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POWER SECTOR ROUNDTABLE

Policy Brief

Governance and Regulation:
US Experience and Recommendations for China

Power Sector Roundtable Working Group

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Power Sector Roundtable (PSR)

NRDC launched the Power Sector Roundtable (PSR) in 2015, aiming at addressing climate change and supporting China's efforts in power sector low-carbon transition. PSR provides an open platform for dialogues within a diverse group of policymakers, industry experts, researchers, and NGO representatives. As the current round of Chinese power sector reform involves a wide spectrum of stakeholders representing a multitude of perspectives and interests, the Power Sector Roundtable was designed from its inception as a forum and an ongoing channel for discussion of critical and contentious reform issues. These exchanges and analyses will inform policymakers with an on-the-ground picture of the effects of the reform across industrial sectors, and in turn, support policy implementation.

Power Sector Roundtable Working Group

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Preface

China is currently engaged in a major effort to reform its power sector. The overarching goals of reform are set out in Document #9, issued in March 2015 by the Central Committee of the Communist Party and the State Council. One of those goals is "better governance and regulation," a critical prerequisite to achievement of the other objectives of reform. The distinction between governance and regulation is blurry at best. Here we think of "regulation" as the legal framework by which government oversight is conducted and policy objectives, such as economic efficiency and environmental protection, are advanced. We think of "governance" primarily as the process by which the industry is overseen: How do regulators do their job? Is the process transparent? Can affected parties participate? And is there accountability—how are decisions implemented and enforced and are the rights of parties and other stakeholders appropriately protected?

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Introduction

The nature of government oversight of the power sector varies around the world, driven by each country's unique historical, political, and economic circumstances. But the fundamental need to regulate the power sector is shared by all countries. It derives from the special features of the product it provides. First, because electricity is essential to the well-being of modern society, the power sector is an industry "affected with the public interest."[1] And second, the technologic and economic features of the industry are such that a single provider is often able to serve the overall demand at a lower total cost than can any combination of smaller entities.[2] Competition cannot thrive under these conditions; eventually, all firms but one will exit the market. The entities that survive are called natural monopolies, and, like other monopolies, they have the power to restrict output and set prices at levels higher than are economically justified. Economic efficiency and fairness are threatened under such conditions.

Constraining monopoly power and ensuring the provision of reliable service at reasonable cost are two central purposes of regulation, which we define as the explicit public or governmental intervention into a market that is necessary to achieve public benefits that the market fails to achieve on its own.

1 The term "affected with a public interest" originated in England around 1670, in the treatises De Portibus Maris and De Jure Maris, by Sir Matthew Hale, Lord Chief Justice of the King's Bench.

2 John Stewart Mill, cited in Garfield, P., and Lovejoy, W. (1964). Public Utility Economics. Englewood Cliffs, NJ: Prentice Hall; p. 15.

In recent years, the power supply element of the electric industry has been subject to greater competitive pressures—that is, technologic and economic changes have made generation responsive to competitive provision—and now in many places it has been excluded from direct economic (i.e., price) regulation (but not from rigorous market oversight and environmental regulation).[3]

Reform around the world has been propelled by these changes. This is true too in China, where questions about the role of regulation and the nature of reform in the electricity sector date back more than two decades. A series of reforms since then has opened up the sector to new technology and investment, driven greater economic efficiency, and greatly improved system reliability. No other electric system in the world has seen such dramatic change in so short a span.

A new round of sectoral reforms was launched in March 2015 with the issuance of Document #9, which outlined a broad set of public policy goals to be achieved by comprehensive reform.[4] Since then, a number of follow-on documents, providing guidance for implementing the reforms, have been issued by the National Development and Reform Commission (NDRC), and provincial pilots testing different approaches have been initiated. However, none has so far addressed the question of regulatory reform, and there's been no detailed description of Document #9's intent in this regard. Thus many of the questions that China has been struggling with—how can regulation be best organized to serve the country's energy and environmental goals, what activities should be regulated and how, and what should be turned over to competitive provision and what shouldn't?—still want answers.

Regulation lies at the nexus of policy and implementation. It is the means of transforming public aspiration into private action, and it is in the day-to-day administration of their duties that regulators grapple with the practical problems that change in essential infrastructural industries presents. With the broad outlines and direction of sectoral reform laid out by Document #9, deeper, more challenging issues emerge.

There are at least two dimensions of regulatory oversight: institutional and methodologic. The first refers to the specifics of the governmental structures for regulation: How is regulatory responsibility allocated among agencies? Are there overlaps in jurisdiction and, if so, do they help or hinder achievement of public policy objectives? Do the regulatory authorities have sufficient authority to perform their duties? This aspect of regulation is as important as the other, but it isn't the focus of this discussion. We assume, for our purposes here, that the requisite authority and responsibilities reside in the appropriate agencies of the Chinese government.

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3 Lazar, J., et al. (2016, June). Electricity Regulation in the U.S.: A Guide (2nd ed). Montpelier, VT: The Regulatory Assistance Project. Available at http://www.raponline.org/wp-content/uploads/2016/07/rap-lazar-electricity-regulation-US-june-2016.pdf

4 Broadly paraphrased, those objectives are: electric system reliability; increased use of market mechanisms; protection of residential and agricultural consumers; energy savings, emissions reductions, and increased use of renewable and distributed generation; and better governance and regulation, including better planning and strengthened capacity in terms of regulatory agencies and approaches.

The second dimension—the one that we are interested in here—is what we are calling the methodologic, and it too has at least two aspects: substantive and procedural. In substance lie the technical details of regulatory oversight: What elements of the industry are regulated and how are they regulated? What methods are used and how can they best be fashioned to achieve the results desired? The procedural aspects are matters of process: How do regulators make their decisions? How is information gathered and tested? What parties (stakeholders) can participate in the process? How are parties' (including consumers') rights protected? How are regulatory decisions implemented and enforced? These questions, both substantive and procedural, go to the heart of any reform effort.

This brief identifies the broad categories of regulatory action that are affected by reform, to begin a discussion of how best to meet the objectives of Document #9. As a basis for that discussion, we provide a review of regulatory history and practice in the United States, for the insights it might offer.

2 Regulation and Governance in the United States

How the United States is dealing with the regulatory challenges created by a rapidly evolving power sector may provide some guidance for Chinese policymakers as they grapple with similar issues. This is because the two systems have more in common than it might seem at first glance. They are the two largest electric systems in the world, characterized by a historic reliance on coal, and they are overseen through shared jurisdiction between provincial (state) and central (federal) regulators.

2.1 Background

The US electric industry comprises over 3,000 public, private, and cooperative utilities, more than 1,000 independent power generators, and over 700,000 homes and businesses with onsite solar generating systems. There are three regional synchronized power grids (the Eastern Interconnection, the Western Interconnection, and the Electricity Reliability Council of Texas).

About 75 percent of the US population is served by investor-owned utilities. These are private companies, financed by a combination of shareholder equity and bondholder debt. The remainder is served by publicly owned (generally "municipal" or city-owned) or cooperative (consumer-owned) utilities.

Vertically integrated utilities are responsible for all elements of service: generation, transmission, and distribution of power to retail customers. In many cases, they own some or all of their power plants and transmission lines, but they may also buy power through contracts from others, giving them the operational equivalent of power-plant ownership.

Many electric utilities are not vertically integrated, and provide only distribution service. These distribution-only utilities do not own any generating resources. Either they buy power from wholesale providers or, in the "restructured" states (that is, states where competitive markets for supply have been created), consumers obtain their power directly from suppliers, with the utility providing only the distribution (delivery) service.[5]

5 In most restructured states, the distribution utilities provide "default" or "basic" service for those consumers who, for whatever reason, do not receive service from a competitive provider.

2.2 History: The Movement From Monopoly to Competition

The arc of power sector policy in the United States over the past 40 years has generally been toward introducing competition where it is the most efficient model for allocating resources and meeting essential needs. The network components of utility service (that is, to their fixed transport and delivery facilities) still exhibit the characteristics of natural monopoly. However, even where there is sufficient competition among the providers of energy supply, the utility sector's critical role in the infrastructure of modern technologic society justifies its careful oversight.

Around 1980, electricity prices began to rise sharply as inflation became significant, fuel prices soared, and the costs of new power plants rose sharply. Aware of competitive reforms in telecommunications and natural gas industries, large industrial power users began demanding the right to become wholesale purchasers of electricity. This led, a decade or so later, to a period of restructuring, during which some states "unbundled" (separated) the electricity-supply function from distribution, on the theory that the wires (the fixed network system) constituted a natural monopoly, whereas power generation no longer did. In some cases, large-volume customers (commercial and industrial users) were allowed to negotiate directly with wholesale power suppliers for services provided by the utility at regulated prices. In other states, the utilities were forced to divest their power plant ownership, and the production of power was left to a new industry of competitive suppliers. In both cases, the utilities retained the regulated natural monopoly of distribution. In the years since 2010, the availability of electricity generation from customer-sited facilities (primarily from solar units) at prices competitive with retail prices has forced some regulators to ask whether even distribution remains a natural monopoly. Time will tell.

Competitive wholesale markets cover roughly 60 percent of US power supply. Vertically integrated monopolies serve the remainder, but even so, there are competitive third-party providers, very often wind and solar generators, selling power through bilateral contracts with utilities and some large customers, or under regulatory mandates (e.g., renewable portfolio standards). Third-party access to the grid, at first to supply electricity through wholesale contracts to distribution companies, began with the passage in 1978 of the Public Utilities Regulatory Policy Act (PURPA), which, among other things, required utilities to purchase output (at prices set by the states) from "qualifying facilities," that is, independent renewable and combined heat and power producers.

PURPA combined with several challenges in the 1980s and 1990s to drive sectoral and regulatory reforms. One challenge was the need to include the high costs of nuclear power in retail prices. Demand for electricity had begun to flatten after the oil price shocks of the 1970s, and the combination of excess capacity and nuclear cost overruns created a financial crisis for investor-owned utilities with nuclear assets. Another was that policymakers began to see the need to deal with the environmental impacts of electricity production. They recognized that alternative resources, in particular end-use energy efficiency, offered both cleaner and cheaper means of meeting demand. The industry was no longer growing at over 7% per year, as it had been in the 1950s and 1960s; its long-standing supply-side investment strategies were no longer justified. Wanting to avoid the consequences of such strategies in these new economic circumstances, states developed methods of resource identification and acquisition—called "least-cost integrated resource planning"—that established open, public processes to examine the wide range of energy choices available to meet demand over the long term (typically 10 to 20 years) and set out the course of action to acquire them. The plans were regularly updated, typically every three years or so, to address changing conditions and technologies.

By 1992, however, the costs of generation had begun to drop significantly. There were several reasons for this, including PURPA's encouragement of independent power producers, advances in natural gas combined-cycle technology, and falling natural gas prices. There was now a growing consensus that the generation component of electric service no longer exhibited the characteristics of natural monopoly, and therefore would be better "regulated" through competition instead of administrative price-setting. Congress, although unwilling to impose comprehensive national reform, nevertheless passed the Electricity Policy Act of 1992 (EPAct), an important step toward opening up the grid to wholesale competitive providers. It required transmission companies to provide non-discriminatory access to the grid to all suppliers (subject to interconnection and reliability requirements). A number of states—California in the west and those in the east already operating their systems as parts of multistate balancing areas—took the opportunity provided by EPAct to initiate the move to competitive wholesale energy markets.[6] By 1998, there were such markets operating in five parts of the country: California, the mid-Atlantic states, New York, New England, and Texas (although, most of Texas is not subject to federal jurisdiction).

In the 20 years since, these markets have evolved significantly, although not necessarily in the same ways. In a companion paper, we examine in greater detail the differences among various markets and what they might signify for China. Our interest here is in how the restructuring of the sector affected regulatory models.

6 For the most part, the states that acted first to introduce wholesale (and, in some cases, also retail) competition into their electricity markets were those whose average costs of production were relatively high. There were several reasons for this, among them a lack of access to power from federal power authorities (e.g., the Tennessee Valley Authority [TVA] and the Bonneville Power Administration [BPA], which had been created originally to provide power to low-population density rural areas of the country), more stringent air quality requirements than in other states, and, as mentioned earlier, a misplaced reliance on high-cost nuclear power. These states saw in competition a real hope of reducing costs, spurring innovation, and expanding customers' service choices. Whether they have been successful remains a matter of debate and, therefore, of continuing reform efforts.

2.3 Regulatory Authority in the United States

The United States is a federation of states and a central government. The Constitution describes the rights and responsibilities of state governments and their relationship to the federal government. As a general matter, the Constitution allows federal intrusion into private economic activity only where interstate commerce is involved. Interstate transmission of electricity clearly meets this test and is therefore subject to federal regulation. The courts have also concluded that other parts of the electricity supply system that affect interstate commerce, notably wholesale energy transactions, fall under federal jurisdiction. Authority over all aspects of retail service (e.g., pricing, service quality, utility expenses and investments, facilities siting, and environmental performance) is reserved to the states.

2.3.1 Federal Regulation

The federal regulator, the Federal Energy Regulatory Commission (FERC), derives its authority from the Federal Power Act (1935) and its amendments. The Commission has jurisdiction over the prices and service standards for interstate transmission services and bulk power transactions—both what is charged to utilities or generators[7] and what is charged to individual industrial consumers who buy power directly at transmission voltages. Its central task is to assure that wholesale prices are "just and reasonable," which is generally understood to mean that they are as low as possible yet sufficient to cover all the provider's prudently incurred costs of providing service, including a fair rate of return on investment. In so doing, it protects interstate commerce against abuses of market power—specifically, it prohibits state or utility actions (e.g., unfair pricing or discriminatory barriers to market entry) that will in some way give an economic advantage to some (usually in-state) buyers and sellers over other (usually out-of-state) buyers and sellers.

Competitive wholesale markets that function within multistate, synchronously operated grids are regulated by FERC because they affect (or are affected by) interstate commerce.[8] FERC has not been given authority by Congress to create such markets (and therefore that power resides in state law) but, once such markets are established, FERC's jurisdiction applies. FERC's interest then lies in assuring that the markets are competitive, that no participant can exercise market power. So long as that is found to be the case, FERC can declare the prices that the market produces are "just and reasonable," on the accepted principle that competitive markets meet demand for service at the lowest possible cost—that is, that the outcomes are most economically efficient.

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7 Under federal law, the transmission system must be accessible to any generator that wants to use it. This is accomplished commercially through an "open access transmission tariff," which requires owners of transmission to provide all users of the system service under the same terms and conditions that they (the transmission owners) provide it to themselves.

8 Hawaii, parts of Alaska, and most of Texas are served by grids that are not synchronously interconnected to other states or countries. They are therefore not subject to FERC authority.

Many entities manage the minute-to-minute coordination of electricity supply with demand: regional transmission organizations (RTOs), independent system operators (ISOs), and individual utility control areas. RTOs and ISOs are very similar (they differ primarily on the legal bases under which they were created) and for our purposes here we treat them as the same thing. Both are voluntary organizations that plan, operate, dispatch, and provide open-access transmission service under a single, FERC-approved tariff. Each is the control area for its region, assuming this role for all transmission-owning members, who turn over control of their systems to the RTO/ISO. ISOs/RTOs also purchase balancing services, and they manage various markets for energy and other grid services. To accomplish their mission, ISOs/RTOs must have functional control of the transmission system. Their purpose is to foster competitive neutrality in wholesale electricity markets and reliability in regional grid systems.

Not all parts of the United States are served by ISOs/RTOs. Some, mainly in the west and southeast, are managed by individual utilities and some by the federal power marketing agencies.[9] These are called "control areas" or "balancing authorities." In the west, there is no region-wide RTO or ISO (the California ISO has recently taken steps to serve states to its north and east), and the individual control area operators must coordinate with each other to ensure region-wide reliability. Although the western United States has had a history of bilateral cooperation between control area operators, the proliferation of wind generation has motivated a new level of interest in some market solutions to managing resources in a least-cost manner. A number of utilities, with support of some state regulators, are implementing an Energy Imbalance Market that will enable exchanges of excess generation from one control area to address high costs or shortages of generation in other areas, in ways that may be more efficient than possible under traditional relationships.

Whether served by an RTO, an ISO, or a utility control area operator, all places have some form of a wholesale market for power under the supervision of FERC. A utility market may have a single buyer, whereas an ISO/RTO will tend to have many buyers. FERC's Order 1000 on regional system planning applies to control area operators, and specifies objectives for inter-control-area planning.

Federal Oversight of Competitive Markets

There are seven RTOs/ISOs in the United States, each with market structures whose degree of reliance on competitive mechanisms is uniquely its own. We do not go into the nuances of market design here,[10] but rather focus on the role of regulators in ensuring that the markets function as intended.

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9 Federal power marketing agencies (PMAs) were created by Congress to sell power produced by federal dams. In some cases, they have also been given authority to build and own thermal power plants. These federal PMAs include the BPA, the Southeastern Power Administration, the Southwestern Power Administration, and the Western Area Power Administration. The TVA is technically not a PMA, but operates in much the same way. Generally, the PMAs only sell power at wholesale to local, vertically integrated utilities or local distribution utilities. However, BPA and TVA also operate extensive transmission grids, serving numerous local distribution utilities.

10 See the companion brief "Electricity Wholesale Markets" for an overview of competitive wholesale markets in the United States.

The government's primary objective is that the markets be competitive—that is, free of abuses of market power and meeting demand for service at the lowest possible cost. A necessary characteristic of competitive markets is that they are liquid—that is, populated by sufficient numbers of buyers and sellers. Liquidity is a critical protection against exercises of market power, although not the only one. A prerequisite for liquidity is ease of entry into the market. All market participants must be subject to the same eligibility rules (relating to, among other things, corporate credit-worthiness, technical expertise, interconnection requirements, and so forth), but the rules must be no more burdensome than is necessary to ensure that participants can, in fact, deliver desired services, and they must not be written so as to unfairly favor certain kinds of resources over others.

FERC's authority to oversee competitive markets and penalize market manipulation was clarified in the EPAct of 2005. In 2008, FERC acted to improve the competitiveness of those markets. It set new rules for (1) demand response and the use of market pricing to incentivize demand response during times of system stress (i.e., when there are shortages in operating reserves); (2) long-term power contracting; (3) market monitoring; and (4) ISO/RTO governance.[11]

It is only through the gathering and analysis of market data that FERC can determine whether a particular market is competitive and, as a consequence, that its prices are "just and reasonable." Each ISO/RTO has a "market monitoring unit" (MMU) that is separate from its market operations. In 2008, FERC required each ISO/RTO to provide its MMU with market data, resources, and personnel sufficient to carry out its duties, and required MMUs to report directly to their ISO/RTO boards of directors. FERC also ordered that the MMUs take on additional responsibilities:

- Identifying ineffective market rules and recommending proposed rules and tariff changes.
- Reviewing and reporting on the performance of the wholesale markets to the ISO/RTO, the Commission, and other stakeholders and interested parties.
- Notifying the Commission of instances in which a market participant's or the ISO/RTO's behavior may require investigation.

An ISO/RTO's wholesale market design document and associated rules constitute the tariff that is subject to FERC's jurisdiction. Where it finds market power abuse, FERC will direct the ISO/RTO to amend its market rules to remedy the problem. It also has the authority to fine parties guilty of exercising market power up to $1 million per day per violation.

11 FERC Order No. 719 (and 719-A), 2008.

2.3.2 State Regulation

States regulate all aspects of the power sector that relate ultimately to retail service; most prominent among them are the following:

- Utility revenues and retail prices: The setting of prices is the core regulatory function.
- Portfolio standards: Many states have established requirements for the resource mix that must be used to provide service. These "portfolio standards" require providers to meet a certain percentage of their sales with designated resource types, typically renewable resources.
- Resource acquisition: Utility planning and investment is subject to regulatory review and approval.
- End-use energy efficiency: About half of the states have directives related to energy efficiency, which is recognized as a least-cost resource for meeting consumer needs.
- Service standards and quality: Regulators adopt specific standards for voltage, frequency, and other technical requirements, generally based on industry standards. They also set interconnection standards for distributed energy resources. And they set service quality performance standards, based on indicators such as the frequency and duration of outages or the speed of response to customer reports and complaints.
- Siting and environmental compliance: As part of the investment approval process, regulators will often have authority over the siting of new facilities, which addresses questions of land use and, often, the impacts on air and water quality.

State law requires that retail prices be "just and reasonable," which means, as it does in federal law, that they are as low as possible yet sufficient to cover the utility's costs. Price-setting in this manner is called "cost-of-service regulation."[12] It doesn't guarantee that costs will be fully recovered, but it does give the well-managed company a reasonable opportunity to recover its costs and earn returns for its investors (whether private or public). The rate-making process can be initiated at any time, by the regulators themselves, at the request of other government entities as the law allows, or at the request of the utility in question.

For most of US utility history, the rate-making process has been one of price-setting only; whether a utility in fact collected revenues sufficient to cover its costs depended on its sales levels and on its ability to manage its costs. Over the last 30 years, however, many states have reformed their rate-setting methods to focus on both prices and revenues. This emerged from an understanding of several things: (1) that utility behavior is driven by the manner in which actual revenues are determined: (2) that price-only regulation causes utilities to act in ways that are generally at odds with public policy objectives: and (3) that well-designed alternative regulatory methods reduce risks for both utilities and their customers. Revenue-based regulation (referred

12 Wholesale costs, of course, are components of the retail cost of service that state regulators use to set the prices that end-users pay. Under the "filed-rate doctrine," state regulators must accept the validity of wholesale prices set by FERC, for the purposes of retail price-setting. The filed-rate doctrine is a common law rule that obligates any entity that is required to file tariffs governing the rates, terms, and conditions of service to adhere strictly to those terms. It likewise prevents other regulatory authorities from changing or disregarding tariffs that are legally in force.

to as "decoupling"), which breaks the mathematic link between unit sales and revenues collected, has been widely adopted across the United States. It is often augmented by performance requirements that reward the utility for achievement of specified outcomes, such as service quality improvements, emissions reductions, and increased end-user efficiency of energy use, which would, under traditional price-based regulation, pose a threat to utility revenue collection.[13] This approach is referred to as "performance-based" or "incentive" regulation.

Revenue-based regulation has been applied primarily to the natural monopoly components of the system, that is, to the transmission and distribution (T&D) networks. This is true even in jurisdictions that remain vertically integrated. Generation costs—the costs of the commodity—are often recovered through prices that are separate from T&D prices and which are allowed to fluctuate (according to regulator-approved formulas) with changes in fuel costs. It is not unusual to see performance metrics applied to power costs as well, with rewards for utilities that meet cost-containment and other stated objectives. Where there are competitive markets for electricity, the commodity costs will also be recovered separately from the T&D costs, but it is market liquidity and customer choice that are expected to impose discipline on prices.

A number of states have developed integrated resource planning methods that value, from a broad societal perspective, the costs and benefits of alternative resource choices. The costs include, of course, the direct financial costs of generating and delivering electricity to end-users, but they can also include effects that are not easily monetized, for example, damage to the environment and public health. In some cases, the secondary economic effects of such damage are taken into account. The avoidance of such costs count as benefits to society, and can justify investment in sometimes higher-cost, clean energy resources. More than three decades' experience has shown that improvements in the efficiency with which electricity is used are very often less expensive—and more reliable—than generation. As a result, end-use energy efficiency is treated as a power system resource in these long-term plans.

When states divested utilities of their generation assets and required that the commodity be provided through competitive mechanisms, they gave up direct control over planning and investment in generation. Integrated resource planning persists in some of these "restructured" states, typically with a focus on the grid and distributed energy resources. States use other policy tools, such as renewable portfolio standards, feed-in tariffs, and emissions trading systems, to guide investment in preferred resources. In the northeast, for example, where all states but one have restructured their electric sectors, an emissions cap-and-trade regime (called the Regional Greenhouse Gas Initiative, established in 2009) requires all power plants that emit carbon dioxide to purchase (through auctions or secondary markets) allowances for every ton they emit. The revenues raised through the auctions are used by the states to invest directly in emissions-reducing measures, primarily end-use efficiency, in homes and businesses.

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13 This general approach to rate-making was recently piloted in Shenzhen and is now national policy for regulating T&D utilities in China. For a detailed examination of decoupling and performance-based regulation, see Lazar, J., Shirley, W., and Weston, R. (2011) Revenue Regulation and Decoupling: A Guide to Theory and Application. Montpelier, VT: The Regulatory Assistance Project. Retrieved from: http://www.raponline.org/knowledge-center/revenue-regulation-and-decoupling-a-guide-to-theory-and-application-incl-case-studies/

2.3.3 How Do Regulators Regulate?

Regulatory procedures at both the state and federal levels are quite similar. Regulation is a legal process in which evidence and testimony are subjected to close examination by affected parties and by the regulators themselves. Regulators thus determine the facts that are relevant to the issue before them, and decide on the outcome in accordance with applicable law. Their decisions have the force of law—that is, they must be obeyed. They are subject to appeal in state courts or, in the case of FERC decisions, in federal court. Appellate courts are generally reluctant to overturn a regulatory decision. They give it deference in their review, because the regulator is an expert on the matters in question, but that deference extends only so far. If they find that the regulators have exceeded their statutory authority, misinterpreted the law, or conducted an unfair process, the appellate courts will order appropriate remedial action.

Effective regulation depends on the availability of accurate and reliable information. It comes to the regulators through the testimony and evidence of the affected parties, primarily the regulated utilities and market actors, but also other government agencies charged with representing the public interest (e.g., consumer advocates, energy policy offices, and environmental regulators) and private and non-governmental entities (such as large industrial customers, environmental organizations, low-income advocates, and, in some cases, individual citizens). The utilities, of course, possess the most information, the most data, as they are the central actors in the electric sector. Under US law, regulators have full and complete access to that information. All information (technical, financial, managerial, and so forth) that is relevant to the regulated service must be provided by the utilities to the regulators when so directed.

The accuracy and reliability of that information, and of any information provided by parties to a regulatory proceeding, are tested through rigorous examination by the regulators and the other parties. Consequently, parties must present information that can be defended, if they are to persuade the regulators to decide in their favor. The information is typically quite detailed and complex. It usually consists of financial statements, project cost analyses, outputs from power planning and operations models, environmental impact statements, technology assessments, demand forecasts, fuel price forecasts, and so on. The review process is aimed at determining fact (or, perhaps more accurately, what is true or highly likely to be true), on the basis of which a decision can be made in accordance with the law. And the regulators' decisions too must be able to be defended; for this reason, they are written, with detailed citations to the evidentiary record, and made public.

In sum, the notable features of energy regulation in the United States are (1) that it relies on an open and public process; (2) that it adheres to well-understood, established practices; (3) that it subjects testimony and evidence to rigorous examination by the affected parties and the regulator; and (4) that it applies the law in a consistent manner. When parties and the public can observe what is going on and when decisions are within the range of reasonable expectations, risks are reduced and the likelihood of good outcomes is increased.[14]

14 For more detail on regulatory practices in the United States, see Lazar et al., 2016.

3 Key Insights and Recommendations, and Topics for Further Inquiry

The first requirement of any regulatory body is that it possess sufficient authority to do its job. A second requirement is that it has the capacity and resources to do so.

A characteristic of all effective regulatory regimes is predictability—that is, the affected parties understand what is expected of them (what they are required to do), know what the rules are (how they can perform their duties), and can expect that the rules will be applied consistently. Predictability decreases risk and increases the likelihood of the system functioning as desired. A corollary to this is transparency—that regulatory processes and decision-making are not "hidden behind closed doors." Openness serves the goal of predictability, as it requires (1) that both stakeholders and decision-makers act consistently, and (2) that regulatory decisions be based on verifiable facts.

A principal lesson to be drawn from US experience (and from experience elsewhere in the world) is that regulated entities—grid companies, generators, third-party suppliers, and the like—respond to the regulatory requirements imposed on them. By this we mean that every regulation creates limitations on what the regulated entity can do, but every regulation also gives the entity incentives to act in ways (driven generally by the desire to maximize net income, or earnings) that may or may not promote the public interest. Regulated entities will take those actions that most benefit their principal constituencies—owners (shareholders, government) and management—while meeting (or merely attempting to meet) the requirements of the regulations.

What this means is that all regulation is incentive regulation. The important thing for regulators is to understand what the incentives are and then design a regulatory approach that rewards the regulated entities (grid companies, generators, others) for desired behavior and achievement of public policy objectives.

Another insight is that policy and planning on the one hand and competition on the other are not mutually exclusive. Competitive markets are generally quite good at minimizing electric commodity costs, but they have not, in the absence of public policy and integrated resource planning, proven effective at delivering diversified, environmentally sustainable resource portfolios. California, Texas, and New England have demonstrated that the combination of public policies in support of renewables and end-use energy efficiency and well-designed competitive means to acquire these and other resources has transformed their electric sectors, and put them on trajectories to long-term economic and environmental sustainability.

A third insight is that energy policy is inextricably tied to environmental policy. The effectiveness, and cost-effectiveness, of each depends on an integrated approach to both. An environmental policy, for instance, that focuses only on smokestacks might be effective at reducing local air pollution, but it will have the unwanted effect of producing more greenhouse gas emissions (because smokestack controls reduce the efficiency of the underlying industrial process). In conjunction with a host of complementary and often less expensive ways of reducing air pollution, however—that is, through increased investment in end-use energy efficiency and renewables—it becomes a component in a multi-pollutant strategy that not only improves public health but also saves customers money. Similarly, an energy policy that requires power planners to design and operate the system so as to minimize both system costs and emissions will reveal new and least-cost ways of meeting demand and avoiding environmental damage. This extends as well to questions of market design and competition. Failure to understand how a particular environmental policy will affect market behavior and costs can result in altogether unwanted outcomes.

Document #9 calls for better governance and regulation, especially with respect to regulatory capacity, regulatory methods, and system planning. China's adoption of revenue-based rate-making for T&D is one important step toward this goal. As the reform effort deepens, however, not only China's methods of regulating, but also its institutional capacity to do so will be in need of improvement. Key areas in need of regulatory attention include:

- Process. It should be transparent, predictable, and open.
- Jurisdiction. Authority and the allocation of authority between central and provincial regulators should be clearly set out in law.
- Methods. The central objectives of price-setting are economic efficiency and fairness. There are different approaches to pricing for different elements of service:
    - o Price-and revenue-setting for monopoly services.
    - o Pricing of competitive services.
    - o Protection of vulnerable customer groups.
- Resource planning and procurement. There should be a clear process, clear roles and responsibilities, and an explicit link among planning, investment decisions, and project approval.
- Overcapacity and potentially unrecovered ("stranded") costs. Should the above-market costs of non-competitive generation be recovered and, if so, how? Who should pay those costs?
- Resource adequacy. How can resource adequacy be assured in an environment of both competitive and non-competitive resources?

- System operations. What should be done to improve the following?
  - o Generator dispatch and compensation reform.
  - o Integration of demand response and variable resources (renewables) into system operations.
  - o Flexibility resources and ancillary services.
- Competitive mechanisms. How can policymakers design and oversee markets so as to achieve regulatory and other public policy goals and prevent abuses of monopoly power?
- Integration of energy and environmental policy and regulation. How should the power sector be regulated so as to advance China's air quality and climate change goals, and how should environmental policy be set so as to complement China's energy and economic objectives?

This list, by no means comprehensive, also suggests topics for possible research and analysis.

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