws on the United States experience, the shared-ownership model has strong potential in emerging economies where regulatory capacity and capital markets are still in development. In such contexts, minority state stakes can attract investments and enhance governance by reducing political

risk and signaling long-term policy commitment, even in the absence of highly liquid equity markets. Public participation also helps align firm strategies with national priorities, as can be seen in Brazil's Eletrobras and China's central SOEs.

However, successful implementation depends on robust institutions, transparent regulatory frameworks and mechanisms to ensure that state involvement does not stifle private initiative or enable undue political interference.

5. Ownership of the Electricity Firm

The rationale of investor ownership of electricity utilities could give us a basis for discussion about the efficiency of investor-owned utilities under the energy transition scenario. As explained by [Hansmann \(1988\)](#), the ownership relationship itself can involve substantial costs and the most significant of these costs can be grouped in 1) monitoring, 2) collective decision-making and 3) risk bearing.

In fact, corporate law gives shareholders the right to vote for the board of directors and to approve certain major changes, such as a change to the firm's charter or a merger or sale of the firm. However, if the shareholders want to exercise effective control over the management of the firm, they must incur in monitoring costs to become informed about the operations of the firm.

Also, because the ownership of the firm is usually shared, methods for collective decision-making must be devised, considering that shareholders need to communicate among themselves for the purpose of exchanging information and bringing their decisions to bear on the firm's management. These methods are costly, and they are basically annual and special meetings of shareholders.

Finally, the risk bearing cost of ownership is associated with the fact that market contracting with customers or suppliers creates a substantial degree of risk, which can be avoided by the assignment ownership to customers or suppliers (vertical integration), which means that the state ownership (as a representative of the customers and public interest) could reduce this risk by holding ownership.

To analyze how these costs apply to the electricity utilities we need first to consider the structure of ownership in this industry. As explained by [Jensen & Meckling \(1976\)](#), in industries where the freedom of management to take riskier projects is severely constrained, as in regulated industries, the ownership structure of the firm is usually characterized by relatively little outside equity with almost all outside capital obtained through the use of debt.

In other words, this means that electricity utilities are most often characterized by few shareholders. Under the angle of the state this structure of ownership is interesting because it reduces the monitoring costs of the regulators. Under the shareholders point of view if the regulation of the electricity sector guarantees a rate-of-return, there is no reason for a lot of equity investors to split the limited profits.

The low equity/high debt structure of the electricity utilities impacts directly the ownership costs involved. Regarding the monitoring costs, Jensen and Meckling explain that as the owner-manager's fraction of the equity falls, his fractional

claim on the outcomes falls and this will tend to encourage him to appropriate larger amounts of corporate resources in the form of perquisites. This also makes it desirable for the minority shareholders to spend more resources in monitoring his behavior.

This, however, applies only partially to the case of electricity utilities. Because the rate-of-return is regulated, shareholders, and particularly the minority shareholders, do not have incentives to spend resources in monitoring the behavior of the manager, although the managers (especially an owner-manager) have incentives to appropriate corporate resources, considering that the costs of the electricity utilities are borne by the society.

In fact, even if we consider a lot of shareholders (equity investors) in a specific electricity utility, the effective spending on monitoring would be considerably lower than normal considering the regulated rate-of-return for the reasons described above.

The rate-of-return and the discretionary regulation place the shareholders in a comfortable position, because the regulators' legal monitoring activities operate as a substitution of the shareholders' monitoring. Considering that the asymmetric information is bigger in face of the regulators than in face of the shareholders, however, the manager (even an owner-manager) in electricity utilities is subject to considerably less monitoring than usual.

The low equity/high debt structure of the electricity utilities also results in effects for the collective decision-making cost. Because the number of shareholders is relatively low, the cost of the collective decision-making method will be usually low, as if it was a small industry (bar or restaurant). Also, because of the regulated rate-of-return, the shareholders, and particularly the minority shareholders, do not have incentives to spend money or time on collective decision-making.

In addition, part of the decision-making of the managers of electricity utilities is based on discretionary regulation established by the regulators, which reduces considerably more the incentives for spending in collective decision-making.

Finally, regarding the risk bearing cost of ownership in electricity utilities, the low equity/high debt structure does not directly impact in this cost. However, considering that electricity utilities are regulated, the risk of contracting is minimized by the role of the government in the market, although vertical integration is usually avoided, even by law.

Therefore, the question is: what are the effects of the low spending on monitoring and on collective decision-making of the electricity firms for energy transition?

6. Allocation of Decision Power and Managerial Incentives in Electricity Utilities

The analysis of the allocation of decision power and managerial incentives in electricity utilities, considering the rationale of investor ownership, will finalize our understanding about performance of investor-owned utilities under an energy

transition scenario.

According to [Easterbrook & Fischel \(1996\)](#), as residual claimants, shareholders have the appropriate incentives to make discretionary decisions, because they receive most of the marginal gains and incur most of the marginal costs.

In corporate law, the term residual claimant refers to the party entitled to a company's residual profits, which are those remaining after all fixed claims, such as debts and operational expenses, have been satisfied. Traditionally, shareholders are viewed as the primary residual claimants, as they receive dividends and value appreciation after all other obligations are met. This status grants them specific rights, including voting privileges and fiduciary protections, aligning directors' duties with shareholder interests.

The collective choice problem prevents dispersed shareholders from making day by day decisions. Therefore, corporate law confers to shareholders the right to vote for the board of directors and to approve major changes in the firm. Also, corporate law specifies managers' duties to shareholders and provides a way for shareholders to collectively sue management for its failure to fulfill these obligations.

Managers' knowledge that they are being monitored by those who have the right incentives, and the further knowledge that the claims could be aggregated, and votes exercised at any time, leads them to act in shareholders' interest, i.e., efficiently, in order to advance their own careers and to avoid being ousted.

In addition, as explained by [Manne \(1965\)](#), corporate law regulates the takeover process, which allows poorly run firms to be acquired by third parties. If a firm is run poorly, either because managers are inattentive or appropriate corporate resources, it may become the target of a takeover and its managers replaced. Thus, an active market for corporate control gives managers incentives to be efficient, increasing the firm's value.

The question to be analyzed here is how this managerial rationale applies to the electricity industry and energy transition. The low equity/high debt structure of the electricity utilities certainly reduces the collective choice problem, but should the shareholders be considered the only residual claimants of this industry?

As explained by [Spulber \(1989\)](#), the rate structure that is chosen by regulators, for given output and cost levels, may be seen as determining the size of transfers of gains between shareholders of the electricity utilities and utility customers. Utility rates must provide shareholders of the electricity utilities with adequate returns and compensate them for reasonable costs of maintenance, plus sunk costs, when applicable. Utility customers, in their turn, must have positive gains from the trade in purchasing electricity.

The rate-making process, therefore, involves adversarial interested parties. Spulber identifies the shareholders' interests with those of investors who seek maximization of profits. The opposing interests are those of the utility customers who seek maximization of their gains from the trade.

The price formation through rate-making process, for this reason, determines

the share of results in the electricity utilities between shareholders and utility customers, avoiding the use of monopoly prices by the shareholders. In fact, the marginal gains are shared between shareholders and utility customers and the marginal costs, if they exist, are also shared between them, as the shareholders usually can't recover sunk costs in a reasonable period of time.

This fact leads us to the conclusion that the residual claims of the electricity utilities are shared between shareholders and utility customers. Consequently, because the power to control directly the electricity utilities is reserved to partial residual claimants (shareholders), there is a wrong allocation of decision power in this industry, which affects directly the managers' behavior, resulting in non-optimal decisions.

This "residual claimants' problem" results in effects that should be compared to a classical situation of a firm in distress. Because the rate-of-return is pre-determined, there is no reason for shareholders or managers to be answerable to them to invest money and energy necessary to make improvements when the customers reap the gains. In a firm in distress the consequence to this situation is that the shareholders lose their control over the company, what, in the case of public utilities, never happens.

This residual claimants' problem in electricity utilities is maximized by the absence of a market for corporate control and by the rationale of investor ownership in this industry. Basically, considering the regulated rate-of-return, the theory of market for corporate control doesn't apply to electricity utilities, because the replacement of incumbent managers will not result in more gains to the firm or in more benefits to the shareholders.

In addition, because shareholders do not have incentives to spend resources in monitoring the efficiency of the manager or to establish an appropriate decision-making method, as explained above, the manager has more freedom to appropriate corporate resources.

The conclusion is that the electricity utilities not only have a problem of wrong allocation of decision power of customers in favor of shareholders, but also a problem of wrong managerial incentives, which could also be considered an indirect result of the residual claimants' problem.

Discretionary regulation is the current government proposal for solving the residual claimants' problem. However, under asymmetric information, direct supervision of the managers behavior and of the respectively electricity utilities' performance by regulators may not be sufficient to avoid inefficient outcomes completely, even without considering residual claimants' problem.

As explained by [Cooter & Freedman \(1991\)](#), under the appropriation-incentive model and effort-incentive model, because the agent controls the asset, the principal cannot distinguish between bad luck from appropriation and shirking in a good state from sufficient effort in a bad state, respectively.

Applying the appropriation-incentive model and the effort-incentive model to the case of electricity utilities, it is very difficult for regulators to distinguish bad

management from appropriation or shirking by managers.

The residual claimants' problem increases these difficulties. If non optimal decisions generated by the residual claimants' problem are considered the normal behavior of the market by the regulators, it is easier for the managers to appropriate corporate resources for him or for the company through hiding behavior.

In fact, taking into account the possibility of opportunistic behavior of rate-of-return in face of sunk cost investments, the residual claimants' problem not only facilitates, but also is an incentive to appropriation and shirking, generating underinvestment in the absence of investment commitments or overinvestment in the existence of a pre-commitment to a binding rate-of-return.

This means that decision power and managerial incentives on electricity firms may directly affect negatively energy transition. If government regulation is the only solution to incentivize energy transition, it is likely that such energy transition will be subject to opportunistic behavior, which means underinvestment on clean technologies in the absence of investment commitments or overinvestment in the existence of a pre-commitment to a binding rate-of-return.

7. Shared-Ownership Structure in Electricity Utilities

7.1. Current Solutions

In the absence of sunk costs, competition may serve to ensure efficient production levels and elimination of some monopoly rents in public utilities. Further, discretionary regulation of entry, exit, prices, and terms of service may be employed to achieve, indirectly, welfare-optimal objectives.

However, electricity utilities are characterized by high levels of irreversible, industry-specific investment (sunk costs). In this setting, discretionary regulation of entry, exit prices, and terms of service are costly and may fail to result in efficient industry equilibrium.

Also, competition is of limited value, because it will not serve to guarantee efficient pricing and investments over time, including on energy transition. In addition, supervision of investment and other aspects of performance by regulators are not sufficient to avoid inefficient outcomes completely, particularly because of asymmetric information.

One solution to the problem of discretionary regulation of electricity utilities is full state ownership and control. As discussed, unlike some persons believe, the state ownership structure is present in the regulation of the electricity industry in the United States. In this case, the electricity utilities are owned and operated by the government, which determines the prices, makes production decisions and regulates entry.

There is, however, a preference for investor ownership of electricity utilities, particularly because in this situation the private investors would be bearing the immediate costs of the electricity facilities, resulting in a more competitive and efficient market.

A hybrid solution of concession contracts was proposed by [Demsetz \(1968\)](#).

According to Demsetz's proposal, the local government would own the utility plant, equipments, and transmission facilities. By placing ownership in the hands of the government, the costly duplication of transmission facilities would be avoided. The sunk costs of the plant and equipments would not be linked to the entry and exit of firms that operate the utility. By divorcing ownership and control, repeated franchise auctions could be held, or repeated renegotiation of franchise contracts between the government and private investors, without large entry costs.

The dependence of this proposal on government investments, rather than private investments, however, is considered questionable. Further, if fixed term contracts are signed, the government will also face the standard problems of monitoring and enforcement of contract terms by regulators.

Self-regulation, through cooperatives, is another alternative of solution to the problems involved in discretionary regulation of electricity utilities. In this situation, the electricity facilities are owned by their own customers. Managers designated by customers are responsible for setting the prices, making production decisions and regulating entry.

This ownership structure presents potential problems in relation to energy transition, however. The work of [Ostrom \(2009\)](#) has shown that private parties are capable of self-regulating the use of a common pool resource like the atmosphere; however, this can be done only in very specific circumstances, like small groups of private parties with deep social bonds. Those requirements effectively limit the application of the self-regulation theory of CPRs to the energy field, given its scale and the dynamicity of the shareholder structure of electricity utilities.

Therefore, one of the side effects of the moral hazards of customer-owned cooperatives is that each cooperative would have incentives to pursue the cheapest energy sources for their respective customer base, at the expense of the public interest of fighting climate change. From an ESG point of view, therefore, the customer-owned structure does not solve the fundamental problem posed by energy transition to the electricity sector.

Ownership in the hands of the customers, furthermore, creates limitations in terms of investment capacity. In addition, the customers also face the standard problems of monitoring the managers, plus high costs of a method for collective decision-making, which usually limits the extent of this structure.

As discussed, apart from the discussions about a single optimal solution for regulation of public utilities, the regulation model that has been adopted by the United States to the electricity industry is a combination of structures in different situations and also, in some circumstances, the creation of exceptions to government intervention, i.e., situations in which the government decides to apply no regulation.

The current United States' electricity regulation model, however, does not solve the problems of energy transition. The proposal for supporting the necessity of investments in new generating capacity over time with the government bearing

the costs of the electricity facilities (through tax incentives and loan guarantees) is inconsistent with the choice for investor ownership.

Furthermore, under the present regulation model the government is not creating incentives to optimal decision-making of managers in investor-owned utilities, which can result in effects over the energy transition. This inconsistent scenario of regulation leads us to suggest the shared-ownership structure as a feasible alternative to minimize both the regulatory problem and the residual claimants' problem and to incentivize energy transition.

7.2. New Proposal

The shared-ownership structure is basically inspired by the concept of production sharing agreement. The production sharing agreement, as laid out by [Binder mann \(1999\)](#), is a contract extensively used to regulate the relations between government and investors with respect to prospecting, exploration and extraction of mineral resources (in particular oil).

The first version of the production sharing agreement was used in Bolivia in the beginning of the 50s. Agreements on production sharing were also successfully applied in Indonesia in the 60s and gradually recognized by the major oil companies.

Since those times, production sharing agreements have received wide applications in countries with economies in transition and are used today in more than 40 countries, including Angola, Azerbaijan, Egypt, Equatorial Guinea, Kazakhstan, Libya, Malaysia, Peru, Philippines, Russia, Syria, and Vietnam, attracting huge private investments.

These contracts are characterized by a contractual relation between two legally equal parties, government and investor, each subject to rights and obligations mutually agreed. In fact, the government as a party in this contract acts in two different roles. On the one hand, it fulfills its obligations under the contract, as a normal party. On the other hand, it preserves its public-legal functions, trying to achieve welfare-optimal objectives.

These roles may converge or come into conflict with each other. In their delimitation, the practice is guided by the following principle: within the scope of conditions provided by the contract, the government and the investor are equal partners, outside such scope, however, the government makes decisions related to the regulated activities in a regulatory basis.

This dual function of the government in production sharing agreements is the center of the shared-ownership structure here proposed. Basically, the shared-ownership structure is characterized by the state assuming both the position of minority shareholder in a strategic investor-owned electricity utility or other strategic entities to the energy sector and still being the regulator, through the regulatory agency.

The quantity of shares to be owned by the government will depend on the ownership structure of the specific electricity utility or strategic entity and on the im-

portance of those entities to the market. When we say strategic electricity utility or strategic entity, we mean that the government should limit its participation in electricity utilities or entities of great public relevance, i.e., the bigger electricity suppliers, the big electricity customers or the electricity suppliers/customers responsible for the most important investments in clean energy (the reasons for this configuration will be explained below).

The shared-ownership structure, therefore, creates a contractual relationship between government and investors, which does not conflict with the discretionary regulation of regulators, but complement it. The idea is that the corporate governance of the electricity utility or strategic entity, through the government as shareholder, should be used to reduce the residual claimants' problem, creating the appropriate incentives to managers' optimal decision-making.

As a shareholder, the government would have the right to vote for the board of directors and to approve major changes in the firm, such as changes to the firm's charter or mergers of the firm or investments in energy transition or clean technologies. Managers would have corporate duties to the government and bigger disclosure responsibilities. Also, the government would be able to sue the management for its failure to fulfill firm obligations.

These points, however, do not answer our major question: why should we have the government as a shareholder?

7.3. Arguments in Favor of the New Proposal

A first argument in favor of this structure we could take from [Gómez-Ibáñez's \(2003\)](#) affirmation that market-oriented and contractual solutions to monopoly are preferable where they are practical.

In his opinion, and ours also, market-oriented solutions such as private contracts and concession contracts enjoy the basic virtue of approximating the agreements that public utilities (in our case electricity utilities) and their customers would reach voluntarily in a world of no transaction costs.

Moreover, by providing a clearer and stronger commitment to energy transition than discretionary regulation, market-oriented approaches influenced by the government as a shareholder can offer stronger protection against opportunism. In summary, the government as shareholder is a private contract solution that reduces the transactions costs of the negotiation between investors and small customers.

In addition, the reduction of opportunism activity generated by shared-ownership structure is very important for generating new clean energy investments in this sector, because a serious problem in long-term rate-of-return regulation is the possibility that electricity utility takes advantage of the government's asymmetric information.

The effects of the shared-ownership structure to the rationale of investor ownership in electricity utilities are a second argument in favor of this structure. As explained above, because electricity utilities are characterized by low equity/high

debt structures with regulated rate-of-return, the shareholders, and particularly the minority shareholders, do not have incentives to spend resources in monitoring the behavior of the manager or in establishing an appropriate decision-making method, although the managers (especially an owner-manager) have incentives to appropriate corporate resources, considering that the costs of the electricity utilities are born by the society.

The presence of the state as shareholder, however, changes the whole configuration of the investor ownership on electricity utilities. The government has a natural incentive to spend resources in monitoring the efficiency of the manager and to establish an appropriate decision-making method, particularly because he wants to preserve its public-legal functions and to achieve welfare-optimal objectives, such as energy transition.

A third argument in favor of this structure results from the allocation of decision power and managerial incentives in electricity utilities. The shared-ownership structure brings the government to a shareholder position, minimizing the residual claimants' problem, allowing a better and continued discussion about appropriate rates to justify actual and new investments in efficiency and new generating facilities, including clean energy.

In this situation, the managers will have the appropriate incentives to make discretionary decisions, respecting the interest of the shareholders (including the government), since the rates will be more accurately determined to pursue an optimal result.

Managers' knowledge that they are being monitored by those who have the right incentives, and the further knowledge that the reduction of asymmetric information between the firm and the government increases the chances of being caught in any wrong conduct leads to optimal decisions, which ends the problem of wrong managerial incentives.

Furthermore, the position of the government as shareholder and the appropriate managerial incentives allows also discussions about welfare-optimal goals for electricity utilities (like universalization or energy transition), which are usually objectives of discretionary regulation that could be mutually agreed, i.e., in a more efficient way.

Finally, a fourth argument in favor of the shared-ownership structure are the direct government costs involved in its implementation, which could be incorrectly considered by some Professors as a weakness of this structure.

In this setting, our understanding is that the shared-ownership structure should be applied only to electricity utilities or strategic entities of great public relevance. The reasons for this configuration are basically two: 1) First, the government should be able to exercise an active role as shareholder, which would be difficult and expensive to be done in all investor-owned electricity utilities at the same time; 2) Second, we do not understand that the residual claimants' problem need to be solved in every single investor-owned electricity utility in the country, especially considering that the regulator would still be exercising the discretionary reg-

ulation.

What we understand is that the shared-ownership structure would create a new standard of efficiency for investor-owned electricity. This new standard would generate direct and indirect competition in the market, stimulating the performance of other investor-owned electricity utilities. Furthermore, this new standard could be used in a yardstick regulation to measure the performance of other investor-owned electricity utilities in the market.

One challenge in shared-ownership arrangements is the potential for conflicts of interest when the state acts both as regulator and shareholder. To address this challenges, several safeguards are possible: 1) establishment of independent regulatory agencies whose leadership and operations are insulated from political interference; 2) creation of ‘firewalls’ between shareholder and regulatory functions; 3) appointment of independent directors to company boards to ensure that decision-making reflects both public and commercial interests; and 4) requirements for public disclosure, transparency, and accountability in all major transactions and regulatory decisions.

Furthermore, given the recommended restrictions in the application of the shared-ownership structure, the analysis of the costs involved in its implementation changes considerably.

7.4. Benchmark and Academic Support

The direct interest of the government in companies refers to situations where a government has a direct ownership stake or control in a business or corporate entity. This involvement can take several forms, typically falling under state ownership or state participation.

SOEs are companies that are wholly or majority-owned by the government. In this case, the state typically has full or effective control over operations, strategy, and appointments. Usual examples are national airlines, public utilities, oil and gas companies, postal services.

Through state participation, the government holds shares in a company but doesn't necessarily have controlling interest, which can be through public investment funds, sovereign wealth funds, or strategic shareholding. The purpose of this equity participation of the government may be to support key industries, stabilize markets, or ensure national interest, which follows exactly in the case of the proposed shared-ownership connected to energy transition.

Even with a minority stake, the state may hold special rights allowing it to veto certain decisions, especially those affecting national interest or strategic sectors, named Golden Shares. In some cases, governments may temporarily take ownership (e.g., during a crisis or bailout) to stabilize a company or protect jobs.

By holding a minority interest the government can influence rather than control such entities and protect national interest in critical sectors like energy, even without full ownership.

The TEPCO (Tokyo Electric Power Company) case is a notable example of mi-

minority state ownership used as a tool for crisis management and strategic oversight, particularly after a major disaster.

In March 2011, the Fukushima Daiichi nuclear power plant, operated by TEPCO, was severely damaged by a massive earthquake and tsunami. The incident led to multiple reactor meltdowns, triggering one of the worst nuclear disasters in history.

TEPCO faced massive liabilities (tens of billions of dollars), including compensation claims, decommissioning costs, and cleanup responsibilities. To prevent TEPCO from collapsing (which could have had severe implications for Japan's economy and energy supply), the government stepped in.

The Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF) was established to oversee financial support and reforms and the Japanese government acquired a 50.1% stake in TEPCO's voting rights, though the actual equity stake was around 30%, making it a minority shareholder in terms of capital but with effective control.

The government injected around 1 trillion yen (~\$10 billion) to stabilize the company and, even with a minority equity stake, secured veto powers and influence over management decisions via special arrangements, allowing it to guide corporate reform, safety protocols, and compensation frameworks.

TEPCO was placed under tight oversight for decommissioning Fukushima, a process expected to take 30 - 40 years and compensation to victims was managed under a government-supported framework. The state has consistently pressured TEPCO to restructure, including divesting non-core businesses and considering mergers (e.g., with other regional utilities).

TEPCO continues to operate and invest in renewables and grid infrastructure, with a long-term focus on clean energy transition and nuclear safety. TEPCO's energy transition strategy is centered on decarbonization, safety, and restructuring, with a long-term vision of becoming a carbon-neutral utility by 2050.

This strategy was shaped heavily by the Fukushima disaster, public pressure, regulatory changes, and Japan's national energy goals. It shows how a state can intervene in a strategic industry during crisis, stabilize it, and retain influence without full ownership.

The case of TotalEnergies is also a fascinating example of limited state ownership with strategic influence. Unlike companies like Equinor or ENI, where the government holds a major or controlling stake, the French state holds only a small minority stake in TotalEnergies, although still retains subtle influence due to the company's national importance, historical ties, and strategic role in energy and foreign policy.

The French government, via Bpifrance (a state investment bank), holds a small minority stake, typically around 1.5% - 2%. This interest does not give control, but it provides board-level presence or access, voting rights at shareholder meetings and a signal of strategic alignment with national policy goals.

Despite holding a minority state, TotalEnergies is considered a strategic com-

pany, meaning the state can screen or block foreign investment in the company under French and EU laws and apply political or regulatory pressure in times of national interest (e.g., fuel pricing, energy supply).

In the energy transition space, France has pushed its energy giants to decarbonize, and TotalEnergies has responded with major investments in solar, wind, batteries, and biofuels and active participation in France's hydrogen and EV charging initiatives, targeting 40% low-carbon energy by 2050.

The French government has also historically supported TotalEnergies' international ventures, especially in Africa and the Middle East. There's an informal alignment between French diplomacy and the company's overseas projects, not through ownership, but through mutual interests.

Therefore, while the French state doesn't control TotalEnergies, it still exerts policy-driven influence through a mix of soft power, strategic designation, and regulatory tools, making it a subtle but powerful example of modern state-capital interaction, including for energy transition.

Several academic authors and institutions have explored the relationship between state ownership (or influence) in companies and their role in the energy transition. Andreas Goldthau, for example, wrote various papers on energy governance, including "State capitalism and the geopolitics of energy transition", where he explores how state-owned companies, and national strategies shape the global energy transition. According to Goldthau, countries with strong state control (like China or Norway) can steer companies more directly toward energy transition goals.

Both the International Renewable Energy Agency—IRENA and the Organization for Economic Co-operation and Development, OECD have published reports named "The Role of State-Owned Enterprises in the Low-Carbon Transition" (OECD, 2020) and "Global Landscape of Renewable Energy Finance" (IRENA, 2023) which explore how SOEs are often key enablers or blockers of clean energy adoption, particularly in emerging markets.

Mazzucato (2021), a leading economist known for her work on the role of the state in innovation and economic transformation, argues that the state should not be a passive market fixer but an active market shaper. In the context of the energy transition, she has advocated for public ownership or equity stakes in key sectors, including energy, to ensure that public investments align with long-term social and environmental goals.

Mazzucato argues that when the state funds or de-risks innovation, such as in renewable energy technologies, it should retain a share in the upside, not just socialize the risks. By taking equity stakes in energy companies or new green ventures, the public can benefit from future profits and reinvest them in further innovation or public services.

Ownership gives the state a governance role, allowing it to guide companies toward long-term goals like decarbonization, instead of leaving such missions to the market. This is key to ensuring a just and rapid energy transition rather than

one driven solely by short-term profits.

With a stake or direct role, the state can set conditionalities, for example, on emissions reductions or labor practices, making it harder for companies to green-wash or delay the transition. She makes the case for the state taking equity stakes in companies that benefit from public investment, especially when tackling grand challenges like decarbonization, which is exactly what we sustain in this article.

In a comprehensive literature review, [Meelen and Sluijs \(2025\)](#) conclude that public ownership can positively contribute to sustainability transitions, provided certain governance conditions are met. They synthesize studies across innovation, economics, and political science, observing that government-owned enterprises often pursue broader social and environmental mandates. The authors recommend harnessing this potential by ensuring strong rule-of-law, citizen oversight, and regulations tailored to these entities. With those in place, state-owned firms are well-suited to ‘market-shaping’ roles, for instance, investing in nascent industries, maintaining energy affordability, or coordinating large-scale projects in line with climate plans. Their review echoes the idea that the state can steer markets toward decarbonization goals through its enterprises, which can internalize public interests more than purely private firms.

In a comparative analysis of state-owned power companies published in *Journal of Cleaner Production*, Benoit et al. argue that SOEs can be ‘more effective vehicles for decarbonization’ than private firms. Their study develops an analytical framework showing that when governments give clear climate-focused mandates and sufficient operational autonomy, state-owned power companies are well-positioned to invest in low-carbon assets and modernize infrastructure. The authors highlight that SOEs’ distinctive traits—insulation from short-term market pressures and access to patient capital, allow them to invest aggressively in decarbonizing their asset base (e.g. retiring coal plants, building renewables) in ways that purely profit-driven companies might not. In other words, state ownership can enable companies to prioritize public climate objectives and long-term planning over short-term profits.

Through case studies of China’s wind power boom, Zhu, Qi and colleagues underscore how central SOEs took a long-term strategic approach to renewable investment. Even when faced with challenges like severe wind curtailment that made projects less profitable in the short term, China’s state-owned power companies continued to invest heavily in wind farms. Zhu et al. note that the vast majority of wind capacity expansion in China over the past decade was driven by central SOEs, who treated wind projects as a “rational long-term strategy” for future profitability and energy security. In a 2022 follow-up, they found that SOEs (accounting for over 70% of China’s wind market) were not merely obeying top-down political mandates, but also responding to market reforms and internal entrepreneurial incentives—a dynamic that enabled China’s wind power “miracle”. These findings suggest that SOEs, free from the pressure of immediate shareholder re-

turns, can pursue consistent investment in renewables aligned with long-term policy goals.

8. Conclusion

Energy transition impacted the classical debate on electricity regulation and overall energy regulation reinforcing the need for government intervention to address the long-term public external cost of energy use.

Corporate governance of electricity firms shows that there is little incentive for shareholder spending on monitoring and on collective decision-making, which is not ideal for energy transition.

If government regulation is the only solution to incentivize energy transition, it is likely that such energy transition will be subject to opportunistic behavior, which means underinvestment on new clean technologies in the absence of investment commitments or overinvestment in the existence of a pre-commitment to a binding rate-of-return.

In this case, we have proposed the shared-ownership structure as a feasible alternative to be applied considering the particularities of the energy transition. The shared-ownership structure would solve the residual claimants' problem by placing the government as a shareholder in specific and strategic energy companies. This new structure changes the rationale of investor ownership in energy companies and also the allocation of decision power and managerial incentives, resulting, however, in lower direct costs for the government.

This study is primarily conceptual and draws on theoretical and comparative analysis. While it advances the debate on regulatory structures and corporate governance in energy transition, several limitations remain. Most notably, empirical testing of the cost-of-capital implications, risk of politicized investment, and real-world performance of shared-ownership structures, especially in diverse regulatory and market environments, should be prioritized in future research. Quantitative studies comparing financing costs, investment outcomes, and decarbonization trajectories under different ownership models would greatly enrich the field and inform policy design.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- Andrews-Speed, P. (2015). Applying Institutional Theory to the Low Carbon Energy Transition. *Energy Research & Social Science*, 13, 216-225.
- Bindermann, K. (1999). *Production-Sharing Agreements: An Economic Analysis*. Oxford Institute of Energy Studies.
- Black, J. (2001). Decentring Regulation: Understanding the Role of Regulation and Self-Regulation in a "Post-Regulatory" World. *Current Legal Problems*, 54, 103-146. <https://doi.org/10.1093/clp/54.1.103>

- Black, J. (2002). Critical Reflections on Regulation [plus a Reply by Dimity Kingsford Smith]. *Australasian Journal of Legal Philosophy*, 27, Article ID: 200201.
- Brammer, S., Jackson, G., & Matten, D. (2012). Corporate Social Responsibility and Institutional Theory: New Perspectives on Private Governance. *Socio-Economic Review*, 10, 3-28. <https://doi.org/10.1093/ser/mwr030>
- Chow, M. (2012). *An Introduction to Ostrom's Eight Principles for Sustainable Governance of Common-Pool Resources as a Possible Framework for Sustainable Governance of Space*. Secure World Foundation.
https://cdn.charmverse.io/user-content/8ac100ce-0a07-46f5-860b-aa7d2f8b9aa1/d0ea0ddb-7c82-4418-a9c6-a5ccb0dda914/Space_as_a_Commons.pdf
- Coase, R. H. (1960). The Problem of Social Cost. *The Journal of Law and Economics*, 3, 1-44. <https://doi.org/10.1086/466560>
- Cooter, R., & Freedman, B. (1991). The Fiduciary Relationship: Its Economic Character and Legal Consequences. *New York University Law Review*, 66, 1045-1076.
- Demsetz, H. (1968). Why Regulate Utilities? *The Journal of Law and Economics*, 11, 55-65. <https://doi.org/10.1086/466643>
- Downs, A. (1957). *An Economic Theory of Democracy*. Harper & Row.
- Easterbrook, F. H., & Fischel, D. R. (1996). *The Economic Structure of Corporate Law*. Harvard University Press.
- Esty, D. C. (2008). Rethinking Global Environmental Governance to Deal with Climate Change: The Multiple Logics of Global Collective Action. *American Economic Review*, 98, 116-121. <https://doi.org/10.1257/aer.98.2.116>
- Esty, D. C., & Moffa, A. L. I. (2012). Why Climate Change Collective Action Has Failed and What Needs to Be Done within and without the Trade Regime. *Journal of International Economic Law*, 15, 777-791. <https://doi.org/10.1093/jiel/jgs033>
- Gómez-Ibáñez, J. A. (2003). *Regulating Infrastructure: Monopoly, Contracts, and Discretion*. Harvard University Press.
- Hall, J., & Shakya, S. (2019). *Federal Regulations and U.S. Energy Sector Output*. West Virginia University Economics Faculty Working Papers.
- Hansmann, H. (1988). Ownership of the Firm. *Journal of Law, Economics, & Organization*, 4, 267-304.
- Hardin, G. (1968). The Tragedy of the Commons. *Science*, 162, 1243-1248. <https://doi.org/10.1126/science.162.3859.1243>
- Herber, B. P. (1991). The Economic Case for an International Law of the Atmosphere. *Environment and Planning C: Government and Policy*, 9, 417-429. <https://doi.org/10.1068/c090417>
- Ho, V. H., & Park, S. K. (2019). ESG Disclosure in Comparative Perspective: Optimizing Private Ordering in Public Reporting. *University of Pennsylvania Journal of International Law*, 41, 249.
- International Renewable Energy Agency (IRENA) (2023). *Global Landscape of Renewable Energy Finance*. IRENA.
<https://www.irena.org/Publications/2023/Feb/Global-landscape-of-renewable-energy-finance-2023>
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics*, 3, 305-360. [https://doi.org/10.1016/0304-405x\(76\)90026-x](https://doi.org/10.1016/0304-405x(76)90026-x)
- Joskow, P. L. (2006). Competitive Electricity Markets and Investment in New Generating

- Capacity. In *The New Energy Paradigm* (pp. 1-74). Oxford University Press.
- Joskow, P. L., & Tirole, J. (2006). Reliability and Competitive Electricity Markets. *The RAND Journal of Economics*, 38, 60-84.
<https://doi.org/10.1111/j.1756-2171.2007.tb00044.x>
- Mancur, O. (1965). *The Logic of Collective Action: Public Goods and the Theory of Groups* (Vol. 124). Harvard University Press.
- Mankiw, N. G. (2017). *Principles of Economics* (8th ed.). Cengage Learning.
- Manne, H. G. (1965). Mergers and the Market for Corporate Control. *Journal of Political Economy*, 73, 110-120. <https://doi.org/10.1086/259000>
- Mazzucato, M. (2021). *Mission Economy: A Moonshot Guide to Changing Capitalism*. Companhia das Letras.
- Meelen, T., & Sluijs, J. P. (2025). Government-Owned Enterprises and Sustainability: Review and Research Agenda. *Energy Research & Social Science*, 122, Article ID: 103994. <https://doi.org/10.1016/j.erss.2025.103994>
- Michaels, R. (2005). The Restatement of Non-State Law: The State, Choice of Law, and the Challenge from Global Legal Pluralism. *Wayne Law Review*, 51, 1209.
- Mirza, N., Naqvi, B., Rizvi, S. K. A., & Umar, M. (2023). Fiscal or Monetary? Efficacy of Regulatory Regimes and Energy Trilemma of the Inflation Reduction Act (IRA). *International Review of Financial Analysis*, 90, Article ID: 102821. <https://doi.org/10.1016/j.irfa.2023.102821>
- Neuhoff, K., & Richstein, J. C., & Kroger, M. (2003). Reacting to Changing Paradigms: How and Why to Reform Electricity Markets. *Energy Policy*, 180, Article ID: 113691.
- OECD (2020). *The Role of State-Owned Enterprises in the Low-Carbon Transition*. OECD Publishing. https://www.oecd.org/en/publications/state-owned-enterprises-and-the-low-carbon-transition_06ff826b-en.html
- Ostrom, E. (2009). *A Polycentric Approach for Coping with Climate Change*. Policy Research Working Paper, The World Bank.
- Parenteau, P. (2023). The Atmosphere as a Global Public Good. *University of St. Thomas Journal of Law & Public Policy*, 16, 217.
- Paul, H. (2007). Collective Action on Climate Change: The Logic of Regime Failure. *Natural Resources Journal*, 47, 195-224.
- Peltzman, S., Levine, M. E., & Noll, R. G. (1989). The Economic Theory of Regulation after a Decade of Deregulation. *Brookings Papers on Economic Activity. Microeconomics*, 1989, 1-59. <https://doi.org/10.2307/2534719>
- Pendergraft, C. A. (1998). Human Dimensions of Climate Change: Cultural Theory and Collective Action. *Climatic Change*, 39, 643-666. <https://doi.org/10.1023/a:1005323809980>
- Pollitt, M. G. (2008). The Future of Electricity (and Gas) Regulation in a Low-Carbon Policy World. *The Energy Journal*, 29, 63-94. <https://doi.org/10.5547/issn0195-6574-ej-vol29-nosi2-5>
- Posner, R. A. (1974). Theories of Economic Regulation. *The Bell Journal of Economics and Management Science*, 5, 335-358.
- Spulber, D. F. (1989). *Regulation and Markets*. Harvard University Press.
- Stigler, G. J. (1971). The Theory of Economic Regulation. *The Bell Journal of Economics and Management Science*, 2, 3-21. <https://doi.org/10.2307/3003160>

- Stigler, G. J., & Friedland, C. (1962). What Can Regulators Regulate? The Case of Electricity. *The Journal of Law and Economics*, 5, 1-16. <https://doi.org/10.1086/466579>
- Swenson, G. (2018). Legal Pluralism in Theory and Practice. *International Studies Review*, 20, 438-462. <https://doi.org/10.1093/isr/vix060>