



OVERVIEW

# Rethinking **Power Sector Reform** in the Developing World



SUSTAINABLE INFRASTRUCTURE SERIES

OVERVIEW

# Rethinking Power Sector Reform in the Developing World

*Vivien Foster and Anshul Rana*

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# Foreword



Thirty years ago, a new paradigm emerged to fundamentally alter power sector organization. It aimed to improve the financial and operational performance of utilities, ensure reliable power supply, and attract private sector participation and fair market forces while setting up the public sector to take on a regulatory role.

Yet, after almost three decades, only about a dozen developing countries have been able to fully implement the 1990s model. For many countries, the model simply did not fit the economic preconditions of their power sector; for many others, the approach encountered political challenges in implementation. Many of those who have adopted the reforms have done so selectively, leading to a situation where elements of market orientation coexist with a strong state presence—something the designers of the 1990s model did not anticipate.

Moreover, since the turn of the twenty-first century, the power sector has been overtaken by important policy shifts and momentous technological changes. In recent years, the world has embraced the Sustainable Development Goal on Energy (SDG7), which aims to achieve universal access to sustainable, affordable, and modern energy by 2030. We are also witnessing a swift global transition to low-carbon and renewable energy sources in line with the Paris Accord's commitment to fight climate change. Technological disruption is ushering new, decentralized actors into the sector and reshaping business models.

However, the various reform approaches based on the 1990s model alone will not be sufficient to deliver on global energy objectives. We also need complementary, targeted policies to reach the 840 million people who live without access to electricity today and to rapidly increase the share of clean energy in the global energy mix.

*Rethinking Power Sector Reform in the Developing World* comes at a crucial time. The world is changing—and so must the power sector. The principles that guided policy makers and stakeholders in the 1990s remain strong today. Financial sustainability and good institutional governance in the power sector are still just as critical, even as the scope of private sector participation is increasing and technological disruptions and the benefits of competition energize the sector.

It is only natural that the reform approaches will need to be updated to support these changes.

This report offers a fresh frame of reference shaped by context, driven by outcomes, and informed by alternatives. It has three clear messages for policy makers and industry practitioners. First, reform approaches must be shaped by the political and economic contexts of individual countries. Second, reform approaches should be tailored to achieve desired policy outcomes. Finally, multiple institutional pathways to achieve the desired outcomes must be possible. There is no one-size-fits-all framework, and the particular needs and challenges of low-income and fragile environments deserve special consideration.

Our hope is that this report can refresh the thinking on power sector reform in the developing world; help deliver electricity access to those who need it most; and ultimately result in a clean, green, and financially sustainable power sector.

**Riccardo Puliti**

Global Director, Energy and  
Extractive Industries and

Regional Director, Infrastructure (Africa)  
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The wide scope of the report meant that a very large team of sector experts was involved in preparing each chapter, including many World Bank specialists complemented by external consultants.<sup>1</sup> These were based on the main themes of the project, namely: political economy of power sector reform, economic regulation of the power sector, wholesale power markets, utility reform, cost recovery, and disruptive technology.

- For the political economy theme, original research was done by a team led by Ashish Khanna and comprising Anton Eberhard, Catrina Godinho, Alan David Lee, Brian Levy, Zainab Usman, and Jonathan Walters.
- For the regulation theme, Katharina Gassner and Joseph Kapika led the team, which comprised Martin Rodriguez Pardina and Julieta Schiro of Macroconsulting Argentina, as well as Kagaba Paul Mukibi.
- For the power market theme, original research was conducted by a team led by Debabrata Chattopadhyay and comprising Hugh Rudnick and Constantin Velasquez from the University of Chile, as well as Tatyana Kramskaya and Martin Schroder.
- For the utility restructuring and governance theme, the team was led by Vivien Foster and comprised Joeri de Wit, Victor Loksha, and Anshul Rana, with advisory support from Pedro Antmann, Elvira Morella, Mariano Salto, and Pedro Sanchez.
- For the cost recovery theme, original research was conducted by a team led by Ani Balabanyan and comprising Joern Huenteler, Arthur Kochnakyan, Tu Chi Nguyen, Arun Singh, and Denzel Hankinson and Nicole Rosenthal of DH infrastructure. The analysis is based on a methodologically consistent set of financial models prepared for 25 utilities across 14 countries and 3 Indian states. The financial analysis was led by Arthur Kochnakyan,

<sup>1</sup> All names listed are World Bank staff unless otherwise stated.

supported by a team of independent consultants, including Emiliano Lafalla, Adrian Ratner, Vazgen Sargsyan, and Martin Tarzyan. The chapter was drafted by Joern Huenteler and Tu Chi Nguyen.

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- For the Arab Republic of Egypt, data collection and stakeholder interviews were conducted by Hafez el Salmawy as an independent consultant. Marwa Mostafa Khalil and Ashish Khanna provided valuable guidance and feedback.
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- For the Philippines, the data collection and stakeholder interviews were undertaken by Rauf Tan, an independent consultant. Yuriy Myroshnychenko provided valuable support and feedback, while Wali del Mundo acted as a reviewer.
- For Senegal, data collection and stakeholder interviews were conducted by Assane Diouf, an independent consultant, under the guidance of Anton Eberhard, Catrina Godinho, and Celine Paton of the University of Cape Town. Valuable support and guidance were provided by Manuel Berlengiero, Alioune Fall, Manuel Luengo, and Chris Trimble.

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- The report also benefited immensely from global databases including the World Bank Private Participation in Infrastructure Database (PPI 2018), the S&P Global Platts World Electric Power Plants Database, Regulatory Indicators for Sustainable Energy (RISE), *Tracking SDG7: The Energy Progress Report*, and other databases managed by the International Energy Agency (IEA) and the U.S. Energy Information Administration (EIA).
- The report was edited by Steven Kennedy. Final design was provided by Critical Stages, and typesetting was undertaken by Datapage.



## About the Authors



**Vivien Foster** is the Chief Economist for the Infrastructure Vice Presidency of the World Bank. Throughout her 20 years at the World Bank, she has played a variety of leadership roles and contributed to client dialogue, as well as advisory and lending engagements, in more than 30 countries across Africa, Asia, Europe, Latin America, and the Middle East. She has spearheaded several major policy research initiatives, including: *Water, Electricity, and the Poor* (2005), examining the distributional impact of utility subsidies; *Africa's Infrastructure* (2009), analyzing the continent's network infrastructure challenges; *Building Bridges* (2009), detailing China's growing role as infrastructure financier for Africa; *Tracking SDG7: The Energy Progress Report* (2013–18), a global dashboard for tracking progress toward the achievement of SDG7 goals for energy; and *Regulatory Indicators for Sustainable Energy (RISE)* (2016, 2018), monitoring worldwide adoption of good-practice policies to support sustainable energy. She is a graduate of Oxford University; she holds a master's degree from Stanford University and a

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## Background Papers



The report draws from 27 background papers that are being published on a rolling basis in the World Bank's Policy Research Working Paper series and can be accessed on the project website at [http://www.esmap.org/rethinking\\_power\\_sector\\_reform](http://www.esmap.org/rethinking_power_sector_reform).

The background papers include some that aim to paint a broad-brush picture of power sector reform across the developing world:

- Foster, V., S. Witte, S. Ghosh Banerjee, and A. Moreno. 2017. "Charting the Diffusion of Power Sector Reforms across the Developing World." Policy Research Working Paper No. 8235, World Bank, Washington, DC.
- Foster, V., and S. Witte. Forthcoming. "Evaluating Electricity Tariff Structure Design in the Developing World." Policy Research Working Paper, World Bank, Washington, DC.
- Considerable emphasis was placed on conducting thorough reviews of existing literature covering the main themes of this report, namely, utility reform, political economy of power sector reform, economic regulation of the power sector, wholesale power markets, and cost recovery. These reviews are published in the following set of background papers.
- Bacon, R. W. 2018. "Taking Stock of the Impact of Power Utility Reform in Developing Countries: A Literature Review." Policy Research Working Paper No. 8460, World Bank, Washington, DC.
- Huenteler, J., I. Dobozi, A. Balabanyan, and S. Ghosh Banerjee. 2017. "Cost Recovery and Financial Viability of the Power Sector in Developing Countries: A Literature Review." Policy Research Working Paper No. 8287, World Bank, Washington, DC.
- Lee, A. D., and Z. Usman. 2018. "Taking Stock of the Political Economy of Power Sector Reform in Developing Countries: A Literature Review." Policy Research Working Paper No. 8518, World Bank, Washington, DC.
- Pardina, M. R., and J. Schiro. 2018. "Taking Stock of Economic Regulation of Power Utilities in the Developing World: A Literature Review." Policy Research Working Paper No. 8461, World Bank, Washington, DC.
- Rudnick, H., and C. Velasquez. 2018. "Taking Stock of Wholesale Power Markets in Developing Countries: A Literature Review." Policy Research Working Paper No. 8519, World Bank, Washington, DC.

Detailed power market case studies were prepared for four countries from the Rethinking Power Sector Reform Observatory that were most advanced in the creation of wholesale power markets, namely, Colombia, India, Peru, and the Philippines.

- Rudnick, H., and C. Velasquez. 2019. "Learning from Developing Country Power Market Experiences: The Case of the Philippines." Policy Research Working Paper No. 8721, World Bank, Washington, DC.
- Rudnick, H., and C. Velasquez. 2019. "Learning from Developing Country Power Market Experiences: The Case of Colombia." Policy Research Working Paper No. 8771, World Bank, Washington, DC.
- Rudnick, H., and C. Velasquez. 2019. "Learning from Developing Country Power Market Experiences: The Case of Peru." Policy Research Working Paper No. 8772, World Bank, Washington, DC.
- Rudnick, H., and C. Velasquez. Forthcoming. "Learning from Developing Country Power Market Experiences: The Case of India." Policy Research Working Paper, World Bank, Washington, DC.

The background papers also include detailed country case studies that provide a narrative of the reform dynamics for each country in the Rethinking Observatory and evaluate the impact of reforms on key dimensions of sector performance.

- Bacon, R. W. 2019. "Learning from Power Sector Reform: The Case of Pakistan." Policy Research Working Paper No. 8842, World Bank, Washington, DC.
- Bacon, R. W. 2019. "Learning from Power Sector Reform: The Case of the Philippines." Policy Research Working Paper No. 8853, World Bank, Washington, DC.
- Bacon, R. W. Forthcoming. "Learning from Power Sector Reform: The Case of Ukraine."

Policy Research Working Paper, World Bank, Washington, DC.

- Godinho, C., and A. Eberhard. 2019. "Learning from Power Sector Reform: The Case of Kenya." Policy Research Working Paper No. 8819, World Bank, Washington, DC.
- Godinho, C., and A. Eberhard. 2019. "Learning from Power Sector Reform: The Case of Uganda." Policy Research Working Paper No. 8820, World Bank, Washington, DC.
- Godinho, C., and A. Eberhard. Forthcoming. "Learning from Power Sector Reform: The Case of Tanzania." Policy Research Working Paper, World Bank, Washington, DC.
- Khurana, M. Forthcoming. "Learning from Power Sector Reform: The Case of Andhra Pradesh." Policy Research Working Paper, World Bank, Washington, DC.
- Khurana, M. Forthcoming. "Learning from Power Sector Reform: The Case of Rajasthan." Policy Research Working Paper, World Bank, Washington, DC.
- Khurana, M. Forthcoming. "Learning from Power Sector Reform: The Case of Odisha." Policy Research Working Paper, World Bank, Washington, DC.
- Lee, A. D., and F. Gerner. 2019. "Learning from Power Sector Reform: The Case of Vietnam." Policy Research Working Paper, World Bank, Washington, DC.
- Paton, C., C. Godinho, and A. Eberhard. Forthcoming. "Learning from Power Sector Reform: The Case of Senegal." Policy Research Working Paper, World Bank, Washington, DC.
- Rana, A. 2019. "Learning from Power Sector Reform: The Case of the Dominican Republic." Policy Research Working Paper, World Bank, Washington, DC.
- Rana, A., and A. Khanna. 2019. "Learning from Power Sector Reform: The Case of the Arab Republic of Egypt." Policy Research Working Paper, World Bank, Washington, DC.

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  - Rudnick, H., and C. Velasquez. Forthcoming. "Learning from Power Sector Reform: The Case of Colombia." Policy Research Working Paper, World Bank, Washington, DC.
  - Usman, Z. 2019. "Learning from Power Sector Reform: The Case of Morocco." Policy Research Working Paper, World Bank, Washington, DC.



# Abbreviations



BOO	build, own, operate
BOT	build, operate, transfer
EIA	Energy Information Administration
ESMAP	Energy Sector Management Assistance Program
EVN	(national utility of Vietnam)
GNI	gross national income
HHI	Herfindahl-Hirschman Index
IEA	International Energy Agency
IPP	independent power projects
IT	information technology
OECD	Organisation for Economic Co-operation and Development
PPA	power purchase agreement
PPI	Private Participation in Infrastructure Database
PPIAF	Public-Private Infrastructure Advisory Facility
PSP	private sector participation
RISE	Regulatory Indicators for Sustainable Energy
SAIFI	System Average Interruption Frequency Index
SDG7	Sustainable Development Goal 7
SOE	state-owned enterprises



## Key Messages



During the 1990s, a new paradigm for power sector reform was put forward that emphasized the restructuring of utilities, the creation of regulators, the participation of the private sector, and the establishment of competitive power markets. Twenty-five years later, only a handful of developing countries have fully implemented these Washington Consensus policies. Across the developing world, reforms were adopted rather selectively, resulting in a hybrid model, in which elements of market-orientation coexist with continued state dominance of the sector.

This book aims to revisit and refresh the thinking on power sector reform approaches for developing countries. The approach relies heavily on evidence from the past, drawing both on broad global trends and deep case material from 15 developing countries. It is also forward looking, considering the implications of new social and environmental policy goals, as well as emerging technological disruptions.

A nuanced picture emerges. Regulation has been widely adopted, but practice often falls well short of theory, and cost recovery remains an elusive goal. The private sector has financed a substantial expansion of generation capacity. Yet, its contribution to power distribution has been much more limited, and its performance on efficiency can sometimes

be matched by well-governed public utilities. Restructuring and liberalization have been beneficial in a handful of larger middle-income nations but have proved too complex for most countries to implement.

Based on these findings, the report points to three major policy implications.

- **Context dependence.** First, reform efforts need to be shaped by both the political and economic context of the host country. The 1990s reform model was most successful in countries that had reached certain minimum conditions of power sector development and offered a supportive political environment. When these same reforms were adopted in more challenging environments, the risk of policy reversal was high, while successful outcomes were by no means guaranteed. The 1990s approach to power sector reform is more compatible with political systems that are based on a market-oriented ideology and contestable power structures. Economic preconditions include a relatively large power system at a high level of electrification with good operational and financial data and a well-functioning framework of tariff regulation.

The report proposes a two-track approach, with countries in more challenging environments focusing on governance

reforms and the achievement of financial viability, while more ambitious structural reforms are deferred until systems are at a more mature stage of development.

- **Outcome orientation.** Second, reform efforts should be driven and tailored to desired policy outcomes and less preoccupied with following a predetermined process. Since the 1990s, countries' policy objectives for the power sector have widened beyond security of supply and fiscal sustainability to encompass important social and environmental goals, such as universal access and power sector decarbonization. The evidence indicates that Washington Consensus reforms alone will

not deliver on twenty-first-century policy objectives; they need to be complemented by more targeted policy measures.

- **Pluralist approaches.** Third, countries found alternative institutional pathways to achieving good power sector outcomes. Among the best-performing power sectors in the developing world are some that decisively implemented the 1990s reform model and others that retained a dominant and competent state-owned utility, guided by strong policy objectives, and combined this with a more gradualist and targeted role for the private sector. This evidence makes a case for greater pluralism of approaches going forward.



# Overview: Key Findings and Policy Implications



## INTRODUCTION

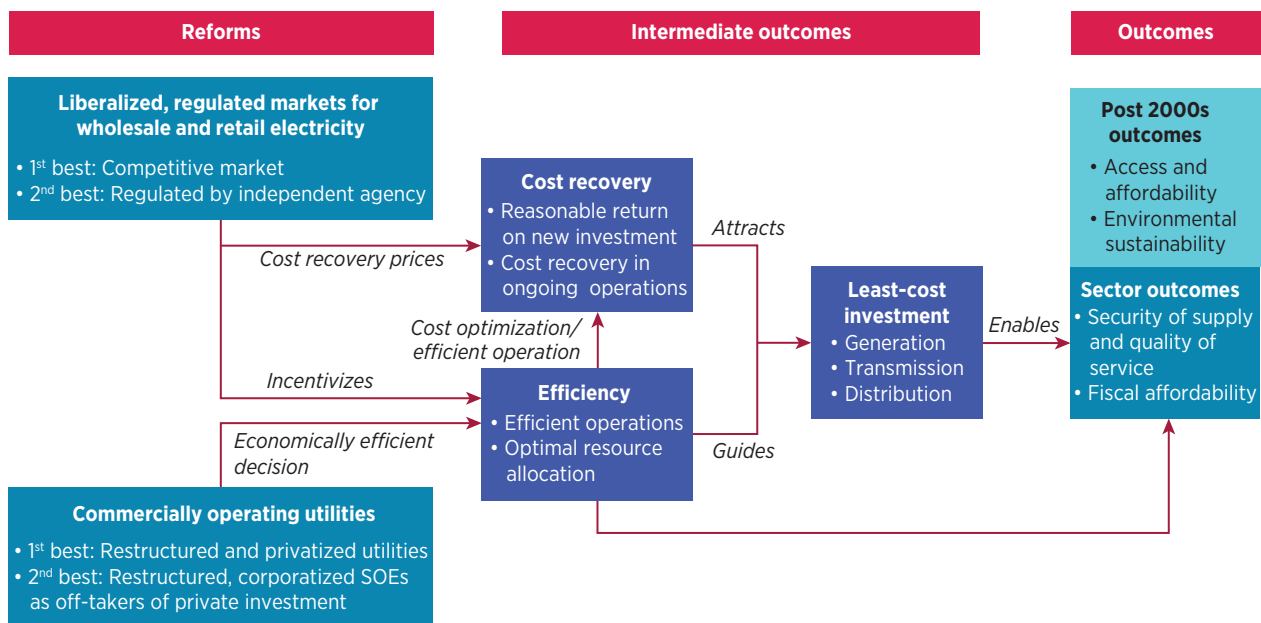
**During the 1990s, a new paradigm for power sector organization grew out of the wider “Washington Consensus” on development and was spearheaded by multilateral institutions.** The new paradigm came on the heels of growing dissatisfaction with state-owned utilities (Bacon and Besant-Jones 2001). These vertically integrated monopolies had successfully supported the rollout of national infrastructure networks in many countries during the 1960s–80s but had begun to show limitations in the form of inefficient operations, burgeoning subsidies, and financing constraints. The 1990s power sector reform model comprised a package of four structural reforms:

- Regulation (through the creation of an autonomous regulatory entity)
- Restructuring (entailing corporatization and full vertical and horizontal unbundling of the utility)
- Private sector participation (particularly in generation and distribution)
- Competition (ultimately in the form of a wholesale power market).

The 1990s reform model was based on the idea that reforms would lead to beneficial behavior change among the key sector actors, resulting in improved sector performance.

Behavior changes when private management is introduced. Private management reorients enterprises from bureaucratic and political incentives to profit-seeking, cost-control, and customer orientation. Market pressure or regulatory incentives would discipline any potential for private management abuses. The private sector and the regulator would prevent day-to-day political interference. The combination of stronger commercial incentives, competitive pressures, and regulatory oversight was expected to improve the efficiency and cost recovery of power utilities. The resulting decline in state subsidies and increase in financial viability would make possible the major investment programs needed to achieve security of supply in fast-growing power systems (World Bank 1993). This thought process is presented as a theory of change underpinning the 1990s reform model in figure O.1. The theory of change is used as a conceptual framework for evaluating the model’s efficacy in this study. By 2015, the adoption of Sustainable Development Goal 7 (SDG7) and the Paris Climate Accord had broadened the policy objectives for the power sector, bringing a new focus on electrification and decarbonization, goals that had not been envisaged in the 1990s.

**The aim of this study is to revisit, refresh, and update thinking on power sector reform in developing countries in**

**FIGURE O.1** The 1990s model was based on an underlying theory of change

Source: World Bank.

Note: SOEs = state-owned enterprises.

**the light of historical evidence and future trends.** The prescriptions of the 1990s reform model were primarily derived from economic theory and principles. By the early 2000s, it had become clear that the model was not universally applicable in practice (Besant-Jones 2006). We now have a quarter-century of empirical evidence against which to evaluate the approach. The case for such an evaluation hinges both on the practical difficulties encountered with the application of the model in the developing world, as well as on the significant changes in policy objectives. At the same time, the emergence of disruptive technologies raises questions about how the recommendations of the 1990s model may need to be adapted going forward.

**Relying on a rich new evidence base, the study looks back over 25 years of experience with power sector reform across the developing world.** The approach is heavily evidence-based, drawing on reform

efforts and performance in 88 developing countries, complemented by a Power Sector Reform Observatory that provides deep-dive studies of 15 countries.<sup>1</sup> Countries are not judged for the reforms they have undertaken but rather for the results they have delivered. Sector outcomes are evaluated along multiple dimensions, including traditional objectives such as security of supply, as well as the new policy agenda focusing on electrification and decarbonization.

**At the same time, the study looks ahead to the technological disruptions sweeping the power sector, developments that are challenging conventional wisdom about sector organization and structure.** Traditionally, power systems have developed around centralized infrastructure designed to reap economies of scale and achieve simultaneous balancing of supply and demand through the one-way flow of power to passive consumers. However, the current wave of

innovations—including decentralized renewable energy, battery storage, and digitalization—empowers consumers and other decentralized actors to participate in the production of electricity and in so-called demand-response services,<sup>2</sup> generating reverse flows along power networks and introducing the possibility of trade at the retail level. Moreover, as large-scale battery storage becomes increasingly flexible and cost-effective, the need for power systems to simultaneously match supply and demand will recede.

**The purpose of this overview is to summarize the lessons from the study and reflect upon their implications for future practice.** Ten key findings are followed by the policy implications of those findings. The comprehensive analysis contained in the main report begins with a survey of the uptake of the 1990s power sector model by developing countries, considering both the economic and political drivers of reform. Attention then turns to the implementation of each of the fundamental building blocks of the reform model: sector restructuring and governance; private sector participation; regulation; and market liberalization. Thereafter, reform measures are evaluated in terms of their impacts both on intermediate sector outcomes (such as efficiency and cost recovery) and on final sector outcomes (such as security of supply, access and affordability, environmental sustainability).

**The study suggests that future reforms should be shaped by context, driven by outcomes, and informed by alternatives.** The 1990s reform model is sometimes misconstrued as a universally applicable policy prescription. However, the findings reported here suggest instead that the 1990s model contains valuable insights that can support improvements in efficiency, cost recovery, and security of supply when deployed in the right circumstances and for the right reasons. However, economic and political preconditions are found to be important determinants of the success of reforms; these deserve closer

consideration when determining the appropriate reform path for each country. Reform choices also need to be guided by desired sector outcomes, notably, with respect to decarbonization and universal access objectives. Fortunately, good sector outcomes can be achieved in a variety of institutional settings, as the experience of developing countries around the world has shown. Those settings will be tested, as new business models emerge in response to the technological disruptions that are reshaping the economic logic of the sector.

## KEY FINDINGS

This section summarizes the most relevant and interesting results of the study in the form of 10 key findings.

- *Finding #1.* Uptake of power sector reform in the developing world did not evolve according to the textbook model.
- *Finding #2.* Power sector reforms were more likely to gain traction if they were consistent with the country's political system and ideology and led by champions enjoying broad stakeholder support.
- *Finding #3.* The private sector made an important contribution to expanding power generation capacity in the developing world, albeit with significant challenges along the way.
- *Finding #4.* Wholesale power markets helped improve efficiency in the minority of countries that was ready for them; many others found themselves stuck in transition.
- *Finding #5.* Good corporate practices, particularly with respect to human resources and financial discipline, were associated with better utility performance; these were more prevalent among privatized utilities.
- *Finding #6.* Private sector participation in power transmission and distribution delivered good outcomes in favorable settings; elsewhere, it was susceptible to reversal.
- *Finding #7.* Regulatory frameworks have been widely adopted, but implementation

has often fallen far short of design, particularly when utilities remained under state ownership.

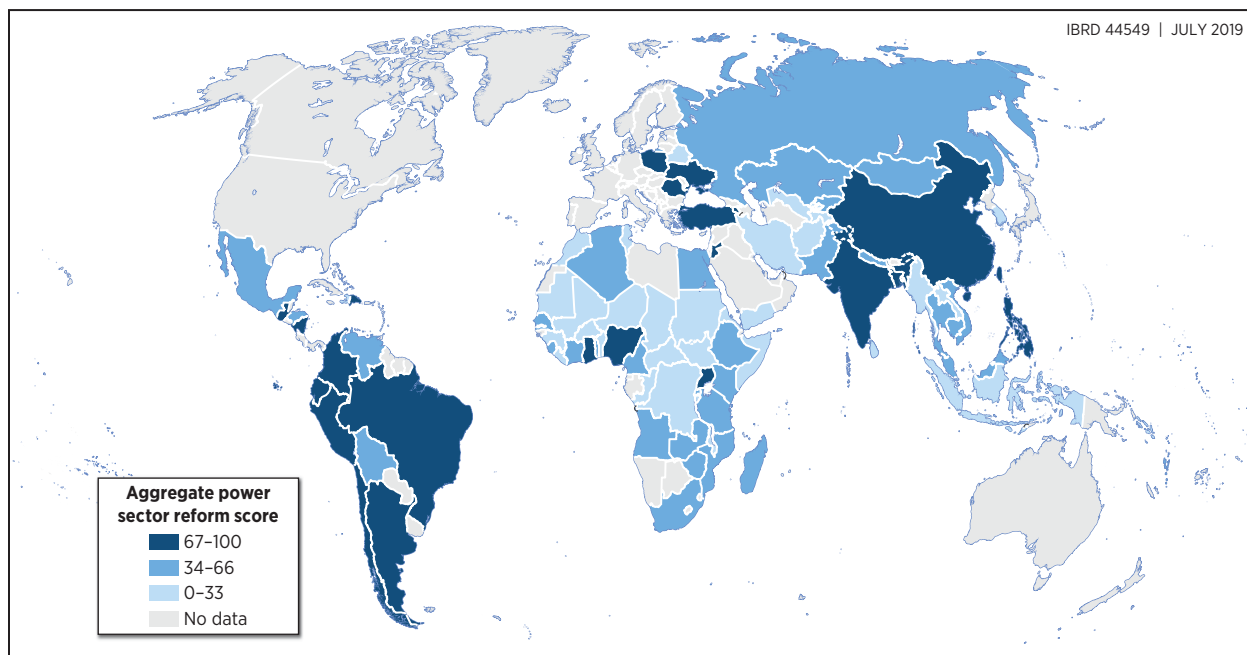
- *Finding #8.* Cost recovery has proved remarkably difficult to achieve and sustain; the limited progress made owes more to efficiency improvements than to tariff hikes.
- *Finding #9.* The outcomes of power sector reform were heavily influenced by the starting conditions in each country.
- *Finding #10.* Good sector outcomes were achieved by countries adopting a variety of different institutional patterns of organization for the sector.

**Finding #1: Uptake of power sector reform in the developing world did not evolve according to the textbook model**

**The diffusion of power sector reform in the developing world was strongly affected by contextual factors.** The 1990s

power sector reform model spread rapidly across both the developed and developing worlds. A quarter-century later, however, the patterns of adoption are quite different. Organisation for Economic Co-operation and Development (OECD) countries have adopted (on average) close to 80 percent of the 1990s policy prescriptions, although with some notable exceptions. The degree of adoption in the developing world is much lower at under 40 percent. The level of uptake differs systematically according to the geographical, economic, and technical characteristics of countries (map O.1).<sup>3</sup> Specifically, reform adoption is twice as high in Latin America relative to the Middle East, in middle-income relative to low-income groups, and in countries with larger power systems relative to smaller ones. Moreover, the momentum of reform slowed markedly over time, with uptake more limited during the decade from 2005–15 than from 1995–2005.

**MAP O.1** Power sector reform spread unevenly across the developing world



Sources: World Bank elaboration based on Rethinking Power Sector Reform utility database 2015; Regulatory Indicators for Sustainable Energy 2016.

**As a result, reform implementation diverged from the theoretical paradigm.**

Overall, barely a dozen developing countries were able to implement the 1990s model in its entirety. Instead, most are stuck at an intermediate stage of implementation, sometimes referred to as the “hybrid model” (Eberhard and Gratwick 2008). A further quarter of developing countries—including many small, low-income, and fragile states—have barely begun to reform their power systems. Underlying this partial implementation has been a tendency to cherry-pick components of the 1990s model that were easier to implement, while leaving others aside. Creation of a regulatory entity and private sector participation in generation through independent power projects (IPPs) were, by far, the two most popular reforms, adopted by more than 70 percent of developing countries; the uptake of other reforms was much lower. This à la carte approach to reform does not sit well with the original conception of the 1990s model as a coherent package of mutually supportive reform measures. It meant that countries ended up with contradictory reform combinations, such as private sector participation in distribution without a regulator—or, more frequently, the other way around.

**Finding #2: Power sector reforms were more likely to gain traction if they were consistent with the country’s political system and ideology and led by champions enjoying broad stakeholder support**

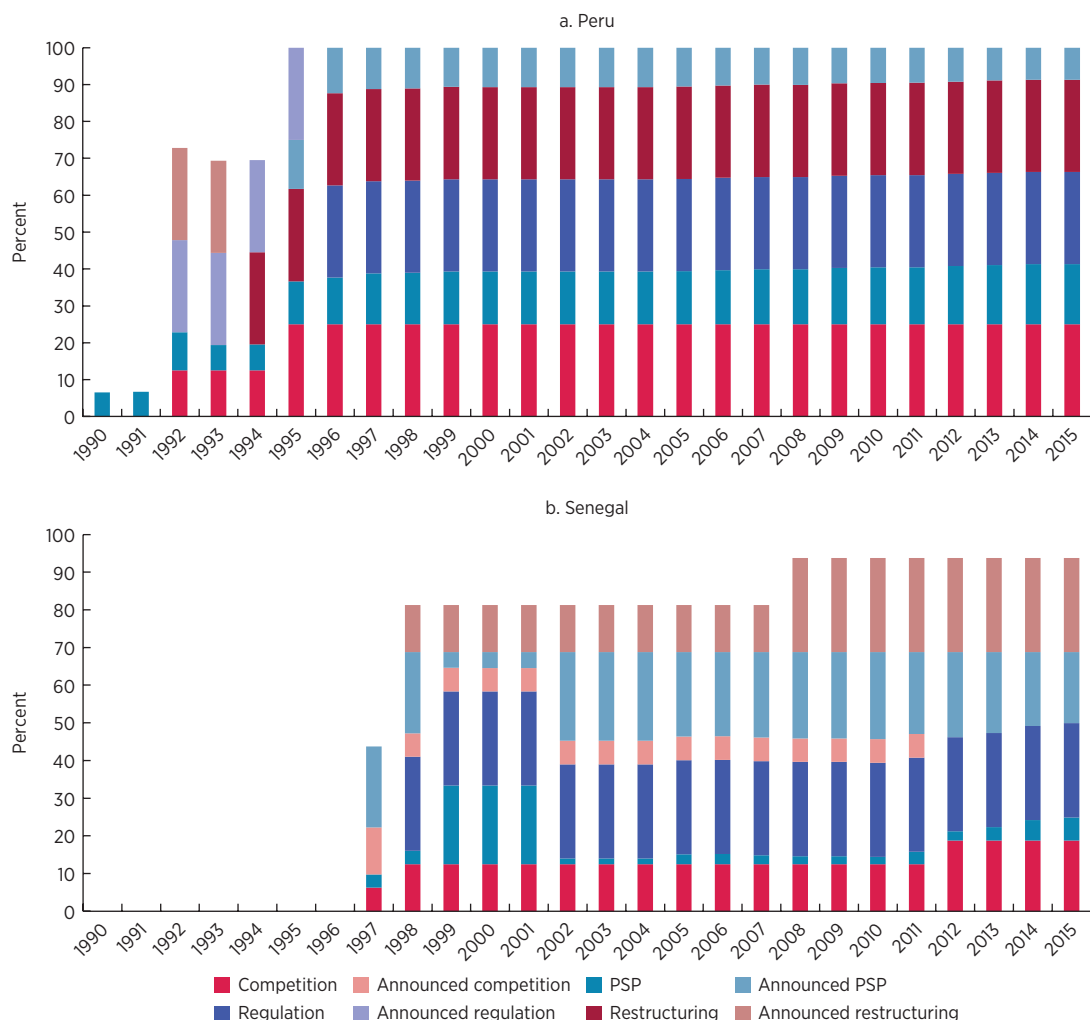
**The 1990s reform model drew heavily on economic first principles, with no explicit attention to the political dynamics of the reform process.** Yet, the reality is that the power sector is highly politicized across much of the developing world. Power utilities—with their significant employment rolls and contracting volumes, as well as their ability to direct valued electricity services to different

communities—are a natural focus for patronage politics. Moreover, the cost and quality of electricity supply has the potential to become an electoral issue that can mobilize public unrest and topple governments.

**Power sector reforms almost always take place in the context of a crisis and often as part of a wider national transformation process.** There are few examples of countries that reformed in the absence of a crisis or of countries that failed to reform when beset by crisis. The triggering events sometimes originated within the power sector, such as a drought or oil price shock or a situation of unsustainable utility debt. However, in many cases, the power sector was implicated in a wider national crisis, either linked to fiscal stabilization (such as tariff reforms in the Arab Republic of Egypt) or to socioeconomic transition (such as privatization in Ukraine). This finding underscores the fact that power sector reform does not take place in a vacuum; it needs to be understood in terms of the wider political and economic context.

**The trajectory of reform varies substantially across countries, with reform announcements providing no guarantee of sustained implementation.** The reform process typically begins with the public announcement of a reform program. Some countries then move rapidly toward implementing the full suite of reforms announced, as in the case of Peru (figure O.2a). In other cases, reforms rapidly lose momentum, with delivery falling well short of original aspirations and even being susceptible to reversal over time, as in the case of Senegal (figure O.2b). Overall, the gap between reform announcements and implementation can be quite considerable (figure O.3).

**Reform trajectories reflect the political dynamics around the power sector in each country, as well as the strategy adopted for reform implementation.** Although reforms are announced by countries

**FIGURE O.2** The trajectory of power sector reform followed different paths across countries

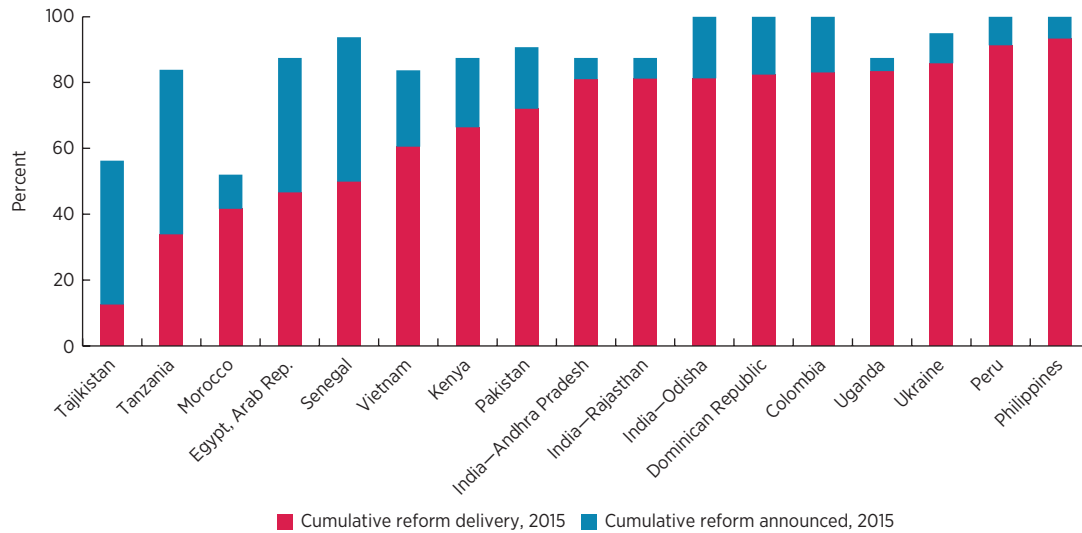
Source: World Bank elaboration based on Rethinking Power Sector Reform utility database 2015.

Note: PSP = private sector participation.

across the ideological spectrum, evidence suggests that those with a stronger market orientation are more likely to make meaningful progress with implementation. Similarly, reforms tend to proceed further in countries that have contestable or multipolar political systems, as opposed to those where power is more centralized. This is consistent with the observation that the reform process typically involves the delegation and decentralization of power by breaking up national monopolies,

delegating responsibility to regulators and private operators, and allowing new entry to competitive markets. The strategy for reform implementation at the sector level is also important. Countries that can mobilize a strong reform champion, ideally supported by a stable and competent bureaucracy, generally go further with sector reform. However, unless wider stakeholder alignment is achieved through outreach efforts and ultimately legislative support, reforms may prove

**FIGURE O.3** For some countries, the gap between reform announcement and implementation has been considerable



Source: World Bank elaboration based on Rethinking Power Sector Reform utility database 2015.

difficult to sustain and vulnerable to reversals of various kinds. Finally, while donors play an important role in introducing reform ideas and supporting their implementation, they do not seem to have much influence on a country's overall reform trajectory, which is rather shaped by local political factors.

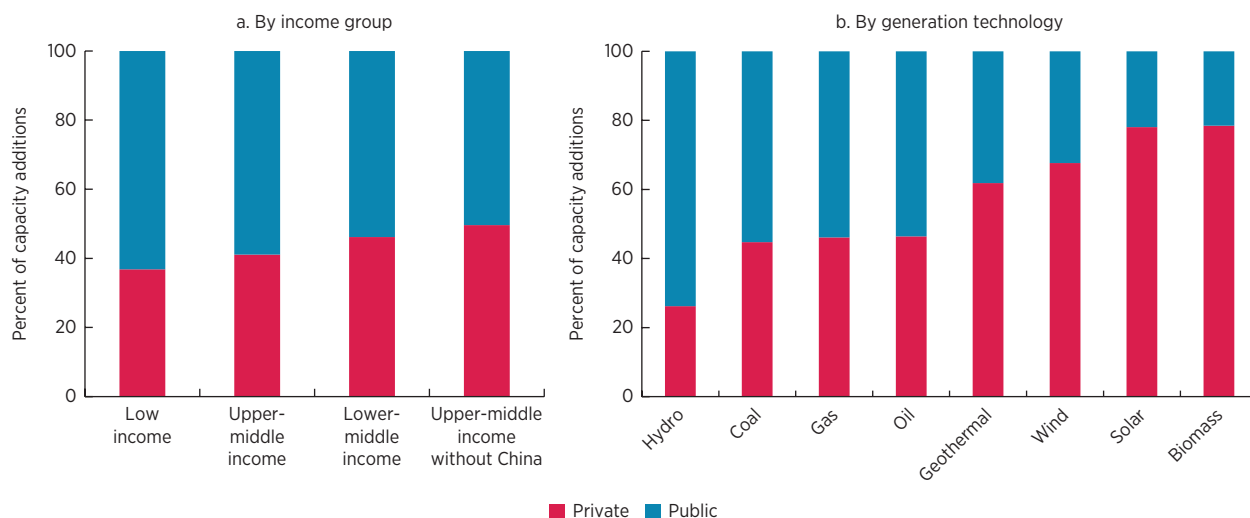
**Finding #3: The private sector made an important contribution to expanding power generation capacity in the developing world, albeit with significant challenges along the way**

**The private sector has contributed just over 40 percent of new generation capacity in the developing world since 1990**, a share that has been remarkably consistent across country income groups. The absolute amount of private investment in Africa has been relatively low, but it still represents about 40 percent of total investment, similar to other regions. Across income groups, the share of private sector investment in capacity additions hovers around 40 percent (figure O.4a). For modern renewable

energy technologies—now in the ascendancy—the share was almost twice as high, at around 70–80 percent (figure O.4b). Nevertheless, only a handful of countries was able to rely exclusively on the private sector for almost all new generation capacity. Foreign sponsors have been a major source of private investment in power generation, particularly in the Middle East and Sub-Saharan Africa (figure O.5). South Asia stands out as the only region where the majority of private investment has been domestically sourced.

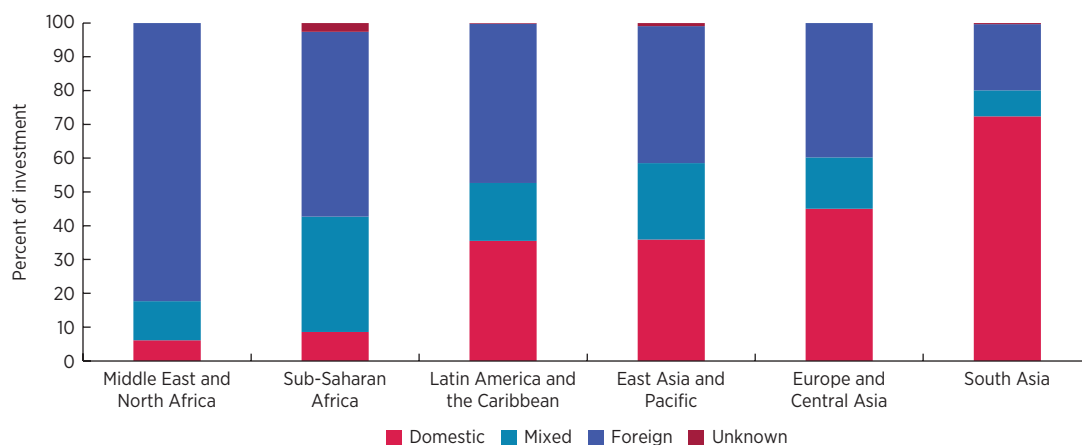
**Nevertheless, private investments in generation have not always been guided by principles of least-cost planning.** During the 1990s, little attention was paid to power system planning, leaving many developing countries without strong technical capacity in this critical area. This was unfortunate at a time when demand for electricity was growing so quickly across the developing world that the scale of the system had to double every decade in many countries. Even when plans were made, they were seldom enforced. Only one in five countries makes

**FIGURE O.4** The private sector's contribution to new generation capacity was steady across income groups but heavily skewed by generation technology



Source: World Bank elaboration based on World Bank–PPIAF Private Participation in Infrastructure Database 2018; UDI World Electric Power Plants database 2017.

**FIGURE O.5** The bulk of private investment in generation came from foreign sponsors

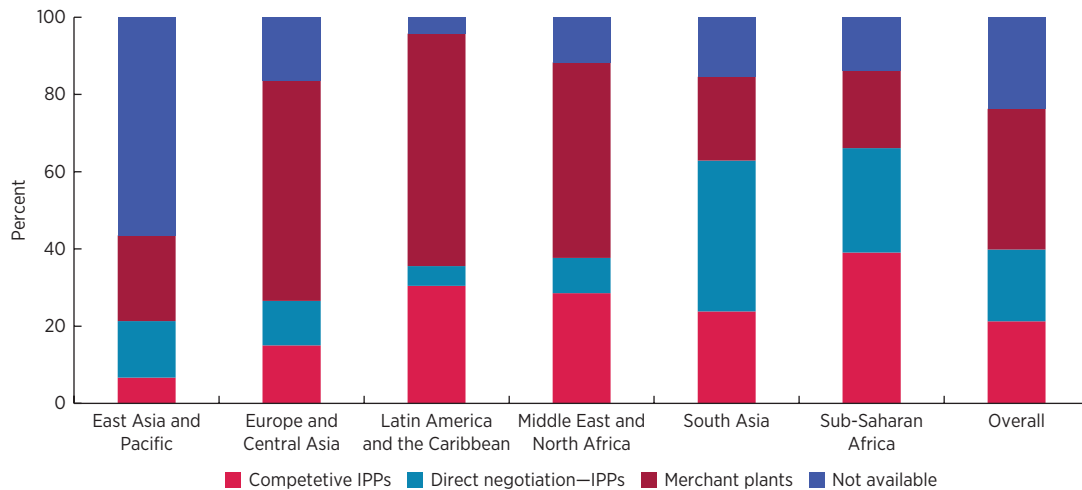


Source: World Bank elaboration based on World Bank–PPIAF Private Participation in Infrastructure Database 2018; UDI World Electric Power Plants database 2017.

power system plans mandatory, which often leaves important decisions about plant capacity vulnerable to the vagaries of political interference or unsolicited bids. In contrast to Latin America and the Middle East, where competitive tendering is more established (although the number of deals in the latter region is limited), direct negotiation of deals for IPPs remains widespread across

Sub-Saharan Africa and South Asia (figure O.6). Such nontransparent procurement processes jeopardize value for money in generation and invite allegations of corruption, which has bedeviled IPP programs in some countries—Tanzania being a prominent example. Countries with strong planning and procurement frameworks were more likely to be able to expand generation capacity to keep pace



**FIGURE 0.6** Direct negotiation of IPPs remains widespread in South Asia and Sub-Saharan Africa

Source: World Bank elaboration based on World Bank-PPIAF Private Participation in Infrastructure Database 2018.

Note: IPPs = independent power producers.

with growth in peak demand. The available evidence suggests that the features of the planning and procurement framework most closely associated with good outcomes for security of supply are the existence of institutional capacity for planning, the use of a transparent and participatory process for developing plans, and the adoption of competitive bidding for new generation.

**Striking the right balance of risk between the public and private sector in power generation has proved challenging.**

IPPs face a plethora of risks, including demand risk, fuel price risk, exchange rate risk, and termination risk. All can weaken investor interest, particularly in untested markets, until a reliable track record has been established. In response, governments provide contractual protections of various kinds. Oil price and currency fluctuations are often passed through directly to the tariff specified in the power purchase agreement (PPA). “Take-or-pay” clauses prevalent in many African IPP contracts guarantee purchase of power even in the absence of demand; elsewhere, capacity charges at least ensure that fixed capital costs can be covered. Sovereign guarantees often need to be provided to

compensate investors in case of premature termination. At one end of the spectrum, IPP programs have sometimes stalled when private sector demands for risk mitigation were not matched by the willingness of governments to provide them. Examples include Egypt’s first IPP program in the early 2000s and Vietnam’s program in the 2010s. At the other end of the spectrum, when governments have assumed excessive risk, IPP programs have sometimes triggered financial crises. Large-scale IPP programs have left governments exposed to currency or oil price risks, as happened during the Asian financial crisis of the late 1990s in Pakistan and the Philippines, where the power sector became a major contributor to public debt.

**Finding #4: Wholesale power markets helped improve efficiency in the minority of countries that were ready for them; many others found themselves stuck in transition**

**Only one in five developing countries has introduced a wholesale power market, reflecting the formidable list of preconditions that must be met before such**

### markets become possible or meaningful.

Power markets are for the most part found in middle-income countries whose power systems are relatively large, financially viable, and unbundled (both vertically and horizontally)—and where regulatory governance is sound. However, regional power markets at varying stages of development are also allowing smaller countries in Africa, Central America, and South Asia to capture some of the benefits of power trade.

**Close to half of the developing countries have adopted the single buyer model as a (sometimes indefinite) step toward wholesale competition.** After some vertical and horizontal unbundling of the sector, IPPs compete alongside incumbent generators to supply power to the publicly owned single buyer, which is typically the transmission (and sometimes also distribution) utility. Although often conceived as a transitional model toward a competitive market, in practice most countries have remained stuck at this stage. A key concern is that the long-term take-or-pay arrangements that are often required to induce IPP investments in emerging markets can introduce distortions into

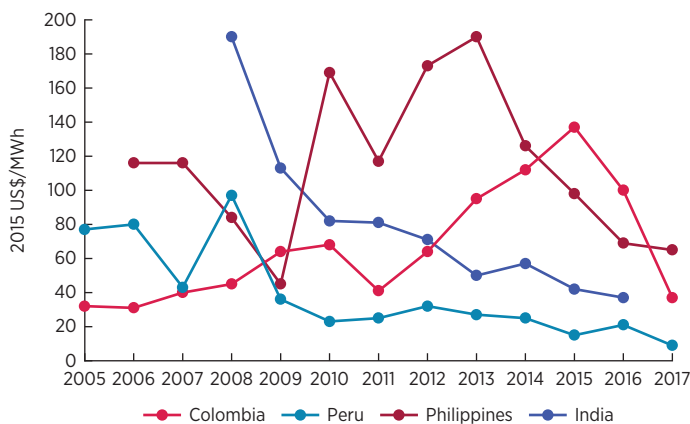
power dispatch and build contractual rigidity into the power system—both of which significantly limit the scope for competition when a wholesale market is eventually introduced.

### Effective functioning of wholesale markets requires a high-resolution, short-term pricing mechanism, as well as a sound and adaptive governance structure.

The main function of wholesale power markets is to provide efficient short-term price signals to guide dispatch and inform investment. Prices across developing country spot markets have varied widely, ranging between US\$20 to US\$200 per megawatt-hour, with price trends conveying the evolution of local market conditions, such as expanding investment in India or drought conditions in Colombia (figure O.7). High spatial resolution of prices—such as the nodal prices used in Peru—is important to signal transmission constraints. Close monitoring of market prices and performance by an independent watchdog, such as the system operator or regulator, has proved important to detect abuses of market power often attributable to inadequate restructuring of generation assets prior to the launch of the market (Jamasp, Newberry, and Pollitt 2005; Jamasp, Nepal, and Timilsina 2015; Nepal and Jamasp 2012). This has been particularly challenging in the Philippines, but it has improved over time owing to new entries and the interconnection of segmented markets, reflected in tumbling wholesale market prices (figure O.7). Good governance of the system operator is critical for the impartial and effective dispatch practices that underpin price formation. Some countries have chosen to combine this function with that of transmission system operator, which is a viable option as long as conflicts of interest can be avoided. The functions of system and market operator have also proved possible to combine.

### Despite expectations, spot market prices have not provided adequate incentives for investment in new generation

**FIGURE O.7** Electricity spot prices have shown wide variation across developing country markets



Source: World Bank elaboration based on Rethinking Power Sector Reform utility database 2015.

Note: MWh = megawatt-hours.

### **capacity across the developing world.**

There has been relatively little entry by merchant plants<sup>4</sup> and limited willingness of regulators to allow spot market prices to spike during scarcity periods to the levels needed to incentivize new investment. Accordingly, several countries have adopted regulated capacity payments, which, although effective in incentivizing new investment, have led to concerns about excess capacity—for example, in Chile. Capacity markets have also been tried, though without success, in Colombia. Increasingly, supply auctions are proving to be an effective model for ensuring security of supply across several Latin American countries. In supply auctions, potential generators compete for the right to supply power to distribution companies on a long-term basis, but they do so without take-or-pay provisions.

**More recently, decarbonization of the generation mix has emerged as a new policy objective to be pursued, creating further challenges for wholesale power markets.** With few exceptions, decarbonization was not a major policy objective pursued through least-cost generation plans during the period under study. Generation investments were largely driven by concerns over security of supply, which coincidentally pushed hydro-dominated countries toward greater carbon intensity and oil-dominated countries toward lower carbon intensity. Nevertheless, these experiences illustrate that such policy-directed investment decisions can materially move the dial on carbon intensity once that becomes the objective. More recently, some Latin American countries, as well as India, have adapted their supply auctions to explicitly support the transition to renewable energy by targeting certain generation technologies. The growing share of variable renewable energy has created even further challenges for capital cost recovery in the generation segment, since the presence of resources such as wind and solar—which are characterized by zero marginal cost—can lead

to periods of zero and even negative spot prices in some markets. Also, the variability of wind and solar resources increases the need for fast-ramping flexible resources to balance the system as needed, yet many markets lack mechanisms for appropriately incentivizing such ancillary services.

**Finding #5: Good corporate practices, particularly with respect to human resources and financial discipline, were associated with better utility performance; these were more prevalent among privatized utilities**

### **Corporatization of public utilities was conceived as a way to put the power sector on a more commercial footing.**

Prior to 1990, many public power utilities operated as administrative departments of their respective line ministries without any separate corporate existence. Doing so left them subject to the vicissitudes of public administration and unable to adopt a commercial orientation. For this reason, the first step to power sector reform in many countries was to separate out the operational functions associated with service provision into a distinct state-owned corporation, typically operating under company law. In doing so, many important decisions were made regarding the governance of the company and the establishment of management processes.

**There is a significant governance gap between corporatized public utilities and privatized ones.** A well-established literature on corporate governance of state-owned enterprises provides a clear frame of reference for good practice in this domain. For those jurisdictions where power utilities are entirely state-owned, corporate governance tends to reflect about 55 percent of good-practice measures, suggesting considerable room for improvement.<sup>5</sup> Governance scores tend to be systematically higher for private utilities, falling in the 60–90 percent range, a level only occasionally matched by

public utilities. Boards of private utilities enjoy almost complete decision-making autonomy, whereas those of public utilities have limited freedom on critical matters of finance and human resources—particularly with respect to raising capital and appointing the chief executive officer. Public utilities also suffer considerable interference in the appointment and removal of board members. Overall, public utilities tend to be less rigorous in staff hiring, with more limited use of standard good practices, such as advertising, shortlisting, interviewing, and checking of references. Owing to public sector employment restrictions, they also have less ability to reward employees through performance bonuses or to fire those who perform poorly. Public utilities also tend to fall particularly short with respect to basic accounting practices that are universal in the private sector. When it comes to adoption of information technology, by contrast, there seems to be relatively little difference between public and private utilities.

**Good practice on corporate governance is strongly correlated with good utility performance in terms of cost recovery and distribution efficiency—irrespective of public or private management.** Surprisingly little has been documented to date regarding the extent to which corporatized power utilities pursued good governance practices and the resulting performance impact. New evidence presented in this study suggests that the quality of managerial practices related to human resources and financial discipline are strongly associated with better performance on distribution efficiency and operating cost recovery (figure O.8). The correlation holds irrespective of whether utilities are publicly or privately managed, since the best-performing public utilities exhibit somewhat better management practices than their peers. Board autonomy and accountability, however, are not so clearly linked to performance. Some of the dimensions of corporate governance that

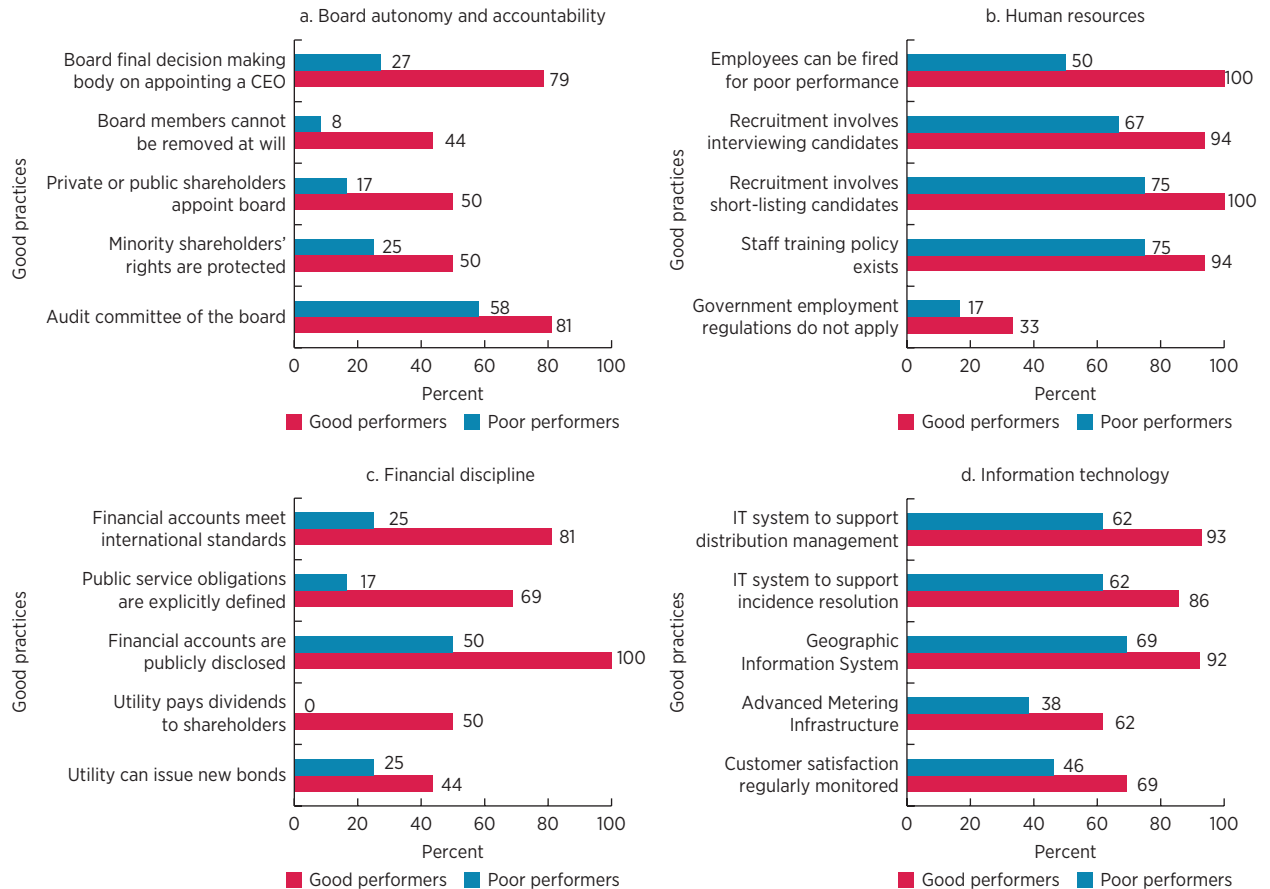
are most strongly associated with efficient utility performance are the publication of accounts consistent with international financial reporting standards, the explicit definition of public service obligations, the ability to fire employees for nonperformance, the use of transparent hiring processes for selecting employees, the adoption of modern information technologies, and the board's freedom to appoint and remove the chief executive officer.

**Finding #6: Private sector participation in power transmission and distribution delivered good outcomes in favorable settings; elsewhere, it was susceptible to reversal**

**Private sector participation in transmission has not been widespread, but some successful examples exist in Latin America and Asia.** The reform model of the 1990s was primarily concerned with establishing private sector participation in generation and distribution. The transmission segment was regarded as a natural monopoly, exercising system-coordination functions best handled under public ownership. Nevertheless, the experience of some countries in Latin America has illustrated that new transmission lines can readily be bid out under build-operate-transfer structures where the investment climate is adequate. These contracts are similar to those used for IPPs, but more straightforward, to the extent that there are no fuel costs or dispatch issues to consider, and remuneration is reduced to a simple annuity payment covering capital and operating costs over the life cycle. Cases of system-wide transmission concessions or even divestiture are much rarer.

**Some of the early-reforming countries introduced widespread private sector participation in their distribution sectors.** The financial health and operational strength of distribution utilities is a key driver of overall power sector performance. A financially precarious distribution utility can undermine the

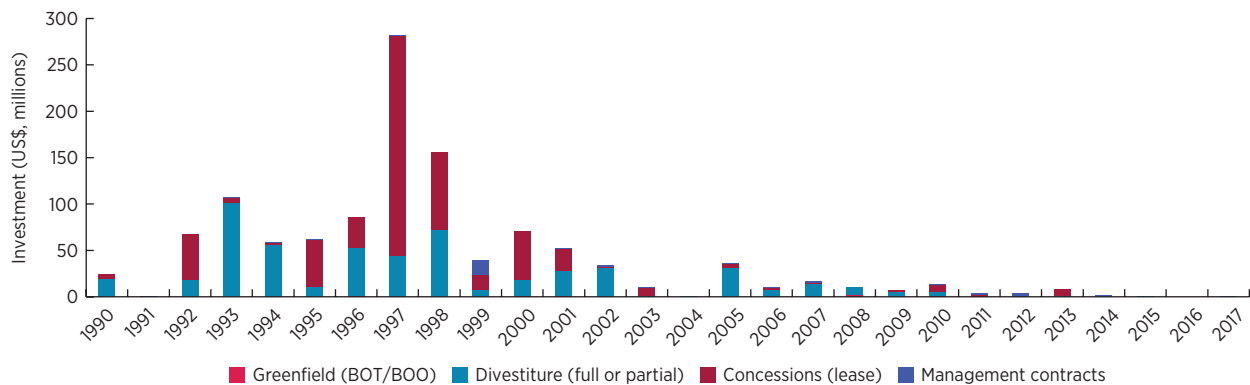
**FIGURE O.8** Certain aspects of corporate governance are strongly associated with improved efficiency performance for distribution utilities



Source: World Bank elaboration based on Rethinking Power Sector Reform utility database 2015.  
 Note: IT = information technology.

entire payment chain, while operational weaknesses in the local grid can prevent power from reaching customers even when it is available. For precisely these reasons, the 1990s model prescribed private sector participation in the distribution tier as one of the first measures to be taken to turn around an ailing power sector. This is reflected in the surge of private sector participation in distribution that took place during the 1990s (figure O.9). Divestiture of distribution utilities was prevalent among early-reforming countries in Latin America, Central Asia, and Eastern and Central Europe, although it was comparatively rare in Africa

and in East and South Asia. Nevertheless, even among countries undertaking privatization of power distribution utilities, relatively few privatized the entire distribution sector. More typically, public and private distribution utilities have coexisted within the same country, with private operators often serving capital cities or larger commercial centers. The decision to privatize only some distribution utilities may reflect differences in the commercial viability of the service areas, or variations in the local political environment, particularly in countries where electricity distribution remains a subnational responsibility.

**FIGURE O.9 Private sector participation in distribution peaked in the late 1990s before declining**

Source: World Bank elaboration based on World Bank-PPIAF Private Participation in Infrastructure Database 2018.

Note: BOO = build, own, operate; BOT = build, operate, transfer.

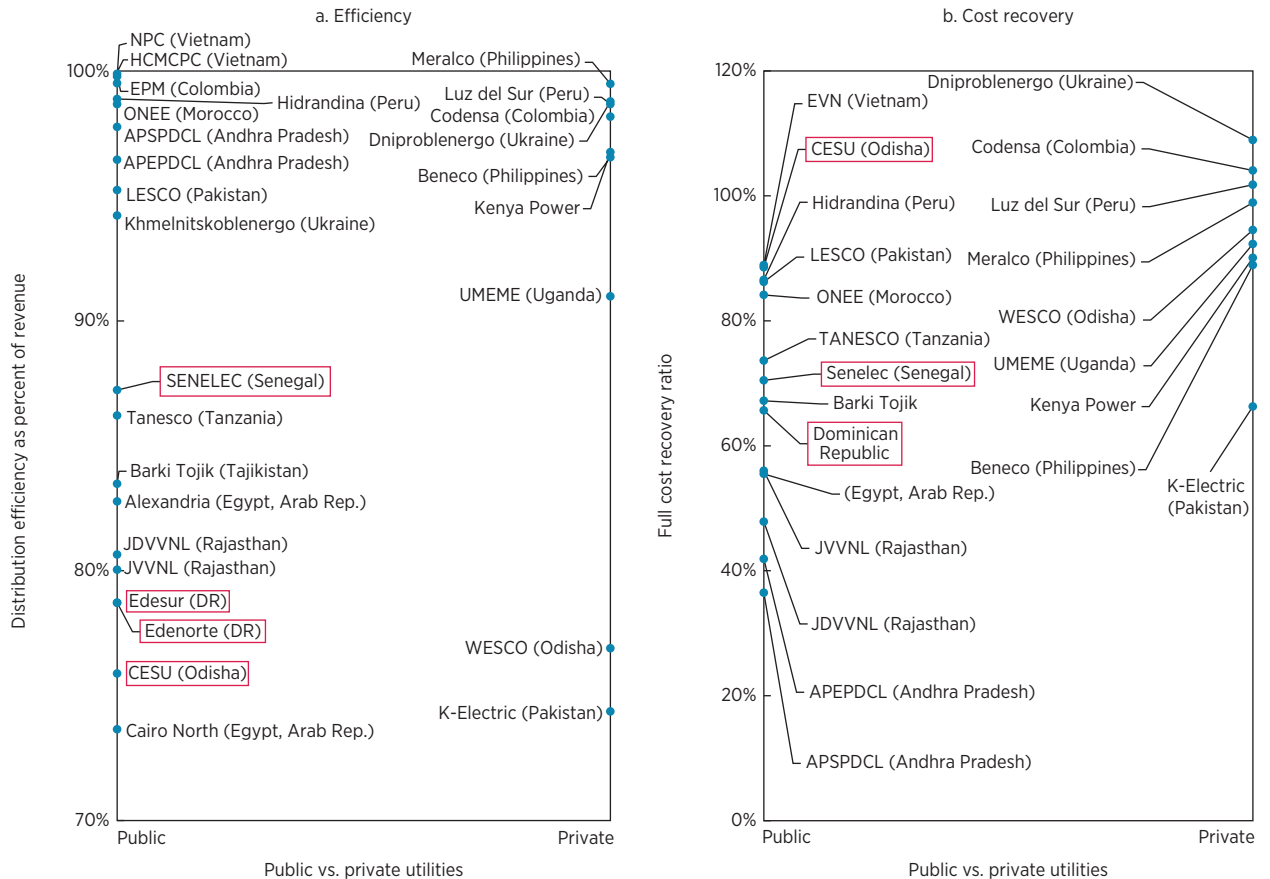
**Private sector participation in distribution has proved susceptible to reversals, and appetite for the reform subsided in the 2000s.** Overall, 32 distribution transactions in 15 developing countries have been reversed (in the case of divestitures) or prematurely terminated (in the case of concessions and other contractual instruments), particularly during the first decade of reform. The probability of reversal was particularly high in Sub-Saharan Africa, affecting more than 20 percent of transactions. Sub-Saharan Africa's experiments with utility management contracts, in particular, have been checkered, encountering difficulties in recruiting and retaining qualified managers and suffering from tense labor relations and inadequate transfer of skills to local staff. Privatization reversals were most often associated with defective operational data (for example, serious underestimation of system losses) that led to unsustainable bids (for example, in the Indian state of Odisha), or with the government's unwillingness to apply tariff regulation as laid down in the legal framework (as in the Dominican Republic). Stakeholder opposition has also been a serious issue in some cases (as in Senegal, where the labor unions vehemently opposed utility privatization). Customers, in particular, often bear the brunt of tariff hikes associated with privatization, without always

seeing an immediate impact on the quality of service, and this can sometimes lead to public disaffection (as in the Pakistani city of Karachi or Uganda). Such concerns led to a dramatic tail-off in private sector participation in electricity distribution after the early 2000s (figure O.9).

**Private sector participation in distribution is strongly associated with full cost recovery.** Private sector participation is the only reform that is associated with higher levels of full capital cost recovery, as opposed to recovery of operating costs alone. Among the countries reviewed that have undertaken significant and sustainable privatization of the distribution segment, it is exceedingly rare for tariffs to fall below full cost recovery levels. This partly reflects the fact that countries achieving higher levels of cost recovery are more likely to attract private sector participation; it also indicates that the presence of the private sector obliges the government to follow through on tariff regulations that call for cost recovery pricing.

**With respect to efficiency, the performance of privatized distribution utilities is on par with the top half of performers among public utilities.** Many of the privatized utilities studied perform to a high degree of operational efficiency (figure O.10). However, a group of publicly owned utilities (in the Indian

**FIGURE O.10 Private sector participation is associated with much higher levels of cost recovery, while performance on efficiency is within the range observed for public utilities**



Source: World Bank elaboration based on Rethinking Power Sector Reform utility database 2015.  
 Note: Red boxes indicate utilities that have seen privatization rollback.

state of Andhra Pradesh, Morocco, and Vietnam) performs as efficiently as the privatized utilities. There are also some privatized utilities facing difficult operating environments (such as in the Pakistani city of Karachi or the Indian state of Odisha) that perform no better than some of the worst public utilities. At the same time, some of the worst-performing public utilities are cases of failed privatization (as in the Dominican Republic and Senegal).

**There is also evidence that private sector participation is associated with good sector outcomes.** Ultimately, the impact of reform is best evaluated in terms of results. Analysis undertaken for this study suggests

that private sector participation has a significant positive impact on generation capacity and electricity access in low-income countries and that it supports the expansion of renewable energy in middle-income countries.

**However, by far the strongest driver of electrification is income per capita, rather than any structural reform.** The substantial progress on electrification made in many countries approaching middle-income status from 1990–2015 primarily took the form of utility-driven, grid-based electrification programs backed by clear political targets and public investment. In some cases (such as India, Morocco, and Vietnam), these efforts

predated the sector reform process in the country. In other cases (such as Kenya, Tanzania, and Uganda), they were adopted long after the power sector reform, usually in response to the limited dynamism of electrification in the post-reform period. Grid electrification may be loss-making for the utility at the margin, meaning that it cannot be left to commercial incentives alone. With the advent of solar technology, decentralized private sector actors are playing an increasingly important role in the electrification process, although the jury is still out on the question of whether the most remote populations can be served on a purely commercial basis.

**Finding #7: Regulatory frameworks have been widely adopted, but implementation has often fallen far short of design, particularly when utilities remained under state ownership**

**The creation of regulatory agencies was widely embraced and supported by sound regulatory frameworks in many countries.** As of 2015, over 70 percent of developing countries had created a power sector regulator. On paper, the associated regulatory frameworks were relatively well-designed, incorporating provisions to balance the autonomy and accountability of the regulatory framework. In addition to the central functions of all such entities—regulation of tariffs and service quality (based on detailed methodologies laid down in the regulatory framework), regulators are widely responsible for licensing market entry, including negotiation of the terms of PPAs (85 percent) and competitive procurement (60 percent). They may also play a role in other important policy areas, such as clean energy (80 percent), power market design (65 percent), and electrification (55 percent).

**In practice, however, it has proved very difficult to apply regulatory frameworks as written, and this has adversely affected**

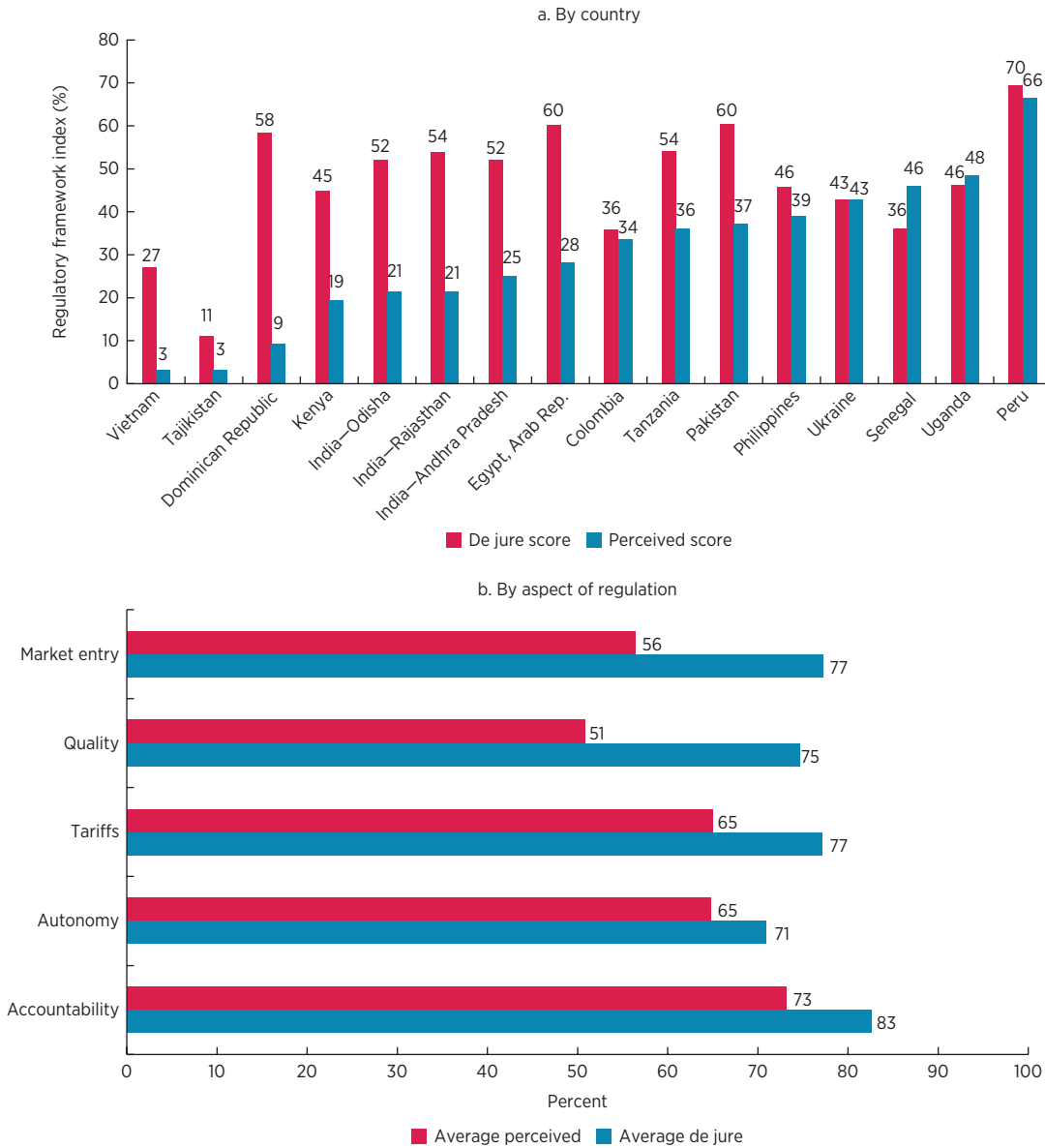
**the efficacy of regulation.** Regulatory frameworks are to varying degrees overlooked or contradicted in practice (Andres, Guasch, and Diop 2007; Gilardi and Maggetti 2011). Whereas, on average, countries meet about 47 percent of good practice regulatory standards on paper, this score drops to 30 percent in practice.<sup>6</sup> The gap between regulation on paper and regulation in practice can be relatively narrow (as in Peru and Uganda, where the gap is less than 10 percentage points) or extremely wide (as in the Dominican Republic and several Indian states, where the gap can be 30–50 percentage points) (figure O.11a). One critical area is the authority of regulators to determine electricity tariffs, which is legally granted in 94 percent of countries but actually honored in only 65 percent—with a lot of caveats. Not surprisingly, the achievement of operating cost recovery is significantly related to the quality of regulation as practiced rather than as written.

**Although originally conceived as an enabler of privatization and competition, regulation was often introduced into sectors still dominated by monopolistic state-owned actors.** Many countries that fit this description adopted legal frameworks based on the principles of incentive regulation, according to which the regulator harnesses the utility's profit motive to incentivize efficient delivery of high-quality services. Such incentives are not typically effective unless regulated utilities operate according to strong commercial principles, making them responsive to incentives. Regulation does seem to have worked quite well, however, in countries with largely privatized distribution sectors. Moreover, evidence indicates that the presence of private actors in the sector is associated with much closer adherence by regulators to the established legal framework. The reason may simply be that it is more difficult for the government to deviate from enacted regulations when third-party private actors are involved.

**Where utilities remain in public hands, the Ministry of Finance can become an**



**FIGURE O.11 Significant divergence exists between regulation on paper and regulation in practice**



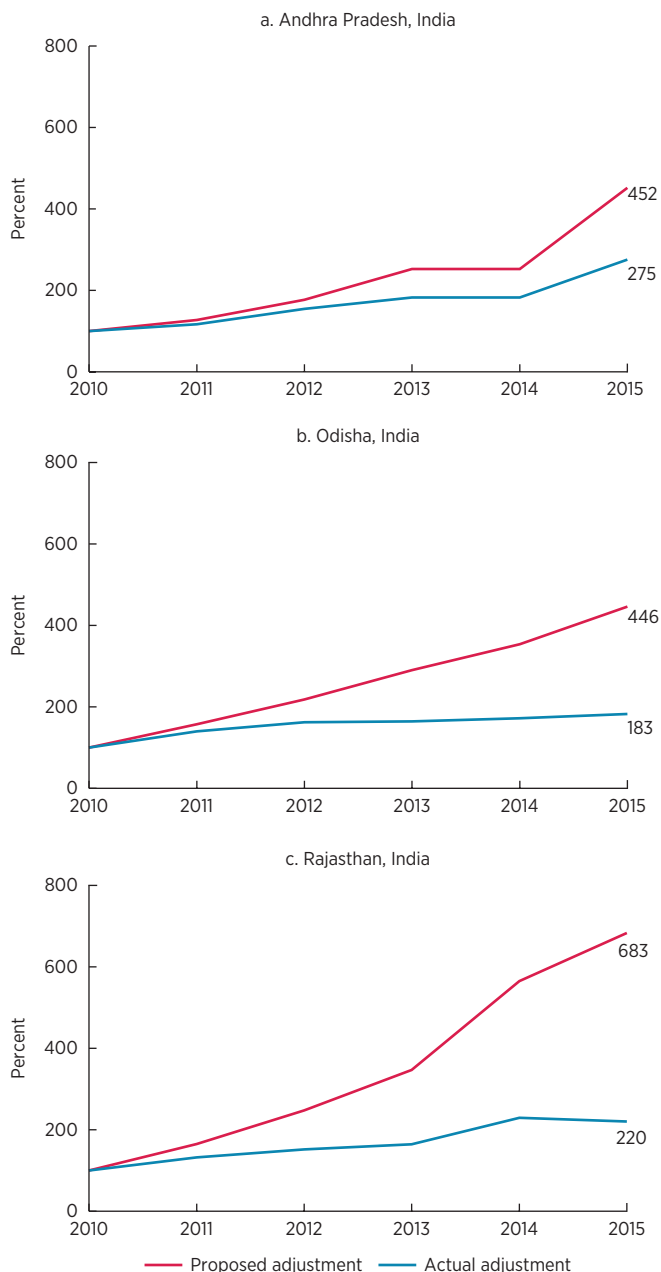
Source: World Bank elaboration based on Rethinking Power Sector Reform utility database 2015.

**important player in the tariff-setting process.** Countries where utilities remain publicly owned are often characterized by weak regulatory authority over tariff-setting and a soft budget constraint overall. When tariffs are not allowed to keep pace with costs (figure O.12), a degree of fiscal liability is created bringing the Ministry of Finance into

the frame. Several countries, such as Egypt and Senegal, have explicitly recognized this in their tariff-setting frameworks, committing to fiscal transfers that exactly compensate for any shortfall in cost recovery from tariffs. This approach acknowledges that sector costs must ultimately be covered by a combination of taxes and user charges and provides a

coherent framework for making such trade-offs. Nevertheless, the Senegalese experience illustrates the challenges of meeting such commitments during periods of fiscal stress.

**FIGURE O.12** Regulatory tariff recommendations are not always respected in practice

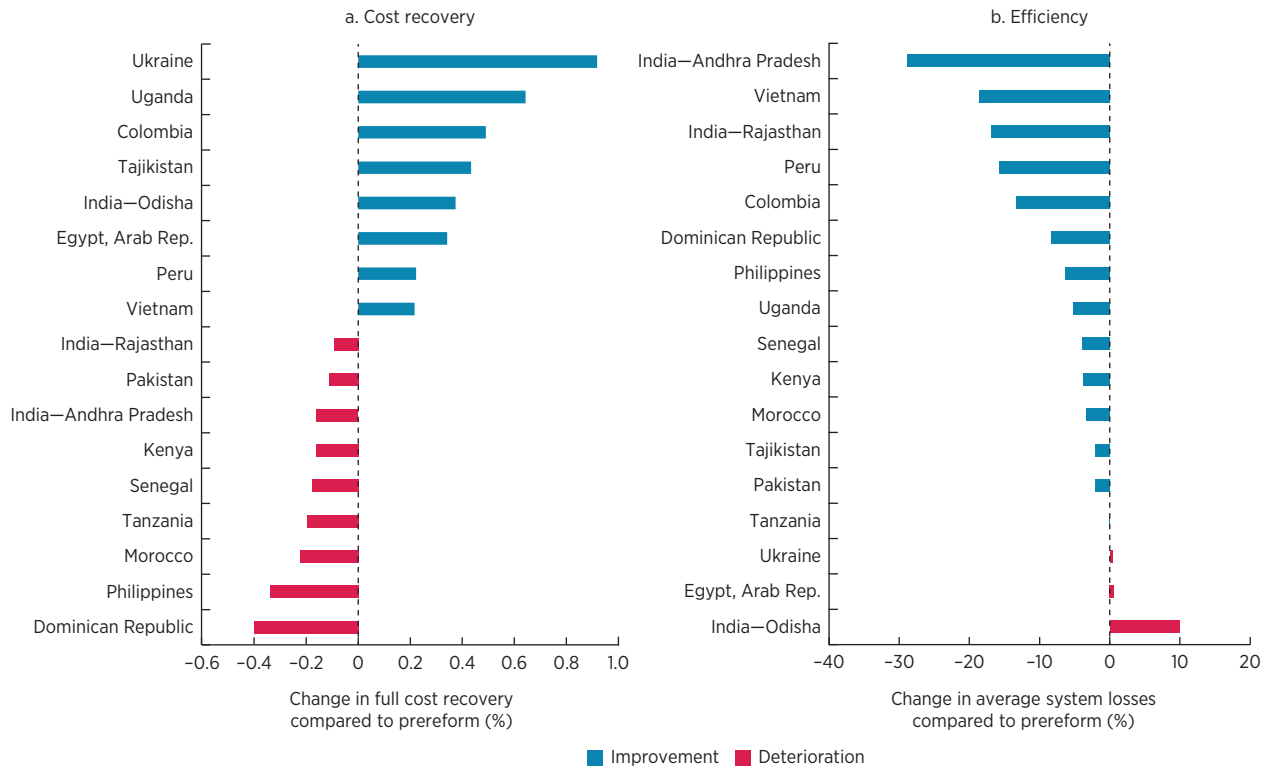


Source: World Bank elaboration based on Rethinking Power Sector Reform utility database 2015.

**While regulators have struggled with tariff-setting challenges, quality-of-service regulation has not received the attention that it deserves and is too often observed in the breach.** The shortfall in practice is particularly large for regulations pertaining to quality of service and market entry (figure O.11b). Indeed, few countries were found to have a meaningful system in place for regulating quality of service. (Colombia and Peru are among the few that do.) On the one hand, legal requirements to develop and monitor quality-of-service standards and penalize noncompliance are not always observed by regulators. On the other hand, utilities may lack the information systems to fully comply with such a framework and to manage reliability issues adequately. This is a serious deficiency, given the importance of service reliability for customers.

**Finding #8: Cost recovery has proved remarkably difficult to achieve and sustain; the limited progress made owes more to efficiency improvements than to tariff hikes**

**Full cost recovery has been a challenge for power utilities.** Only about half of them can be considered financially viable. Over the 25-year period under review, the extent to which end-user tariffs covered the full capital cost of supplying electricity increased from 69 percent to 79 percent, and about as many countries saw their performance on cost recovery deteriorate as improve (figure O.13a). Strikingly, even countries with relatively low cost of service sometimes struggle to achieve full capital cost recovery. In fact, full capital cost recovery is almost exclusively confined to utilities that have been privatized. Experience shows that progress toward cost recovery is subject to sudden erosion by exogenous factors, such as droughts, devaluations, and oil price shocks. Although full capital cost recovery has proved difficult to attain, almost all of the utilities have achieved operating cost recovery.

**FIGURE O.13** More countries made progress on efficiency than on cost recovery, 1990–2015

Source: World Bank elaboration based on Rethinking Power Sector Reform utility database 2015.

Moreover, about half of the utilities can be considered financially viable in the sense of covering both operating costs and historic debt service and repayment obligations, albeit without providing a full rate of return on their asset base.

**Where progress on full cost recovery was made over time, cost reductions played a greater role than tariff adjustments in bringing utilities closer to this goal.** Specifically, average system losses across the study sample of countries fell from 24 to 17 percent between 1990 and 2015, and improvements were observed in more than 80 percent of jurisdictions (figure O.13b). Indeed, some countries would already be able to fully recover costs based on current tariffs if they could raise their commercial and operational efficiency to industry benchmarks. Tariff adjustments, however, have proved hard to apply as some regulators have seen their

recommended adjustments aggressively scaled back or even completely overturned by the political authorities.

**Utilities with revenue shortfalls are seldom fiscally compensated.** The quasifiscal deficit across the study sample remains high, averaging close to one percentage point of gross domestic product, with underpricing being the major contributor in most cases. Financial analysis of the utilities showed that such shortfalls are not typically compensated by fiscal transfers from the state. Instead, utilities are forced to adopt a range of suboptimal coping strategies that often include taking on high-cost short-term commercial debt to cover cashflow shortfalls or simply falling into arrears with upstream suppliers of bulk fuel or electricity.

**Cross-subsidies among customer groups and across consumption levels have long been the norm for electricity**

**tariff structures and may further undermine cost recovery.**

About three-quarters of developing countries practice cross-subsidies between commercial and residential customers, with the former paying on average more than twice as much as the latter for each unit of electricity purchased. A similar share of countries makes use of increasing block tariffs for residential customers, which typically provide sizable discounts at low or even average consumption levels and then step up tariffs for higher levels of consumption without ever reaching full cost recovery even in the highest consumption brackets. Deeper analysis shows that while modest amounts of cross-subsidy have been accommodated historically without seriously prejudicing the achievement of cost recovery, cross-subsidization can seriously undermine the financial equation of the utility if even the highest-paying customers are not paying at the cost recovery level.

**Finding #9: The outcomes of power sector reform were heavily influenced by the starting conditions in each country**

**The 1990s power sector reform model was largely derived from principles believed to apply universally, independent of context.** In practice, numerous

preconditions—both economic and political—have emerged as important in shaping the applicability of the approach. Across the developing world, systematic differences can be observed in the uptake of the 1990s reform model across countries, based on factors such as income group, system size, and political system. Contextual factors also seem to have played a role in shaping the outcome of reforms (table O.1). The analysis distinguishes among “comprehensive reformers,” which applied at least 70 percent of the prescriptions of the 1990s model; “limited reformers”; “stronger performers,” which scored above average on outcome variables capturing progress on security of supply, electrification, and decarbonization; and the remaining “weaker performers.”

**A first group of countries largely applied the full policy prescriptions of the 1990s reform model and went on to see a range of positive outcomes as a result, experiencing improved operational efficiency and cost recovery, as well as enhanced security of supply.** Foremost among these were Colombia, Peru, and the Philippines. In all these cases, the reform package was adopted comprehensively and relatively rapidly during the 1990s without major implementation setbacks. A continuous

**TABLE O.1** Overview of preconditions among groups of countries at the time of reform

	Sector preconditions					Country preconditions		
	Cost of electricity (\$/kWh)	Full cost recovery (%)	System losses (%)	Access to electricity (%)	Electricity consumption (kWh pc pa)	System size (GW)	Income level (GDP pc)	Quality of governance (index)
<b>Comprehensive reformers</b>								
Stronger performers	0.15	69	19	82	1,413	20	1,405	-0.43
Weaker performers	0.17	70	30	53	315	15	756	-0.49
<b>Limited reformers</b>								
Stronger performers	0.13	55	21	77	804	22	737	-0.55
Weaker performers	0.23	84	27	27	172	2	428	-0.40

Source: World Bank data.

Note: The Rethinking Power Sector Reform observatory countries are assigned their categories, specified in the table. All figures relate to the pivotal reform year for each country during the decade of the 1990s or the nearest data point available in some cases. India and Ukraine are excluded from system size calculations. GDP = gross domestic product; GW = gigawatt; kWh = kilowatt-hour; pa = per annum; pc = per capita.

process of second-generation reforms fine-tuned the operation of the model. Each of these countries faced its own challenges, but these could be accommodated, by and large, within the parameters of the new institutional framework.

**A second group of countries also adopted comprehensive reforms but did not experience the same comparatively smooth implementation and positive outcomes.** In Pakistan, for example, the unbundled power sector has been plagued by a chronic circular-debt crisis that undermines the payment chain; the only privatization in the distribution sector continues to be disputed in the courts after more than a decade of litigation. In the meantime, the country struggles to achieve security of supply and universal access to electricity. Other illustrative cases include the Dominican Republic and the Indian state of Odisha, where an extensive power reform was undertaken, including privatization of distribution utilities. However, in both cases, it proved difficult in practice to apply the prescribed framework of tariff regulation, leading to a subsequent renationalization and persisting concerns about security of supply, as well as weak performance on both intermediate and final outcomes.

**Some insight into these disparate experiences can be gained by comparing the preconditions that existed in these two groups of comprehensive reformers at the time of the reform in the 1990s** (compare the first two rows of table O.1). In particular, those countries where reforms proved to be successful started out from a much more advantageous national and sectoral position than the others. In terms of country context, the strong performers had already achieved an income level (around US\$1,400 per capita) that was approximately double that of the weak performers, and they also enjoyed a better institutional environment, as captured by the World Bank Governance Index. In terms of

sector context, the strong performers started out with much better operational performance in terms of system losses (19 percent versus 30 percent), much higher levels of electrification (82 percent versus 53 percent), and a much more developed energy system with significantly higher installed capacity (20 gigawatts versus 15 gigawatts). Their per capita electricity consumption was about four times as high. Even among the group of countries that made only limited reforms, the stronger performers enjoyed significantly better preconditions than those with weaker performance.

#### **Finding #10: Good sector outcomes were achieved by countries adopting a variety of different institutional patterns of organization for the sector**

**Although the 1990s reform model started out with a unified reform blueprint, that blueprint was adapted to widely varying degrees.** A significant minority of countries remains with a traditional vertically integrated national utility model, while the majority finds itself under an assortment of hybrid models.

Countries where adoption of reforms has been slower or more limited have, in some cases, performed as well, in terms of sector outcomes, as those that went further with the reform agenda. Comparing across a wide range of postreform outcomes covering security of supply, social inclusion, and environmental sustainability shows that the stronger performers divide into two equal groups comprising both comprehensive and limited reformers (table O.2). The performance differences are remarkably small between these two groups of countries; the limited reformers do slightly better on reliability, access, and affordability, and slightly worse on overall adequacy of capacity and carbon intensity. In a similar fashion, the weaker performers are also evenly split between countries that took a more comprehensive or limited approach to reform.

**TABLE O.2** Comparison of country performance according to reform strategy

	Security of supply				Social inclusion		Carbon intensity (gCO <sub>2</sub> /kWh)
	SAIFI	Normalized capacity (in MWs per million population)	Capacity diversification (HHI)	Meeting demand (ratio)	Access to electricity (%)	Affordability (% of GNI)	
<b>Stronger performers</b>							
Comprehensive reformers	8.8	551	0.4	1.1	94	4.6	357
Limited reformers	4.3	429	0.6	1.0	99	1.4	387
<b>Weaker performers</b>							
Comprehensive reformers	61.3	166	0.2	0.9	62	4.7	330
Limited reformers	30.3	45	0.5	1.0	35	13.0	419

Sources: IEA data; World Bank data.

Note: All figures relate to postreform performance as measured in 2015. The outcomes are judged based on a detailed framework provided in table 9.2 in chapter 9. Green signifies good outcome, yellow signifies moderate outcome, and red signifies poor outcome. GNI = gross national income; HHI = Herfindahl-Hirschman Index; MWs = megawatts; SAIFI = System Average Interruption Frequency Index.

Of particular interest, then, are the institutional paths taken by limited reformers that achieved stronger performance outcomes. Salient in this group are countries like Morocco and Vietnam, as well as the Indian state of Andhra Pradesh. What these cases appear to have in common is a continued role for a competent state-owned utility, with a more targeted role for the private sector.

Morocco kept a vertically integrated, publicly owned monopoly at the core of the sector, while opening to the private sector for certain generation plants and city-level distribution concessions. Rather than focusing on structural reform and the creation of regulatory capacity, Morocco's energy policy was characterized by the articulation of clear and ambitious social and environmental objectives at the highest political level. Those objectives were accompanied by clear institutional responsibility and accountability for delivery and supported by adequate investment finance, capturing both public and private sources as appropriate.

In Vietnam, the sector continues to be dominated by the incumbent utility operating as an unbundled public sector holding company with weak regulatory oversight. Vietnam's power sector journey prioritized the achievement of universal access through a sustained and well-financed program

spearheaded by the national utility of Vietnam (EVN). The country is moving toward the staged implementation of a wholesale power market, in which a minority of privately owned generators competes alongside publicly owned subsidiaries of EVN.

In the Indian state of Andhra Pradesh, the state government completed unbundling and regulatory reforms but stopped short of privatizing the distribution segment. Instead, considerable efforts were made to sharpen incentives for managerial performance through the establishment of clear performance indicators relating to revenue collection, combined with frequent monitoring by senior management and financial reward for good outcomes. This approach was combined with legal reforms to make power theft a prosecutable criminal offense.

Finally, although Kenya does not feature among the stronger performers globally, it does present the best overall range of sector outcomes among the Sub-Saharan African case studies considered. Kenya's approach to reform was also incremental and distinctive. In particular, majority public ownership was retained in the distribution sector, but an almost equal share of equity floated on the Nairobi Stock Exchange provided an additional discipline on corporate governance of Kenya Power.

## POLICY IMPLICATIONS

The 10 policy implications that follow draw on the review of historical evidence provided and on a forward look at disruptive technology trends in the power sector. The momentous technological changes underway—notably, increasingly cost-effective decentralized technologies—are posing fundamental questions about the viability of the traditional centralized utility and promising to change the structure of the power sector. In some frontier markets, the wave of change takes the form of distribution utilities splitting into a wires business and a distribution system operator, whose primary role is to provide a platform that consumers and businesses can use to trade energy both within the distribution segment and into the wholesale power market. In other cases, the new technologies are seen primarily as opportunities to improve the efficiency and effectiveness of the traditional utility.

As these debates play out into an uncertain future, at least two things seem clear.

First, power consumers will no longer be captive to underperforming utilities. The technological disruption in OECD member countries is taking place against a backdrop of universal access to a relatively high-quality and reasonably priced grid service. In contrast, across the developing world, many utility customers are faced with a costly and unreliable supply. Historically, the only alternative for unsatisfied customers was to supply their own electricity using expensive diesel generators. As rooftop solar power becomes cheaper and approaches grid parity, self-generation will become increasingly attractive where utility service is deficient, particularly once battery storage becomes more cost-effective. This development will start to contest the monopoly power of the incumbent utility, potentially providing incentives for improved performance. At the same time, there is the risk that already precarious utilities may be exposed to further

financial distress resulting from grid defection.

Second, the speed and coherence of the technological transition will depend critically on the design of the regulatory framework, which shapes the incentives for innovation. Incentives for utilities to innovate depend on the regulatory regime under which they operate, since it is this that determines whether and how investments and operational savings can be turned into profits. Incentives for customers to innovate will depend on how much freedom they are given by the regulatory framework to engage in decentralized energy production and storage activities, as well as the associated impact on tariffs. Incentives for new players to enter the market and innovate will similarly depend on the flexibility of the regulatory licensing regime. In view of this, it is clear that the design of the regulatory framework will give countries a certain amount of discretion to accelerate or impede the uptake of disruptive technologies.

The following policy implications identify how disruptive technologies are likely to affect aspects of the power sector reform agenda.

- *Policy implication #1.* The design of power sector reforms should be informed by the enabling conditions of each country and oriented primarily toward achieving better sector outcomes.
- *Policy implication #2.* The design of power sector reform needs to be thoroughly grounded in the political realities of each country.
- *Policy implication #3.* Greater emphasis should be placed on building institutional capacity for power sector planning and associated implementation.
- *Policy implication #4.* Generation plants should be procured through a transparent and competitive process, with as much contractual flexibility as the context allows.
- *Policy implication #5.* Unbundling should not be the highest priority where more

fundamental financial and governance challenges persist; it should be undertaken primarily to facilitate deeper reforms.

- *Policy implication #6.* Wholesale power markets remain a viable option for countries that have put in place all the foundational measures; others may derive greater benefit from regional trade.
- *Policy implication #7.* Greater efforts should be made to strengthen the corporate governance and managerial practices of state-owned utilities.
- *Policy implication #8.* The regulatory framework needs to be adapted to reflect the institutional context and to accommodate emerging technological trends.
- *Policy implication #9.* Private sector participation in distribution should be considered only when enabling conditions are met.
- *Policy implication #10.* Delivering on the twenty-first century agenda of universal access and decarbonization calls for additional reform measures targeted explicitly at these objectives.

**Policy implication #1: The design of power sector reforms should be informed by the enabling conditions of each country and oriented primarily toward achieving better sector outcomes**

**The 1990s power sector reform model was derived from economic first principles believed to apply universally, independent of context.** As a result, it lacks a framework for customizing reform to the country context. In practice, numerous enabling conditions—both economic and political—have emerged as important in shaping its applicability. Across the developing world, systematic differences can be observed in the uptake of the model across countries, depending on their income group, system size, political system, and other factors. Drawing on the case studies that have informed this study, contextual factors also

seem to have played a role in shaping the outcome of reforms.

Experience suggests that it may be helpful to think about power sector reform engagements in two phases, depending on the nature of the country environment. This overall framework is depicted in table O.3, which presents the reform measures likely to be applicable in more challenging versus more mature environments, as well as the enabling conditions that signal a country's readiness for various aspects of the reform package.

In more challenging environments, a basic set of preliminary reform measures is proposed. This applies to countries that may be challenged by low incomes, fragile settings, small scale, or other limiting factors. The priority in these environments should be to work toward a foundation of good sector governance and basic financial viability, without embarking on overly complex structural reforms.

***The policy implications are as follows:***

- *Regulation.* Critical at this juncture is to adopt a transparent and well-founded tariff-setting methodology and to apply it each year. This could be done by a regulatory agency or, at this stage, by a competent unit within the Ministry of Energy or the Ministry of Finance. An adequate initial aspiration for tariff-setting would be to ensure financial viability through recovery of enough capital costs to service and repay existing debt. Equally important would be for the Ministry of Energy to lay the foundations for monitoring the quality of service. The process of tariff and quality regulation should be integrated with other processes for overseeing state-owned enterprises (relating, for example, to performance contracts or fiscal transfers).
- *Restructuring.* This is unlikely to be a high priority at this stage. A vertically integrated power system may be easiest to manage while putting in place strong foundations for the sector. However, the entry of the private sector into generation—through



**TABLE O.3** Customizing power sector reforms to country context

	More challenging environments	Enabling conditions	More mature environments
<b>Regulation</b>	<p>Establish clear tariff-setting methodology with oversight from ministry of energy or finance.</p> <p>Aim for achievement of limited capital cost recovery (that is, financial viability).</p> <p>Establish clear quality-of-service framework with oversight from Ministry of Energy.</p>	<ul style="list-style-type: none"> <li>• <i>Cost recovery ratio exceeds 70 percent.</i></li> <li>• <i>Revenue collection ratio exceeds 90 percent and is enforced by disconnection.</i></li> <li>• <i>System losses are below 15 percent.</i></li> <li>• <i>Electrification rate exceeds 80 percent.</i></li> </ul>	<p>Create separate regulatory entity.</p> <p>Aim for full capital cost recovery.</p> <p>Ensure enforcement of quality-of-service regulation.</p>
<b>Restructuring</b>	<p>Retain vertically integrated utility, and selectively introduce private investment for new plants.</p>	<ul style="list-style-type: none"> <li>• <i>Regular audited financial accounts are compliant with international financial reporting standards.</i></li> </ul>	<p>Restructure the power sector to separate out the transmission system operator and ensure adequate degree of competition in generation.</p>
<b>Privatization</b>	<p>Focus on establishing sound corporate governance arrangements and good managerial practices for power distribution, with special focus on human resource management and measures to promote financial discipline.</p> <p>Prioritize electrification through carefully planned parallel efforts with reach of the grid and off-grid, backed up by strong political commitment and adequate public funding.</p>	<ul style="list-style-type: none"> <li>• <i>Modern IT systems are in place and deliver good operational data.</i></li> <li>• <i>Regular tariff adjustments are in line with regulatory methodology.</i></li> <li>• <i>The political context is supportive, in terms of ideology, leadership, and stakeholders.</i></li> <li>• <i>Generation capacity reaches 1–3GW.</i></li> </ul>	<p>Strengthen commercial incentives in distribution through measures such as: credit-rating and bond issues; stock market listing; and/or private sector participation.</p>
<b>Competition</b>	<p>Ensure adequate technical capacity for power system planning directly linked to competitive procurement of generation.</p> <p>Introduce economic dispatch of generation plants administered by utility.</p>	<ul style="list-style-type: none"> <li>• <i>No major bottlenecks exist on the transmission grid or in fuel supply.</i></li> </ul>	<p>Open the grid to third-party access and allow bilateral contracting between generators and large customers.</p> <p>Create wholesale power market.</p> <p>Conduct supply auctions for investment in new plant.</p>

Source: World Bank.

Note: GW = gigawatts; IT = information technology.

supply contracts with the utility—can play a valuable role in expanding capacity.

- *Private sector participation.* It may be best at this stage to limit private involvement to generation. For the distribution segment, the emphasis should be on building good governance and managerial practices, particularly with respect to financial discipline and human resource management.
- *Competition.* The only relevant form of competition at this stage is likely to be competition for the right to build new generation plants. Particularly critical is the development of the technical capacity required to conduct least-cost planning to determine what plants to build, with mandatory links to a competitive

procurement process. Furthermore, some of the benefits of a competitive market can be mimicked through the administrative practice of economic dispatch.

In more mature environments, it becomes feasible to contemplate a more sophisticated package of reforms, as long as these improve sector outcomes. This applies particularly to middle-income countries with stable political environments and large power systems, where progress has been made toward good governance and financial viability for the sector. Given that reform is a means to an end, the priority in these environments should be to identify where power sector performance

continues to fall short of expectations and to pursue more advanced reform measures geared to delivering results in these specific areas.

***The policy implications are as follows:***

- *Regulation.* Thought should be given to establishing a separate regulatory entity if one does not already exist. It now becomes more important to set tariffs to achieve full capital cost recovery, as well as to tighten enforcement of quality-of-service regulation. Strengthening the regulatory framework is particularly critical if the policy objective is for the sector to repay investment finance at market rates.
- *Restructuring.* This is the right juncture at which to consider vertical unbundling to create a separate transmission system operator that will support impartial third-party access to the grid. At the same time, it becomes important to break up generation assets to provide for sufficient competitive pressure among market players.
- *Private sector participation.* Countries moving toward a wholesale power market should ideally divest at least part of their generation assets to the private sector to ensure some diversity of ownership among competing companies. In the distribution tier, countries experiencing operational inefficiencies may wish to consider private sector participation. Where public utilities are performing efficiently, the case for private sector participation is weaker; the need to raise additional capital, however, may make it necessary for the utility to obtain a credit rating to support access to bond finance, or a minority stock exchange listing, both of which will also have the desirable effect of tightening the utility's financial discipline.
- *Competition.* Countries at this stage are ready to consider the transition to a wholesale power market. This should be accompanied by parallel supply auctions or an equivalent measure to ensure timely development of adequate new generation capacity.

The transition from challenging to mature environments can be gauged in terms of certain key enabling conditions. In practice, it may not be necessary or feasible for countries to meet every one of these enabling conditions; however, the more conditions that are met, the better are the prospects for implementation of the more sophisticated reforms. Most of these enabling conditions are related to readiness for the introduction of private participation in distribution. This is more likely to succeed when certain minimum thresholds of financial viability and commercial efficiency have been passed, and when the challenge of electrification is at a reasonably advanced stage. Good financial and operational data systems will also help to reduce information asymmetries and increase confidence among private participants, as will a good track record of regulatory tariff-setting and a conducive political environment. Other enabling conditions are more directly related to the establishment of wholesale power markets. In particular, the power system should be large enough to support at least five competing generation firms (at least 3 gigawatts) and to generate enough turnover to justify the fixed costs of establishing market platforms (at least US\$1 billion in annual revenues).

**Policy implication #2: The design of power sector reform needs to be thoroughly grounded in the political realities of each country**

**Commitments to power sector reform should reflect a sober assessment of the country's political economy.** The 1990s reform model drew heavily on economic first principles, with no explicit attention to the political dynamics of the reform process. Yet, the reality is that the power sector is highly politicized across much of the developing world. Understanding a country's political dynamics and how they impinge on stakeholder interactions in the power sector should be the starting point for any power

sector reform. Rather than overlooking the political dimension, a smart reform process should be adapted to fit the political context, harnessing potential reform champions and explicitly engaging in consensus-building with contrarian groups.

***The policy implications are as follows:***

- *Undertake a political economy analysis before engaging in reform.* The analysis should aim at discovering how the power sector touches upon the country's vested interests and political groupings to identify potential winners and losers from reform. It should also consider whether the proposed direction of reform is compatible with the country's ideological orientation and broader political system. The findings of the political economy analysis should explicitly guide the design of the reform program to be adopted.
- *Integrate outreach and communication efforts to engage all relevant stakeholders.* The communications campaign should be based on messages that can be used by the reform champions to articulate the value proposition associated with the reform. Those messages can be disseminated through a variety of channels. Communications should be complemented by outreach that directly engages with all stakeholders, particularly those most threatened by the reform process. In addition to an intensive effort at the outset of a reform process, there is a need to monitor the state of public opinion throughout implementation, as sudden changes in the political environment can easily lead to reform reversals.

**Policy implication #3: Greater emphasis should be placed on building institutional capacity for power sector planning and associated implementation**

**The 1990s model had little to say on the issue of planning.** The implicit assumption

was that the advent of a wholesale power market would somehow circumvent the need for planning. The ultimate goal of the 1990s model was to create a competitive market. At the time, it was assumed that private investments in power generation would be adequately guided by price signals. The role of the state was seen primarily as the regulator of a privately owned and operated competitive sector, and great emphasis was placed on the creation of a capable regulatory institution and associated legal framework. Central planning functions were overlooked or downplayed. Indeed, in some countries, the planning function traditionally housed in national power utilities or line ministries fell through the cracks as power sector reform processes worked to unbundle the incumbent utilities and to build technical capacity in regulatory agencies operating outside of line ministries. In practice, power markets proved difficult to establish in all but a handful of developing countries; even there, price signals have not provided an adequate basis for investment decisions.

***The policy implications are as follows:***

- *Create strong technical capacity for planning and empower the planning function.* The development of a strong planning capacity for the development of new generation and transmission infrastructure should be prioritized as a critical component of power sector reform. Various alternative institutional models have been successfully used around the world to locate the planning function, including the line ministry, the transmission utility, the system operator, or a dedicated technical agency. Regulators can play a valuable role in the technical review of investment plans as part of the process of setting revenue requirements for capital expenditure.
- *Make sure the power system plan is actually implemented.* As important as the planning process itself is a strong link between the

power system plan and the procurement of new generation and transmission plant, so that procurement is aligned with the plan and contracted in a timely and cost-effective manner that keeps pace with demand. Without such a clear linkage, governments are vulnerable to unsolicited proposals that may not represent the most cost-effective option for the power system.

- *Incorporate new technologies in power system planning.* Technologies such as distributed energy resources, together with storage and demand response, have the potential to reduce the costs of reaching supply-demand balance. However, the incorporation of such resources is not considered in traditional power system planning, in part because they introduce significant complexity into standard planning methodologies, but also because they would not necessarily be undertaken by the incumbent utility. Storage—in particular—can play multiple roles in the power system, potentially substituting for conventional investments in generation, transmission, and distribution assets. There is a need to modernize planning tools and techniques to integrate such considerations.

**Policy implication #4: Generation plants should be procured through a transparent and competitive process, with as much contractual flexibility as the context allows**

**Although IPPs have proved a popular and effective means of bringing private capital into power generation, much room for improvement remains in the way such projects are implemented.** Direct negotiation of projects, often in response to unsolicited proposals, remains widespread across Africa and Asia, raising concerns about value for money and the potential for corruption. At the same time, the

need to mitigate risk to reassure investors entering uncharted waters has left many countries with rigid take-or-pay contracts and extensive guarantee clauses that both constrain the efficiency of dispatch and saddle the utility and the government with onerous liabilities.

***The policy implications are as follows:***

- *Mandate the use of competitive procurement for generation projects.* Competitive bidding of new generation plants should be the default modality for procurement. If unsolicited proposals are considered—only in clearly defined and exceptional cases and when their prefeasibility and compatibility with existing investment plans can be established—they should also be subjected to a competitive process.
- *Maximize the flexibility of contractual provisions.* Risk-mitigation mechanisms will inevitably be needed in unproven environments, but these should be carefully scrutinized and limited to the minimum required to meet investors' legitimate expectations of return. Doing this could mean, for instance, scaling back the volume or duration of take-or-pay clauses or making use of two-part pricing mechanisms that separate capacity and energy charges.
- *Consider the adoption of supply auctions wherever possible.* The foregoing challenges have been successfully addressed by countries that have moved toward the adoption of supply auctions, ensuring a pipeline of regular, well-structured offerings of batches of new generation plant. These are linked to long-term contracts with distribution utilities that give generators first right of supply without committing to take-or-pay arrangements. A growing number of countries are adopting such mechanisms to procure variable renewable energy, and these could readily be extended to cover other technologies.

**Policy implication #5: Unbundling should not be the highest priority where more fundamental financial and governance challenges persist; it should be undertaken primarily to facilitate deeper reforms**

**In the past, power sector restructuring has, at times, been treated as a panacea for reform and prioritized as an early reform measure.** However, in and of itself, power sector restructuring does little to tackle the fundamental issues of weak governance and financial fragility that plague the power sector in many developing countries. Moreover, restructuring a sector that suffers from weak governance and financial fragility may only exacerbate the challenges of technical coordination and financial payment along the supply chain.

**In reality, unbundling was never intended as an isolated reform measure but rather as a necessary precursor for a competitive market.** Unless the latter is a realistic possibility in the medium term, restructuring the sector may not be a pressing matter. Unbundling entails significant transaction costs, as well as the potential loss of economies of scale and scope, which should not be underestimated (Pollitt 2008; Vagliasindi 2012). For these reasons, the relevance of unbundling to smaller power systems is particularly questionable. There is a well-established minimum size threshold of 1 gigawatt before countries should even consider embarking on sector restructuring, and a further threshold of 3 gigawatts before they definitely need to unbundle should they be preparing for the establishment of a wholesale power market.

***The policy implications are as follows:***

- *Consider unbundling when there is a clear purpose for doing so and where enabling conditions are in place.* The purpose behind unbundling might be to establish a wholesale power market in the not-too-distant future

or to introduce private sector participation in a specific segment of the industry but not elsewhere. The enabling conditions would include (1) a minimum system size of at least 1 gigawatt to avoid the loss of economies of scale and (2) adequate institutional governance, including strong payment discipline and technical coordination along the supply chain.

**Policy implication #6: Wholesale power markets remain a viable option for countries that have put in place all the foundational measures; others may derive greater benefit from regional trade**

**The 1990s power sector reform model held up a competitive power market as the endpoint of reform. The aspiration remains legitimate, but it has proved to be farther out than originally envisaged.** The difficulty of fulfilling the many enabling conditions that a wholesale power market requires has deferred indefinitely the introduction of such markets across much of the developing world. Nevertheless, their attainment remains a valuable and legitimate aspiration, provided that the enabling conditions can be met. Indeed, the present wave of technological disruption only increases the value of wholesale power markets, which, when properly designed, can support the discovery of rapidly evolving costs and foster the integration into the power system of variable renewables, ancillary services, battery storage, and demand response.

***The policy implications are as follows:***

- *Ensure that the enabling conditions for a wholesale power market are in place.* Countries should not consider developing such a market until a wide range of preconditions have been met. These include the following: (1) a fully restructured power sector that has created at least five competing generators

with diversified ownership, (2) an absence of significant constraints in transmission or fuel availability, (3) a financially viable sector with a solid payment chain, (4) solid regulatory practices, and (5) sufficient system size. A wholesale power market entails certain fixed costs that are unlikely to be justified by the potential efficiency gains until the market is large enough. As a rule of thumb, power markets are not likely to become very interesting until a country reaches a national market turnover of around US\$1 billion, which is equivalent to a power system size of some 3 gigawatts.

- *Avoid getting locked into transitional arrangements.* Countries that are ready to move to a competitive market should consider carefully whether transition mechanisms are really needed, since experience suggests there is a relatively high risk of getting stuck in intermediate stages, in particular, the single-buyer model.
- *Establish a strong transmission system operator.* The transmission utility plays a critical role in a competitive power market, ensuring equitable access of third parties to the grid infrastructure, and potentially also playing a leading role in power sector planning, system planning, and sometimes market operation.
- *Monitor and adapt the design of the wholesale power market based on implementation experience.* Wholesale power markets may not always function according to design. Proactive monitoring for potential abuses of market power is very important, particularly in the early stages, as is the flexibility to learn from this experience and adapt market design accordingly.
- *Provide a parallel mechanism for incentivizing investment in generation.* Short-term market price signals alone are not always adequate to provide incentives for investment in new capacity. Parallel capacity mechanisms are needed, with supply auctions proving to be particularly efficient and effective. Such auctions can be adapted to target low-carbon

forms of energy (with associated storage) and can increasingly be used to contract for adequate ancillary services to balance variable renewable energy.

- *Modernize wholesale power markets to accommodate new resources.* Conventional power market designs are not adapted for the presence of variable renewable energy resources, battery storage, or increasingly sophisticated demand response. Integrating them calls for the development of new pricing mechanisms that are able to remunerate the ancillary services required for the successful integration of variable renewable energy, provide suitable price signals to incentivize efficient investment in utility-scale battery storage, and allow demand-response aggregators to participate in the process of dispatch.
- *Participate in regional and cross-border trading arrangements wherever possible.* Regional power markets also offer significant benefits for arbitrage based on differential generation costs and load profiles among neighboring countries. Other benefits include shared reserve margins and greater flexibility to accommodate variable renewable energy. For countries not yet ready to develop wholesale power markets domestically, regional markets can provide an important first step. Nevertheless, even regional markets entail certain basic minimum enabling conditions that cannot always be taken for granted—in particular, creditworthiness on the part of power importers and security of supply on the part of power exporters.
- *Move toward economic dispatch of power plants.* Deviations from principles of economic dispatch are widespread in the developing world, leading to major generation inefficiencies. Countries not yet ready to develop wholesale power markets should consider having their system operator move toward the practice of economic dispatch based on the marginal costs of operating different plants.

### **Policy implication #7: Greater efforts should be made to strengthen the corporate governance and managerial practices of state-owned utilities**

**The 1990s reform model focused on privatization of distribution utilities, but the reality is that most remain publicly owned.** The creation of corporatized public utilities out of traditional ministerial departments was viewed as a short transitional measure toward eventual privatization, which would lead to a full overhaul of managerial practices. However, given the relatively limited uptake of privatization in the distribution segment, it has become very important to address enduring weaknesses in the corporate governance of public utilities. The evidence shows that there is wide variation in the performance of public utilities; a substantial minority reaches efficiency levels comparable to private utilities, while the majority continues to flag. Better-performing public utilities share many aspects of good corporate governance with each other and with private utilities.

#### *The policy implications are as follows:*

- *Improve human resource management of public utilities.* Public utilities should take care to apply aspects of human resource management that are strongly associated with improved performance. These relate primarily to the quality of the selection process for hiring employees—in particular, the application of standard good practices, such as advertising vacancies, shortlisting and interviewing candidates, and conducting reference checks. The liberty to fire employees for underperformance is also found to be important, although this is often difficult to enforce in public sector environments.
- *Strengthen financial discipline of public utilities.* Similarly, public utilities should adopt certain aspects of financial discipline that are strongly associated with improved

utility performance. Again, these comprise standard measures, such as the publication of externally audited financial accounts that are prepared in conformity with international financial reporting standards. Another good practice is the explicit identification and costing of public service obligations that cannot be justified on commercial grounds.

### **Policy implication #8: The regulatory framework needs to be adapted to reflect the institutional context and to accommodate emerging technological trends**

**The creation of sector regulators has been a popular reform, but many of these entities find themselves regulating public rather than private utilities.** The power sector reform model of the 1990s envisaged the creation of a regulatory entity as a prerequisite for introducing private sector participation, particularly in power distribution. The regulator was supposed to play the dual role of protecting private investors from opportunistic government meddling, while also protecting consumers from abuses of privately held monopoly power. The evidence suggests that regulation has functioned much more effectively where the private sector entered power distribution than where utilities remained state-owned.

**Moreover, the regulatory regimes of the 1990s did not anticipate the current wave of technological disruption in the power sector.** The power sector has seen momentous technological change since the development of the 1990s power sector reform model. The changes are challenging the traditional approach to tariff regulation, which is based on ensuring that the utility collects enough revenue to enable it to roll out new infrastructure. It also raises questions about the traditional design of tariff structures that were often motivated by social policy concerns in a context where consumers were largely captive.

***The policy implications are as follows:***

- *Ensure that the instruments of price regulation are consistent with the governance of the utility.* There is little value in applying the instruments of incentive regulation—designed to harness the profit motive of private utilities—to state-owned utilities that are not driven by profit maximization and may not even operate under hard budget constraints. In these cases, it makes more sense to use traditional cost-of-service regulation and focus on creating supportive managerial performance incentives. Even the creation of a separate regulatory entity may be less of a priority when the sector remains state-owned, because, in practice, both the utility and the regulator are likely to be closely overseen by the line ministry, making regulatory independence somewhat illusory. Nevertheless, irrespective of which institution is responsible for regulation, a clear, well-grounded methodology for tariff-setting, applied on an annual basis, is of tantamount importance.
- *Aim for limited capital cost recovery initially.* Most regulatory tariff methodologies are based on principles of full capital cost recovery, including remuneration of the full asset base at the market cost of capital. Where utilities have been privatized, this principle is critical for financial sustainability. However, in the case of state-owned utilities, which often benefit from significant capital grants, it is not essential to remunerate the full asset base at the market cost of capital. Rather, the concern should be to ensure that the utility is able to cover the costs associated with the loans that are carried on its books. This limited capital cost recovery, which ensures the financial viability of the enterprise, is a reasonable interim tariff-setting objective.
- *Integrate regulation with other key public sector processes for state-owned utilities.* In some countries, regulatory frameworks coexist with other forms of state oversight. Utilities may be held accountable through performance contracts with the Ministry of Energy, for example, while tariff-setting is inextricably linked with financial oversight and subsidy decisions that lie in the hands of the Ministry of Finance. Rather than creating parallel tracks, regulation should build upon and integrate these complementary processes. Quality-of-service regulation should be reflected in the key performance indicators determined under performance contracts. Tariff and subsidy decisions should be taken simultaneously in a coordinated manner, ensuring that the overall revenue requirements of public utilities are met through a combination of both sources.
- *Give greater attention to creating a credible regulatory framework for quality of service.* With regulatory attention focused primarily on tariff-setting, efforts to provide a credible framework for monitoring quality of service and enforcing the achievement of the prescribed standards have been inadequate. Such a framework is of critical importance to ensure that regulatory reforms yield tangible benefits for electricity consumers.
- *Test the “future-readiness” of the regulatory framework.* The regulatory pricing regime for power utilities can affect the incentives for adoption of new technologies. For instance, traditional cost-of-service regulation will not encourage a utility to adopt technologies that may reduce demand for energy or meet demand at a lower investment cost. The regulatory licensing regime may also create barriers to the entry of new actors, such as providers of distributed energy resources or demand aggregators. There is therefore a need to review existing regulatory frameworks to evaluate whether they offer adequate incentives for innovation.
- *Ensure that the economics of decentralized electricity supply are reflected in tariff structures.* Electricity tariff structures have traditionally been designed under the premise that consumers have limited alternatives to grid



electricity, so pricing can be guided primarily by considerations of fairness and equity rather than economic efficiency. This practice has led to tariff structures under which costs are recovered primarily through volumetric charges, with extensive embedded cross-subsidies across consumption bands and consumer groups. Because such tariff structures fail to recognize the fixed-cost nature of the power grid, they overreward customers choosing to self-supply and fail to convey time-of-use price signals that would incentivize customers to participate more actively in demand response. Future tariff structures will have to give greater weight to fixed charges that take into account customer load. Volumetric charges will have to reflect time of use and be designed in combination with structures to remunerate prosumers injecting power into the grid.<sup>2</sup>

### **Policy implication #9: Private sector participation in distribution should be considered only when enabling conditions are met**

**Privatization of distribution utilities has delivered good outcomes in suitable environments, but it has proved risky where conditions were not right.** Private sector participation in power distribution was widely adopted in Latin America and parts of Europe and Central Asia, with outcomes that were quite encouraging. Nevertheless, it has also been associated with disappointing performance and dramatic reversals in cases where the utility was not yet functioning at a basic level or the authorizing environment was weak. Some countries that eschewed utility privatization found other ways to incorporate the benefit of private sector discipline through financial market channels.

*The policy implications are as follows:*

- *Determine whether the economic preconditions for distribution privatization are in place.*

Private sector participation is more likely to be successful in circumstances where (1) there is reasonably accurate information about the operating performance of the utility and the condition of its assets; (2) retail tariffs are relatively close to full (capital) cost recovery (at least 70 percent); (3) it is accepted that customers can be disconnected for nonpayment of bills; and (4) a competent regulator possesses the power to adjust tariffs as needed and the technical competence to monitor quality of service.

- *Evaluate whether the political preconditions for privatization of distribution are in place.* Even when the economic preconditions for private sector participation are in place, political impediments may remain. Private sector participation is more likely to be politically feasible in circumstances where (1) there is a broad, established tradition of private sector-led economic activity; (2) domestic actors can be involved in the privatization; (3) the value of private sector participation is clear; and (4) positive outcomes can be arranged for key stakeholder groups.
- *Explore alternative modalities for engaging the private sector.* The 1990s model considered private sector participation primarily in terms of private ownership, or at least management, of the utility. However, financial markets can provide another channel through which private sector discipline can be introduced into power distribution. This can be done through mechanisms such as listing minority shares of a state-owned utility on a local stock exchange or having the utility secure a credit rating and raise its own bond finance.
- *Maintain a proper focus on energy access.* Strengthening the utility's commercial orientation should sharpen its incentive to expand its market through electrification. However, in many developing countries, unserved customers are unprofitable owing to high incremental costs and relatively low consumption. This underscores the need

to complement distribution reforms with a sound electrification planning process comprising clear targets, an associated public funding program, and a suitable monitoring framework. At the same time, off-grid rural electrification can be advanced by creating a suitable enabling environment for private provision of off-grid solar power.

**Policy implication #10: Delivering on the twenty-first century agenda of universal access and decarbonization calls for additional reform measures targeted explicitly at these objectives**

**Universal electrification eventually comes into conflict with a utility's commercial incentives and requires parallel policy and financial supports.** Strengthening utilities' commercial orientation through private sector participation or other means can drive a rapid expansion of connections in urban areas. However, extending access to electricity to the periurban and rural periphery often leads a utility into diminishing and even negative marginal returns on investment, particularly if the power consumption of poor households remains very low. Thus, universal electrification cannot be achieved purely by allowing a utility to pursue commercial incentives. It requires complementary policy action to set access targets, provide sustained public subsidies to offset the associated financial losses, and exploit the opportunities offered by solar technology for off-grid electrification. Looking back over the past 25 years, progress on electrification was not typically synchronized with power sector reform (figure O.14a); rather, it reflected policy commitments that became increasingly likely as a country's per capita income grew. In some countries, the big push on electrification preceded sector reform; in others, it came more as an afterthought.

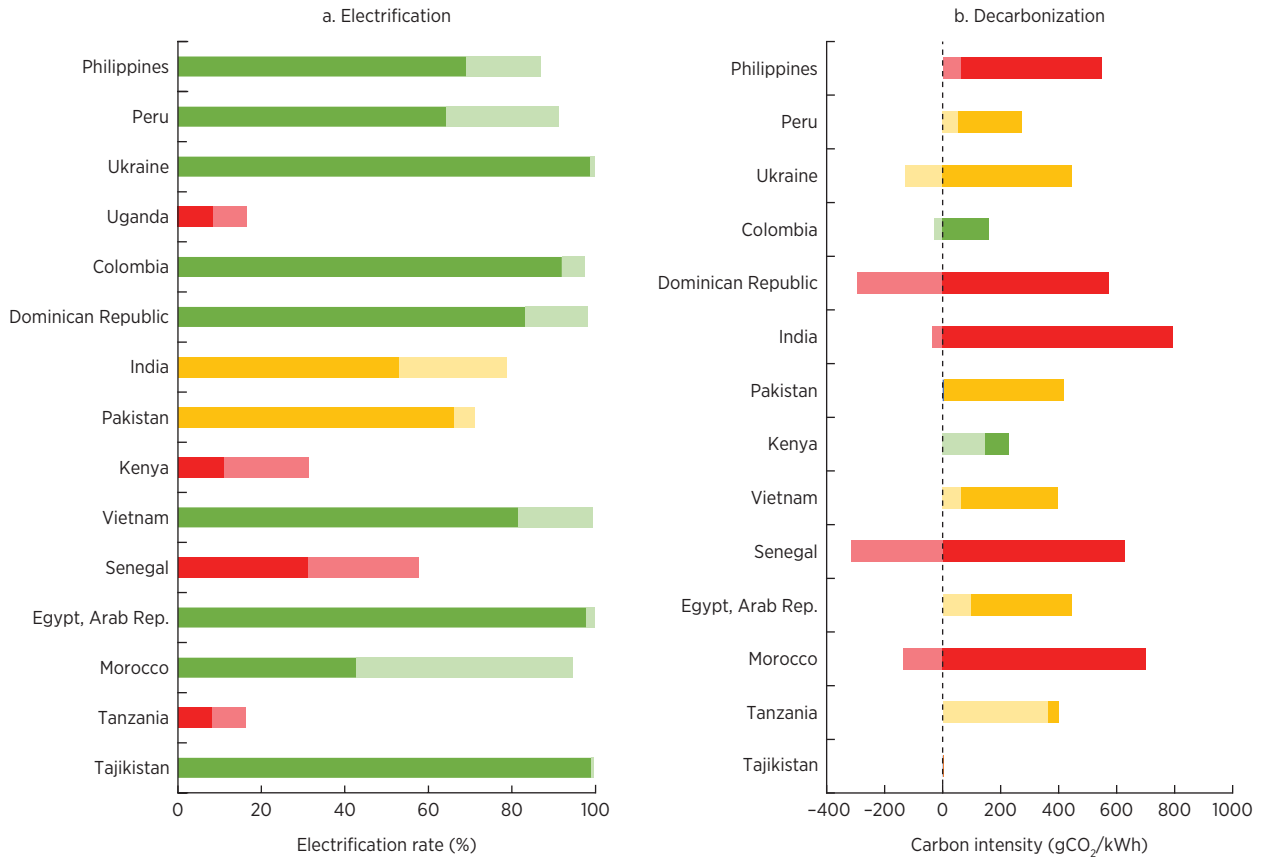
**Power sector reform provides certain enabling conditions for decarbonization,**

**but additional policy and planning measures must be taken to direct investors toward cleaner energy options.** Private sector investment in generation can make a significant contribution to expanding renewable energy capacity. In addition, a wholesale power market, particularly when complemented by supply auctions, can provide a useful mechanism for price discovery related to new technologies, as well as a solid economic framework for pricing services ancillary to variable renewable energy and for remunerating demand response. Nevertheless, the evidence suggests that significant progress toward decarbonization over the past 25 years has been primarily driven by policy targets rather than by institutional reforms per se (figure O.14b). For most countries over this period, the overriding policy goal for generation was security of supply rather than decarbonization, leading oil-dependent countries to become less carbon-intensive as they diversified into gas, and hydro-dependent countries to become more carbon-intensive as they diversified into fossil fuels.

***The policy implications are as follows:***

- *Advance electrification on multiple fronts.* Countries making the most rapid progress toward electrification have done so by making simultaneous progress on- and off-grid, based on an integrated spatial master plan. They typically make long-term commitments to ambitious electrification targets, supporting them with public and donor finance and providing a suitable enabling environment. A critical issue is to ensure that both the upfront and ongoing costs of electricity are affordable for the target populations.
- *Determine explicit policy targets for decarbonization.* Achieving decarbonization goals requires explicit government direction of investment decisions in power generation, as well as incentives for the adoption of low-carbon technologies and more efficient consumption of energy.

**FIGURE O.14** Progress on twenty-first century policy objectives for electrification and decarbonization, 1990–2015, countries ranked in descending order of reform effort



Source: Based on data from Tracking SDG7 report and IEA.  
 Note: Dark shaded bars represent prereform electrification; the light shaded bars represent the change since then. IEA = International Energy Agency; SDG7 = Sustainable Development Goal 7.

Source: Based on data from Tracking SDG7 report and IEA.  
 Note: Dark shaded bars represent average value in 2010–15; light shaded bars represent the change in values from prereform era. gCO<sub>2</sub>/kWh = grams of carbon dioxide produced per kWh; IEA = International Energy Agency; SDG7 = Sustainable Development Goal 7.

**CONCLUSIONS**

**Overall, it is recommended that future reforms be increasingly shaped by context, driven by outcomes, and informed by alternatives.**

**First, there is a need to shift from a context-neutral approach to reform to one that is shaped by context.** An overarching message is that the design of reforms should be sensitive to country conditions. The 1990s power sector reform model was largely derived from economic first principles and first tested in

relatively sophisticated environments. As a result, it lacks a framework for adapting reform to the country context. In practice, numerous preconditions—both economic and political—have emerged as important in shaping its applicability. A more structured approach to mapping out such prerequisites should figure prominently in future efforts along the lines offered in this report.

**Second, there is a need to shift from process-oriented reform to outcome-oriented reform.** The 1990s model focused

primarily on a particular package of institutional reforms, which, it was argued, would lead in time to better overall sector outcomes. Rather, it is important to design a reform process by identifying the most critical outcomes and working backward from there to identify the measures most likely to remove key bottlenecks and roadblocks preventing achievement of the desired outcomes.

**Third, there is a need to shift to a more pluralistic range of institutional models.** Although the 1990s power sector reform blueprint has demonstrated its ability to deliver in certain country contexts, the results have been quite disappointing in other settings. Moreover, some countries that adopted only limited reforms have achieved outcomes at least as good as those achieved by countries that went further with the reform agenda. These findings make the case for a more pluralistic approach to power sector reform going forward, recognizing that there is more than one route to success.

## NOTES

1. The Rethinking Power Sector Reform Observatory includes Colombia, Dominican Republic, the Arab Republic of Egypt, India (states of Andhra Pradesh, Odisha, and Rajasthan), Kenya, Morocco, Pakistan, Peru, the Philippines, Senegal, Tajikistan, Tanzania, Uganda, Ukraine, and Vietnam.
2. Demand response is defined as when the end user changes their electricity usage in response to price signals or incentives payments.
3. A simple Power Sector Reform Index was constructed to aggregate data across the four dimensions of power sector reform considered in this study. The index gives each country a score in the range 0–100 on each dimension of reform. The scores give equal weight to each step of each dimension on the reform continuum. The simple average of the four 0–100 scores is used to summarize the extent of reform. The index is purely descriptive and has no normative value. This index is described in greater detail in Chapter 2, and full technical definitions are provided in the annex of the chapter.
4. Merchant plants are typically nonutility power generation plants that compete to sell power. They usually do not have long term power purchase agreements and are mostly found in competitive wholesale power market places.
5. A Utility Governance Index measures the extent to which specific utilities conform to good practices. It is difficult to say exactly when and how good governance and management practices have been adopted over time, because such measures are usually implemented within institutions and do not necessarily involve major legal or structural changes that can readily be tracked in the public record. Nevertheless, it is possible to measure the current rate of adoption of such practices. Based on a sample of 19 state-owned and 9 privatized utilities from the 15 observatory countries, the Utility Governance Index measures the existence of best practices in utility rules and regulations. For example, a utility may, on paper, allow managers to hire and fire employees based on performance—and the index captures this—however it is unable to tell whether the manager actually does so. This index is described in greater detail in chapter 4 and the full technical definitions are provided in the annex of the chapter.
6. The survey conducted in each of the 15 Observatory countries included 355 categorical and quantitative questions on the regulatory system. The questions were both descriptive and normative. Normative questions aimed to capture regulatory best practices based on the literature. To synthesize the normative data in a convenient and intelligible format, a Regulatory Performance Index was created. Two versions of the same index were calculated for each country. First, a *de jure* index derives from the country's regulatory framework as captured on paper in laws, regulations, and administrative procedures. Second, a perception index determines whether the paper provisions are applied in practice. The local consultant in each country provided the perception index; his or her professional opinion was informed by some 20 interviews with key stakeholders in the reform process. The perception index was also reviewed by the World Bank country energy team knowledgeable about local context. Despite best

efforts, this second index is more subjective than the first. This index is described in further detail in chapter 6 with technical definitions in the annex of the chapter.

7. Prosumers are entities that consume as well as produce electricity.

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