



Getting electricity

Measuring reliability, prices and transparency

- This year *Doing Business* collected new data in 189 economies on the price of electricity and the overall quality of electricity supply.
- High electricity prices and frequent power outages constrain the operations of businesses and affect entrepreneurs' decisions on whether to establish a business and on how to operate it.
- A sound regulatory environment can help ensure a stable electricity supply. In 131 of the 189 economies covered by *Doing Business*, a national energy regulator monitors the frequency and duration of power outages. In 66 of these economies utilities compensate customers or pay fines if outages exceed the limits set by the regulator.
- Electricity tariffs for commercial customers typically range from 10 to 30 cents per kilowatt-hour, but prices in some economies are much higher. Tariffs need to strike a balance—remaining affordable to customers while enabling the utility to recover costs and make a profit.
- Information about tariffs needs to be clear and easily accessible to customers. Making tariffs readily available and providing advance notice of changes in tariffs can help businesses manage their costs.

Electricity plays a vital part in the modern economy. Yet merely having access to power is not enough. The reliability of supply is also crucial. According to 2013 World Bank Enterprise Survey data for 135 economies, business owners perceive an unreliable supply of electricity as one of the main obstacles to their activities. In both Sub-Saharan Africa and South Asia about 45% of firms identified reliability of the power supply and connecting to the grid as among the key constraints to doing business.¹ Businesses in Pakistan estimated losses due to power outages at up to 34% of annual revenue, while respondents in the Central African Republic reported losses of up to 25% of revenue. Not surprisingly, research shows that capital (domestic and foreign) tends to be attracted to countries that are able to offer a reliable and competitively priced supply of electricity.²

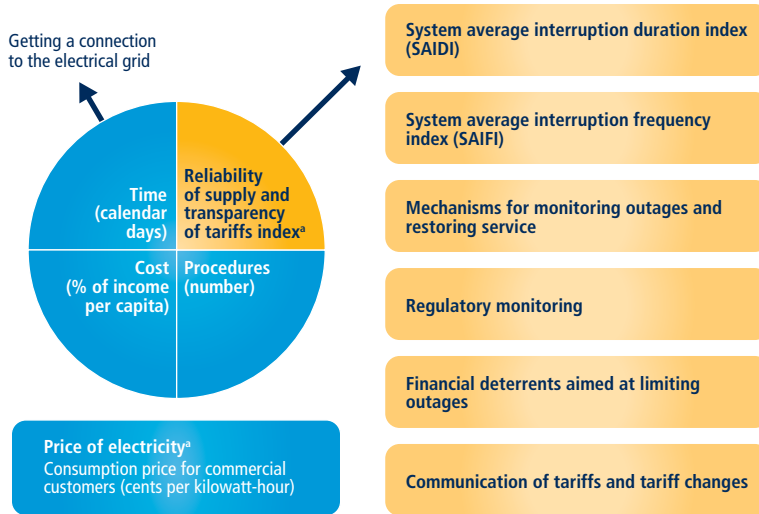
Since 2011 *Doing Business*, through its getting electricity indicators, has measured one aspect of access to electricity—by recording the time, cost and number of procedures required for a small to medium-size business to legally connect a commercial warehouse to the electrical grid. Over the years the getting electricity indicators have served as a benchmarking tool, enabling utilities and regulators to measure the efficiency of the electricity connection service and contributing to dialogue on regulatory reforms and good practices.

But the efficiency of the connection process—as measured by the time, cost and number of procedures to get a new connection—relates to only a small part

of the power sector's overall performance in each economy. For this reason *Doing Business* introduces two new indicators this year (figure 7.1). The *reliability of supply and transparency of tariffs index* encompasses quantitative data on the duration and frequency of power outages as well as qualitative information on how utilities and regulators handle power outages and how tariffs and tariff changes are communicated to customers. The *price of electricity* provides comparable data on electricity prices for commercial customers (this indicator is not included in the ranking on the ease of doing business, however).

The new data broaden the coverage of the getting electricity indicators, providing a more comprehensive picture. Yet the data show that the efficiency of the connection process and the reliability of electricity supply appear to be correlated. In other words, economies where it is easy to connect to the grid tend to have a well-developed and reliable network infrastructure characterized by few outages (figure 7.2). The Republic of Korea, for example, has the fastest process for getting a new electricity connection (taking only 18 days) as well as a low cost to connect (40% of income per capita). Korea also has the highest possible score on the reliability of supply and transparency of tariffs index. Businesses in Seoul typically experience power outages amounting to less than an hour a year and can receive compensation for an outage caused by the utility if power isn't restored within five minutes. The utility uses automated systems for monitoring outages and restoring service. And the independent regulatory

FIGURE 7.1 New measures have expanded the coverage of the getting electricity indicators



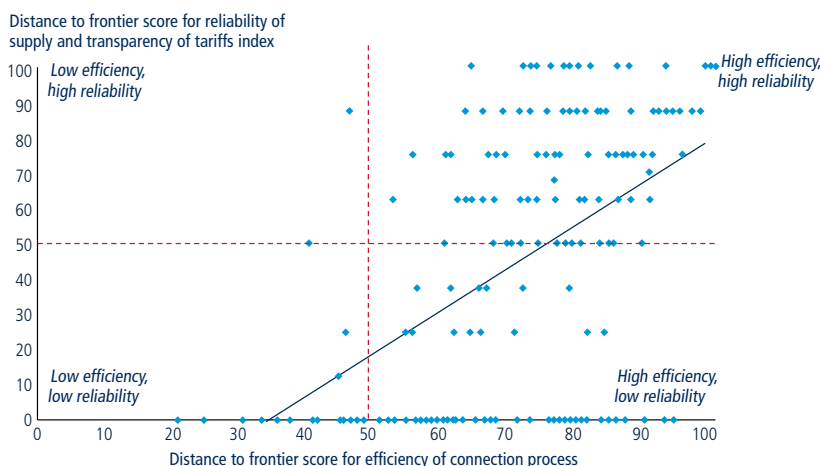
a. New indicator added this year. The price of electricity is not included in the ranking on the ease of doing business.

body that oversees the sector makes sure that changes in electricity tariffs are communicated ahead of time.

Businesses face a different situation in Niger, where there is a substantial gap between the demand for electricity and

its supply and the power infrastructure is outdated and subject to huge transmission and distribution losses. In Niamey getting a new connection takes 115 days and costs more than 6,200% of income per capita. Customers experience power outages almost daily, and the utility still

FIGURE 7.2 Economies with an efficient connection process tend to have a reliable electricity network



Source: Doing Business database.

Note: The figure compares the average distance to frontier score for indicators of the efficiency of the connection process (procedures, time and cost) with the distance to frontier score for the reliability of supply and transparency of tariffs index. The correlation between the two scores is 0.49. The relationship is significant at the 1% level after controlling for income per capita.

uses manual systems to monitor outages. Moreover, there is no active regulatory body, electricity tariffs are not published online, and customers receive no compensation when outages occur.

Even so, an efficient connection process does not automatically translate into better reliability of supply. The ability of a distribution utility to provide reliable supply depends on many factors along the chain from generation through transmission to delivery of electricity to the customer.

RELIABILITY OF SUPPLY

Electricity outages can have serious effects on businesses. They can damage assets (such as electronics) and inventory. And they can disrupt work by shutting down equipment and cutting off lighting, heating or internet connections. “Our businesses are down because of these outages; without electricity we can’t work. We really can’t afford any more of this,” said Mr. Ali, a businessman who owned a dry-cleaning company in downtown Cairo. He was among the 20 million people affected by the city’s frequent power outages in 2014.³

Constrained by outages, millions of businesses around the world need to alter their operations to avoid disruptions or resort to captive power options, usually diesel generators. According to the 2013 World Bank Enterprise Survey data, more than 40% of firms located in 61 developing economies in the Middle East and North Africa, South Asia and Sub-Saharan Africa have their own generator even when they are connected to the grid.⁴ Businesses in higher-income economies also contend with unreliable power supply. As a result of the 2000–01 rolling blackouts in the U.S. state of California, a substantial number of businesses decided to install backup generators,⁵ which typically cost tens of thousands of dollars and generate very expensive electricity.

An unstable electricity supply can also lead to lower employment and to lower production for firms. Using data from Nigeria for 1970–2005, a study identified the inadequate and unstable power supply to the industrial sector as a major cause of unemployment in the country. Industry is a core sector for the generation of national wealth and employment in Nigeria, but faced with an electricity sector hampered by poorly utilized generation capacity, high transmission losses and frequent outages, companies turn to self-provision of electricity. This raises their production costs, reducing their competitiveness and thus their demand for labor. The erratic and inadequate power supply in Nigeria has often been cited as the main reason forcing multinationals to relocate production lines to other countries.⁶ Power outages also affect output levels. As a result of power supply interruptions in Bangladesh in 2001–03, utilities failed to meet an estimated 13.6% of the industrial sector's demand. In 2000–01 the resulting economic losses amounted to 1.7% of GDP.⁷

The effects go beyond economic costs. An unreliable electricity supply also has consequences for a society's well-being and living conditions. Only 25% of health facilities in Kenya can count on a reliable power supply. In India nearly half of health facilities have no access to electricity at all.⁸ Most public services are compromised when power shuts down. And outages can pose a threat to personal safety—such as by putting out streetlights and traffic lights and by disabling burglar alarms in homes.

How is the reliability of supply measured?

The reliability of supply and transparency of tariffs index provides a tool for benchmarking the performance of utilities in providing a reliable electricity supply. To assess the reliability of supply, *Doing Business* uses two standard measures: the system average interruption duration index (SAIDI) and the system average interruption frequency index (SAIFI). SAIDI measures the average

total duration of outages, and SAIFI the average frequency of outages, experienced by a customer in a year (excluding outages due to natural disasters). The calculation of SAIDI and SAIFI values is based on a standardized approach that is the most common one in use around the world. To ensure the comparability of data across economies, *Doing Business* relies only on SAIDI and SAIFI. The data are collected in the largest business city of each economy (and, in 11 economies, also in the second largest business city).

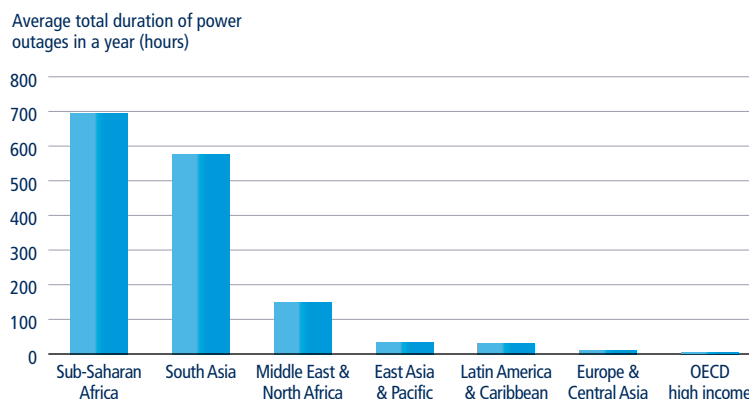
The reliability of supply and transparency of tariffs index also measures five qualitative aspects: whether utilities use automated tools to monitor power outages; whether they use automated tools to restore power supply; whether a regulator—that is, an entity separate from any utility—monitors utilities' performance on reliability of supply (through periodic or real-time reviews); whether utilities face financial deterrents aimed at limiting outages (such as a requirement to compensate customers or to pay fines); and

whether electricity tariffs are transparent and easily available (with effective tariffs available online and customers notified of a change in tariff ahead of the billing cycle).

What do the data on reliability show?

The data show that the occurrence of outages is associated with several factors. One is an economy's income level. A typical firm operating in a low-income economy faces nearly 250 outages a year, lasting close to 1,000 hours in total, while a typical one in a high-income economy experiences only 1.5 outages a year, totaling around 3 hours. The frequency and duration of outages also vary substantially among regions. Sub-Saharan African economies have the longest total duration of outages, averaging almost 700 hours a year for a customer—while OECD high-income economies have the shortest, averaging only about 1 hour a year (figure 7.3). Economies in South Asia have the highest frequency of outages, averaging more than 200 outages

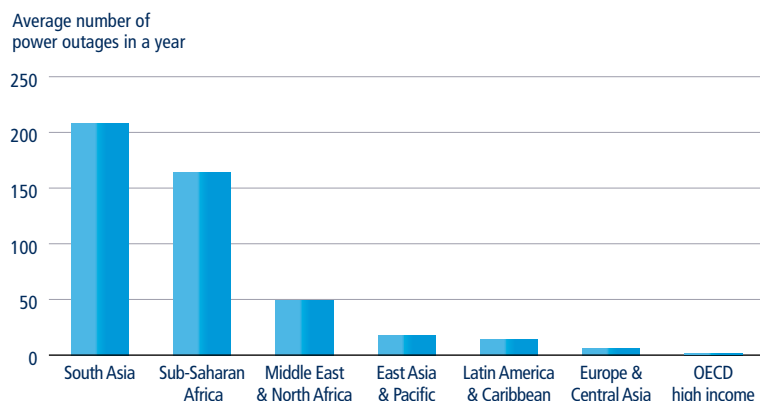
FIGURE 7.3 Electricity customers in Sub-Saharan Africa endure the most time without power supply on average



Source: *Doing Business* database.

Note: The figure shows the average number of hours without electricity supply over the course of a year for a low- or medium-voltage customer in the largest business city of each economy, as measured by SAIDI. For 10 economies the data are also collected for the second largest business city. The data are for the most recent year available. The sample comprises 147 economies. It excludes the following economies, for which no data were available: Angola; The Bahamas; Bangladesh; Benin; Botswana; the Central African Republic; Chad; the Republic of Congo; Djibouti; the Arab Republic of Egypt; Equatorial Guinea; Ethiopia; The Gambia; Ghana; Guinea-Bissau; Haiti; Iraq; Kiribati; the Kyrgyz Republic; Lao PDR; Lebanon; Lesotho; Madagascar; Malawi; Maldives; the Federated States of Micronesia; Montenegro; Mozambique; Myanmar; Nepal; Qatar; Rwanda; São Tomé and Príncipe; Sierra Leone; South Africa; St. Kitts and Nevis; St. Vincent and the Grenadines; the Syrian Arab Republic; Tajikistan; Timor-Leste; República Bolivariana de Venezuela; and the Republic of Yemen.

FIGURE 7.4 Electricity customers in South Asia experience the greatest average frequency of power outages



Source: *Doing Business* database.

Note: The figure shows the average number of power outages over the course of a year for a low- or medium-voltage customer in the largest business city of each economy, as measured by SAIFI. For 10 economies the data are also collected for the second largest business city. The data are for the most recent year available. The sample comprises 147 economies. It includes the following economies, for which no data were available: Angola; The Bahamas; Bangladesh; Benin; Botswana; the Central African Republic; Chad; the Republic of Congo; Djibouti; the Arab Republic of Egypt; Equatorial Guinea; Ethiopia; The Gambia; Ghana; Guinea-Bissau; Haiti; Iraq; Kiribati; the Kyrgyz Republic; Lao PDR; Lebanon; Lesotho; Madagascar; Malawi; Maldives; the Federated States of Micronesia; Montenegro; Mozambique; Myanmar; Nepal; Qatar; Rwanda; São Tomé and Príncipe; Sierra Leone; South Africa; St. Kitts and Nevis; St. Vincent and the Grenadines; the Syrian Arab Republic; Tajikistan; Timor-Leste; República Bolivariana de Venezuela; and the Republic of Yemen.

a year for a typical customer; OECD high-income economies have the lowest, averaging 1 outage a year (figure 7.4).

Many issues affecting the quality of supply are beyond government control. In some economies the national electricity supply is undermined by frequent natural disasters coupled with limited natural resources. Addressing issues of generation capacity and reliability of transmission and distribution grids may take a long-term approach. But in the shorter term there are practical actions that governments can take to ensure more reliable service. One is to put in place a robust regulatory framework with the right oversight and incentives. Electricity supply is typically a natural monopoly, so customers dissatisfied with the quality or price of the service often have no alternatives to choose from. This makes it important for regulators to monitor utilities' performance on matters relating to outages and tariffs. But to ensure that utilities can make the necessary investments to maintain and improve service,

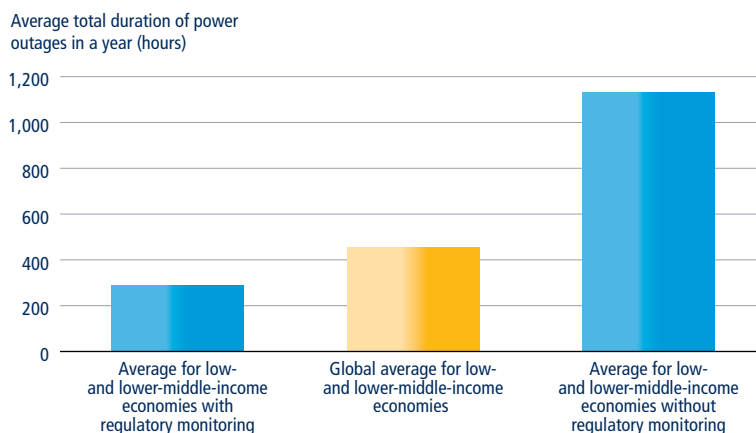
regulation should not compromise their balance sheets.

To create incentives to provide adequate service, one strategy used by regulators

is to set minimum quality standards while also monitoring data on outages. Among the economies with less than one hour of power cuts in 2014, 95% have a regulator that performs periodic or real-time monitoring of outages. Data for low- and lower-middle-income economies underscore the importance of regulatory monitoring (figure 7.5). Regulatory oversight can lead to stark differences in the duration of outages even among economies with similar income levels. Guatemala City, where a regulator monitors power cuts, registered 4 hours of outages in 2013. Tegucigalpa, Honduras, where there is no regulatory oversight of outages, had 257 hours of power interruptions that same year.

Another strategy often used by regulators is to set a limit on the frequency and duration of outages and then require utilities to pay compensation to customers if they exceed that limit. Alternatively, regulators may impose a fine on utilities. The size of such penalties varies across economies. But those that use financial deterrents to limit outages had 14 power cuts on average in 2014, lasting around 30 hours in total, while those that don't use them had 5 times as many outages, lasting almost 10 times as long.

FIGURE 7.5 Among low- and lower-middle-income economies, customers endure far less time without power supply in those with regulatory monitoring of outages



Source: *Doing Business* database.

Note: The figure shows the average number of hours without electricity supply over the course of a year for a low- or medium-voltage customer in the largest business city of each economy, as measured by SAIDI. For four low- or lower-middle-income economies the data are also collected for the second largest business city. The data are for the most recent year available. Regulatory monitoring refers to periodic or real-time monitoring of outages. The sample comprises 51 economies.

Like regulators, utilities can also take action to improve the reliability of supply. One way is to invest in the information technology systems used to monitor power interruptions and restore service. Because of financial constraints and the cost of introducing such systems, many utilities continue to rely on call centers to record outages, then send out maintenance crews to find the location of the fault and identify the cause. This process typically takes several hours. In 119 economies, however, utilities are able to rely instead on an electronic system, such as a Supervisory Control and Data Acquisition (SCADA) system or an Incidence Management System. A SCADA system, for example, transfers data in real time between the substations and the operator terminals. When an outage occurs, information on the exact location and cause of the power cut can immediately be sent to a dispatch crew.⁹ A SCADA system can also automatically restore power flow once it is safe to do so. This automation not only helps increase reliability; by reducing damage to equipment, it also helps lower costs.

Beyond investing in adequate tools to monitor and restore power outages, utilities also need to directly address

the sources of power failures—which in economies with high SAIDI and SAIFI values are usually faulty equipment, inadequate generation capacity and outdated power system infrastructure. Tackling these issues requires considerable investments (box 7.1). But making these expenditures should not necessarily price out the majority of customers—evidence suggests that expensive electricity bills do not ensure efficient service. Indeed, an analysis covering 189 economies that controls for income per capita shows that it is possible to have a stable supply even with low tariffs. This combination is most commonly found in economies that are rich in fuel energy resources. But there are exceptions. One of them is Turkey. Electricity customers in Istanbul experience five outages a year on average, and tariffs amount to 14 cents per kilowatt-hour, considerably lower than the global average.

PRICE OF ELECTRICITY— AND TRANSPARENCY

Efficient pricing is central to a well-functioning power sector. Utilities need to be able to recover their costs and make a profit by charging their customers

reasonable tariffs. At the same time, the private sector takes into account the cost of electricity when making investment decisions, and businesses often try to curb their energy costs through energy efficiency measures. But achieving efficient power pricing is easier said than done. The power sector is characterized by substantial up-front fixed costs, and it takes many years for initial investments to pay off. Beyond that, costs vary between different times of the day (peak, off-peak), seasons (dry, rainy), types of users (residential, commercial) and geographic areas (urban, rural).¹⁰

Tariffs, as well as any changes in them, need to be clearly communicated to customers—whether through the utility's and regulator's websites, the media, public hearings or other means. Customers need this information so that they can plan their expenses, understand the utility's billing system and, if needed, contest the charges. Businesses want to know in advance of any change in expenditure so that they can adjust their allocation of financial resources accordingly. In some economies the law requires utilities to announce changes several billing cycles ahead. In others, the regulator helps ensure that tariffs are published in

BOX 7.1 Improving the reliability of power supply in Mexico

Mexico's capital has had a big improvement in the reliability of electricity supply. In 2010 a typical customer living in the Mexico City metropolitan area experienced 7.33 hours of power outages. In 2014, just four years later, the same customer would have had to deal with outages totaling only 55 minutes.

Power interruptions are often caused by aging infrastructure, faulty equipment, electricity supply shortages and even such factors as erratic weather or falling trees. The local utility in Mexico City, the Comisión Federal de Electricidad (CFE), has been tackling these problems. Between 2010 and 2014 the utility invested 3.76 billion Mexican pesos (about \$244 million) in modernizing electrical circuits and underground networks; improving the maintenance of substations, power plants and other assets; and pruning trees.^a

Besides investing in infrastructure, the utility also relies on a robust system for monitoring outages, to ensure a timely response in detecting power cuts and restoring supply. Thanks to its SCADA system, the utility can conduct real-time monitoring of power interruptions and electronically restore electricity supply in the city.

At the national level too there is a sophisticated monitoring system in place. In 2012 Mexico's Electric Research Institute developed an electronic tool based on GIS (geographic information system) technology to forecast the effects of hurricanes on the country's electricity infrastructure. This has helped improve the planning and preparation for weather-related power outages, reducing the total duration of supply interruptions in Mexico.^b

a. Comisión Federal de Electricidad 2015.

b. Espinosa Reza, González Castro and Sierra Rodríguez 2011; Mena Hernández 2012.

different media outlets and that the information is clear and detailed enough so that customers can calculate their prices. In Pakistan, for example, customers are informed if the regulator and the utility even have a consultation on potential tariff changes.

How are prices and their transparency measured?

To measure the price of electricity, *Doing Business* computes a monthly bill for a small to medium-size business in the largest business city of each economy (and, in 11 economies, in the second largest business city as well). To ensure comparability of the data across economies, *Doing Business* uses a standardized case study centered on a commercial warehouse with a subscribed capacity and level of energy use typical of this kind of customer: the warehouse requires a capacity of 140 kilovolt-amperes (kVA) and has an hourly consumption of 112 kilowatt-hours. The case study assumes that the warehouse uses electricity 30 days a month, in March, and from 9:00 a.m. to 5:00 p.m. (which amounts to a monthly consumption of 26,880 kilowatt-hours). When multiple electricity suppliers exist, it is assumed that the cheapest supplier is used. To allow comparison of the price of electricity for businesses around the world, the total price is then converted to U.S. dollars and expressed in cents per kilowatt-hour.

By compiling a standard electricity bill, *Doing Business* adopts the perspective of a local entrepreneur—measuring the price and not the cost of electricity. Price is what final customers pay for electricity supply. Cost is the expense incurred by the utility company to produce, purchase, transport and distribute electricity. There may be a considerable difference between the price of electricity and its cost. In some economies, for example, the government subsidizes the price customers pay for electricity by paying a portion of the energy costs to the utility.

To assess the transparency of prices, *Doing Business* scores economies on whether tariffs are made available online and communicated properly to customers and whether tariff changes are announced ahead of the billing cycle through a means of communication reaching a majority of customers (television, radio, courier, newspapers). This score is part of the reliability of supply and transparency of tariffs index.

What do the data on prices show?

The price of electricity as measured by *Doing Business* varies widely among regions (figure 7.6). It is lowest on average in the Middle East and North Africa (11 cents per kilowatt-hour) and highest on average in East Asia and the Pacific (27 cents per kilowatt-hour).

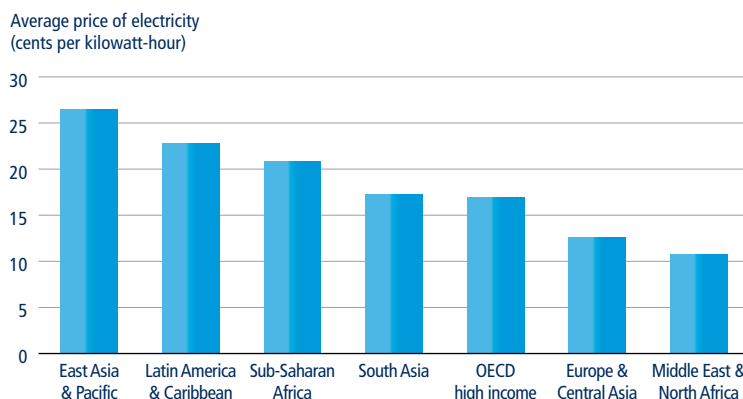
Many factors drive the price of electricity in an economy, with some of the important ones being the availability of domestic energy resources, the condition of power sector infrastructure, the adequacy of generation capacity and the existence and extent of subsidy regimes. A combination of these factors typically explains the differences in the prices observed, and these in turn may affect the electrification rate—the share of the

population with access to electricity. Indeed, in the business sector high electricity prices can discourage investments and also raise questions about whether it makes more sense to connect to the grid or to use a captive power option.

Interestingly, however, data for a sample of 187 economies suggest that electricity prices do not affect average electrification rates across income groups—except perhaps when prices exceed 40 cents per kilowatt-hour (figure 7.7). Indeed, in Liberia, where the price per kilowatt-hour is 56 cents—nearly four times the price in Finland—only 9.8% of the population has access to electricity. Prices this high can be a strong deterrent to establishing a formal connection to electricity—and this indirectly contributes to electricity theft and to revenue losses for the utility,¹¹ triggering a vicious cycle in which it struggles to adequately serve its customers. Even so, utilities need to adopt prices that allow them to maintain the necessary power system infrastructure and provide quality services.

The price of electricity has an important effect on power consumption. According to a report from the U.S. Department of Energy, customers adjust their consumption patterns to changes in price as well as

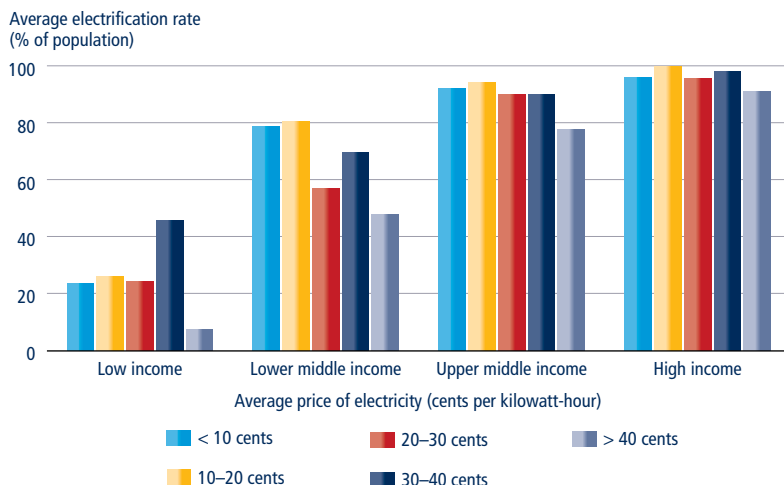
FIGURE 7.6 The average price of electricity varies widely among regions



Source: *Doing Business* database.

Note: The price of electricity is derived from the monthly consumption cost for the commercial warehouse in the *Doing Business* case study. The sample comprises 188 economies. Excluded from the sample is República Bolivariana de Venezuela.

FIGURE 7.7 Electrification rates vary among income groups, but the effect of electricity prices is unclear



Sources: *Doing Business* database; World Development Indicators database (<http://data.worldbank.org/indicator>), World Bank.

Note: The price of electricity is derived from the monthly consumption cost for the commercial warehouse in the *Doing Business* case study. The sample comprises 187 economies. Excluded from the sample are Taiwan, China; and República Bolivariana de Venezuela.

to changes in the structure of tariffs, such as the introduction of a time-of-use (TOU) tariff.¹² Fluctuations in price can affect decision making by businesses, for which electricity bills represent a considerable expense.¹³ Data for 152 economies show a negative correlation between the price of electricity and manufacturing value added as a percentage of GDP.¹⁴ An increase in electricity prices may lead to firms switching to industries with fewer opportunities for enhancing productivity—and away from manufacturing.¹⁵ Moving up the value chain becomes difficult where electricity prices are high.

The structure of a tariff schedule is as important as the tariff itself in sending the right signals to customers. Pricing for nonresidential customers tends to be complex. It is usually structured as a three-part tariff consisting of a monthly fixed charge (determined by the characteristics of the network), a capacity charge (determined by the highest recorded power demand over the billing period) and a volume charge (defined by the energy consumption). In addition, volume charges may be differentiated by

time of use, to adjust to differences in the level of energy consumption between different times of day or between weekends and weekdays. Where TOU tariffs are used, lower tariffs typically apply during times when aggregate consumption is lower, such as at night and on the weekend, and higher tariffs during “peak consumption” periods. Complex tariffs like these are commonly used in industrial economies—as in the United States, for example, where nonresidential customers account for 60% of electricity consumption.¹⁶

Among the 189 economies covered by *Doing Business*, 52% have a TOU tariff option for commercial or industrial customers. This time-based tariff schedule exists in 93% of OECD high-income economies but only 35% of economies in East Asia and the Pacific. In South Africa, for example, the utility defines different daily TOU periods for different types of connections. For most commercial customers there are three daily TOU rates: peak, standard and off-peak. Peak rates apply on weekdays from 7:00 a.m. to 10:00 a.m. and from 6:00 p.m. to 8:00

p.m. Standard rates apply throughout the rest of the day, and off-peak rates at night. On Saturdays the TOU periods are different, and on Sundays only off-peak rates apply. The tariffs for each TOU period then vary according to the season, with higher rates charged between June and August. The complexity of the tariff schedule does not end there: volume charges also vary, depending on the transmission zone (based on the transmission distance) and on voltage levels. Finally, the utility charges customers several other fees each month—for capacity, administration, network access, service, reliability, reactive energy and other network subsidies. Up to 10 different charges may apply, all of them varying according to the characteristics of a customer’s connection.¹⁷

The complexity of tariff schedules makes it important for utilities to circulate clear information on tariffs. Some utilities go a step further. With the aim of helping customers, Malaysia’s largest electric utility company, Tenaga Nasional Berhad, set up a web page with a bill calculator for residential, commercial and industrial connections—making it easy for customers to estimate their future electricity costs based on the voltage level and subscribed capacity of their connection and their estimated monthly consumption during peak and off-peak periods. The website also offers businesses advice on how to boost their energy savings. And it provides an “energy audit calculator” to estimate the electricity consumption of different appliances.¹⁸ Such tools not only help customers understand their electricity bills; they also allow them to analyze their electricity use and identify ways to increase efficiency.

CONCLUSION

Ensuring a reliable supply of electricity, under transparent and efficient pricing, plays a key part in promoting investment opportunities and economic growth—and thus represents a key challenge for

governments around the world. As *Doing Business* data suggest, governments can use regulatory measures to encourage good practices in electricity supply systems. These regulatory measures need to strike the right balance, ensuring that customers receive a reliable and reasonably priced electricity supply without compromising utilities' revenues. Utilities can also take practical measures to increase the reliability of supply and the accessibility of tariff information to customers.

and refer to industries belonging to the International Standard Industrial Classification (ISIC) divisions 15–37. These data are from the World Development Indicators database (<http://data.worldbank.org/indicator>), World Bank. The data on the price of electricity are derived from the monthly consumption cost for the commercial warehouse in the *Doing Business* case study. The sample comprises 152 economies.

15. Abeberese 2013.
16. Brief and Davids 2011.
17. See Eskom's website at <http://www.eskom.co.za/>.
18. See Tenaga Nasional Berhad's website at <http://www.tnb.com.my/>.

NOTES

This case study was written by Jean Arlet, Volha Hrytskevich, Haya Mortada, Tigran Parvanyan, Jayashree Srinivasan and Erick Tjong.

1. Enterprise Surveys database (<http://www.enterprisesurveys.org/>), World Bank.
2. Audinet and Rodriguez Pardina 2010.
3. Arwa Ibrahim, "Egypt's Power Outages Continue to Intensify," *Middle East Eye*, September 5, 2014, <http://www.middleeasteye.net/news/egypts-power-outages-compound-559103879>.
4. Enterprise Surveys database (<http://www.enterprisesurveys.org/>), World Bank. These economies are Afghanistan; Algeria; Angola; Bangladesh; Benin; Bhutan; Botswana; Burkina Faso; Burundi; Cabo Verde; Cameroon; the Central African Republic; Chad; the Democratic Republic of Congo; the Republic of Congo; Côte d'Ivoire; Djibouti; the Arab Republic of Egypt; Eritrea; Ethiopia; Gabon; The Gambia; Ghana; Guinea; Guinea-Bissau; India; Iraq; Jordan; Kenya; Lebanon; Lesotho; Liberia; Madagascar; Malawi; Mali; Mauritania; Mauritius; Morocco; Mozambique; Namibia; Nepal; Niger; Nigeria; Pakistan; Rwanda; Senegal; Sierra Leone; South Africa; South Sudan; Sri Lanka; Sudan; the Syrian Arab Republic; Swaziland; Tanzania; Togo; Tunisia; Uganda; West Bank and Gaza; the Republic of Yemen; Zambia; and Zimbabwe.
5. Black, Larsen and Ryan 2002.
6. George and Oseni 2012.
7. Wijayatunga and Jayalath 2008.
8. Practical Action 2013.
9. Terezinho 2015.
10. Briceño-Garmendia and Shkaratan 2011.
11. According to a recent study, global losses due to electricity theft amount to \$89.3 billion a year (Northeast Group 2014).
12. U.S. Department of Energy 2006.
13. Jewell 2006.
14. *Doing Business* finds that the correlation between manufacturing value added and the price of electricity is -0.21 . The relationship is significant at the 1% level after controlling for income per capita. The data on manufacturing are a three-year moving average for 2012–14