



Defying Outages: The Struggles and Strategies of Businesses Facing Unreliable Electricity

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Electricity services are essential for private sector development, as they support production, foster new business creation, and enhance competitiveness. Using data from the World Bank Enterprise Surveys, this Brief underscores the importance of reliable electricity services for firms and the coping mechanisms they employ to stay competitive. Detailed analysis shows that ownership of generators increases in areas with unreliable electricity. However, factors such as firm size and type of economic activity also play a role, even in countries with more reliable electricity services.

Impacts of unreliable electricity services on businesses

Although many economies are on track to meet the Sustainable Development Goal (SDG) of achieving universal access to electricity, only 45 percent of the population in low-income economies has such access (Sachs, Lafortune, and Fuller 2024). Reliable electricity is critical for the private sector, as it allows firms to grow, create jobs, and drive economic growth. In the short term, unreliable electricity services can interrupt business operations and lead to financial losses. For instance, shortages in India have been shown to reduce manufacturing firms' revenues by at least 5 percent (Allcott, Collard-Wexler, and O'Connell 2016). Sales of firms in 14 economies in Sub-Saharan Africa would increase by 85 percent if outages were reduced to the levels observed in South Africa, Cole et al. (2018) estimate.

Outages might also force businesses to modify production processes by operating fewer hours, changing production schedules, and using less electricity-intensive techniques, reducing their competitiveness. In Ghana—where outages occur 10 days per month, on average—labor productivity of manufacturing small and medium enterprises (SMEs) could increase by 10 percent if service disruptions were eliminated, Abeberese, Ackah, and Asuming (2021) estimate. Other strategies employed by firms to minimize productivity losses in a context of unreliable electricity include outsourcing production of intermediate inputs or storing inputs, as evidenced in China, Ethiopia, and India (Fisher-Vanden, Mansur, and Wang 2015; Abdisa 2018; Allcott, Collard-Wexler, and O'Connell 2016).

Moreover, constant power outages (blackouts) and voltage fluctuations (brownouts) can damage firms' equipment. In Tanzania, for instance, brownouts damaged appliances in about one-third of firms (Bensch et al. 2017). Such unreliable electricity services lead to higher replacement and corrective maintenance costs for firms (Blimpo and Cosgrove-Davies 2019).

In response to unreliable electricity supply, firms frequently resort to using generators, which requires significant upfront investment. The average capacity of generators owned by firms in African economies ranges from 23 kW in Cabo Verde to 353 kW in the Arab Republic of Egypt, with an overall average of approximately 50 kW (Steinbuck and Foster 2010). Even such low-capacity diesel equipment requires an approximate upfront payment of US\$10,000, which is often unaffordable for small or informal firms that lack access to credit markets. For diesel generators of 250 KW, costs can be as high as US\$200,000 (Ericson and Olis 2019; Lazard 2017). Additionally, high operational costs associated with self-generation can diminish competitiveness. Consequently, although generators help businesses remain operational, they cannot fully buffer the negative impact on productivity caused by outages (Abeberese, Ackah, and Asuming 2021; Sosi and Atitianti 2021).

Unreliable electricity services can have profound long-term effects on the competitiveness, innovation, and composition of entire industries (Rentschler et al. 2019). By creating uncertainty in the business environment, electrical outages discourage new firms from entering the market and hold back investment by incumbent businesses (Abeberese 2020). This lack of dynamism reduces job opportunities, as evidenced in Africa, where unreliable electricity services have been associated with reductions in non-agricultural and skilled employment (Mensah 2024). Electricity-intensive sectors in countries that have constant outages tend to have a lower share of small firms (Alby, Dethier, and Straub 2013) because power outages take a larger toll on smaller firms (Abdisa 2018; Adenikinju 2003; Moyo 2012; Osei-Gyebi and Dramini 2023).

Unreliable electricity as a constraint for businesses operations worldwide

Around the world, 46.6 percent of firms report having experienced at least one outage in the last year, but only 30.2

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percent consider electricity issues to be a major or very severe obstacle for their operations. This gap is consistently observed across regions, with the exception of the Middle East and North Africa (see figure 1). In some economies, the frequency and duration of outages might not be severe enough to be considered a significant obstacle. In others, firms may have adapted by using less electricity-intensive production methods or purchasing generators. And in some regions, more pressing issues, such as insecurity, may overshadow unreliable electricity.

This gap is particularly pronounced in Sub-Saharan Africa: 72.1 percent of firms experience outages, but only 39.2 percent consider electricity to be a significant obstacle. This is the region where most firms perceive electricity as a problem, which is consistent with studies documenting how power outages significantly hinder firm productivity and competitiveness (Abeberese 2020; Abeberese, Ackah, and Asuming 2021; Andersen and Dalgaard 2013; Avordeh et al. 2024; Mensah 2024; Moyo 2012; Osei-Gyebi and Dramani 2023). While firms around the world manage to operate under these adverse conditions, their production capacity is constrained, and their competitiveness is consequently diminished.

Figure 2 illustrates the severity of service disruptions. Firms worldwide report an average of 3.8 outages per month, each lasting 0.6 hours. However, disruptions vary by region. For instance, the most outages occur in South Asia, with an average of 12.5 per month, each lasting 0.4 hours. In contrast, Sub-Saharan Africa experiences fewer outages (an average of 7.6 outages per month), but longer ones (lasting 1.9 hours). This latter figure helps explain why the private sector in Sub-Saharan Africa perceives electricity issues to be a substantial obstacle. In all, firms in this region face about 14 hours per month without electricity.

Unreliable electricity service is more prevalent in lower-income regions, a pattern also evident at the country level. Figure 3 shows a negative correlation between GDP per capita and the share of

firms experiencing outages. Some characteristics commonly observed in lower-income economies contribute to service unreliability. In low- and middle-income economies, the financial sustainability of electricity utilities is compromised as only 40 percent can recover the cost of supplying the service (World Bank 2024a), which can hamper their ability to provide high-quality services. Also, higher-income economies tend to have stronger regulatory frameworks and public services that support efficient provision of utility services (World Bank 2024b).

Average losses from electrical outages tend to increase with the total number of monthly hours without electricity, as shown in figure 4, which is based on World Bank Enterprise Surveys (WBES) data. These estimates are likely to represent a lower bound, as firms may struggle to fully quantify all revenue losses and cost increases resulting from unreliable electricity.

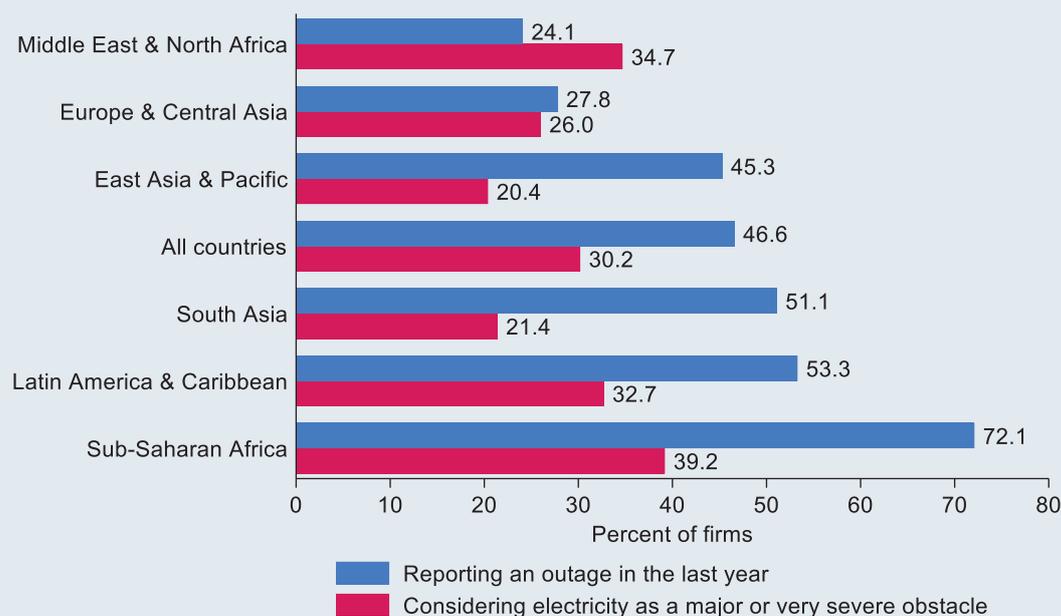
Self-generation of electricity as a coping mechanism

To mitigate the effects of unreliable electricity services, firms generate their own electricity, typically relying on diesel generators as a backup source of electricity. According to the WBES, 30.5 percent of firms worldwide own or share a generator. This share increases to 51.1 percent in Sub-Saharan Africa, a region that, as discussed, experiences a particularly high number of hours without electricity each month. A cleaner way of self-generating electricity is with solar panels. This alternative is increasing as installation costs decline, regulations adapt, and social acceptance grows (IEA 2024). Starting in 2025, WBES will include a question to measure the extent to which firms are adopting this technology.

As firms modernize production processes, reliance on electricity increases, enhancing efficiency but also heightening vulnerability to power supply disruptions (Elliott, Nguyen-Tien, and Strobi 2021).

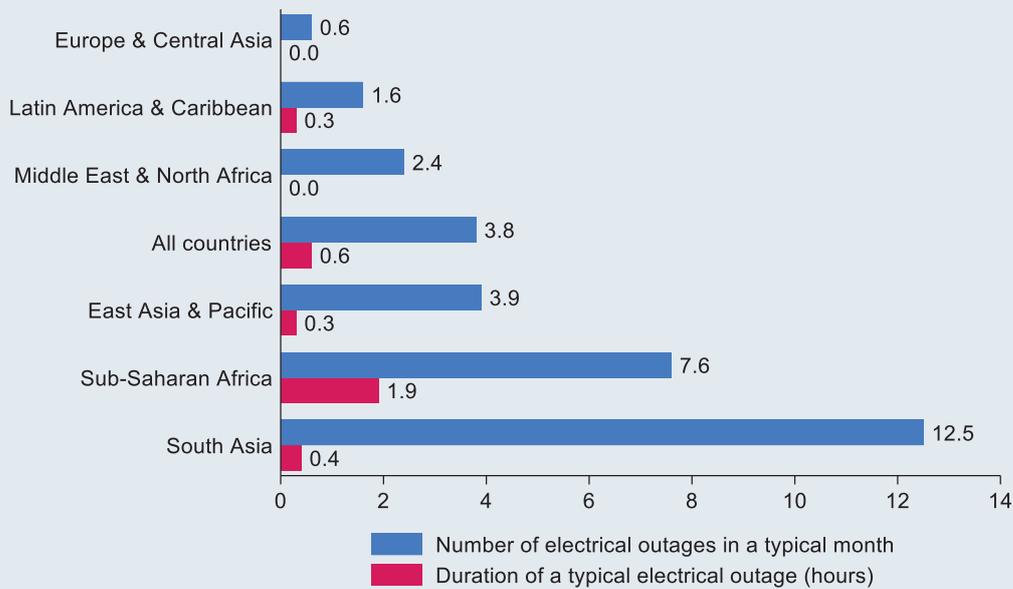
Figure 1

There is a gap between the share of firms that experience outages and those that consider interruptions to electricity to be an obstacle



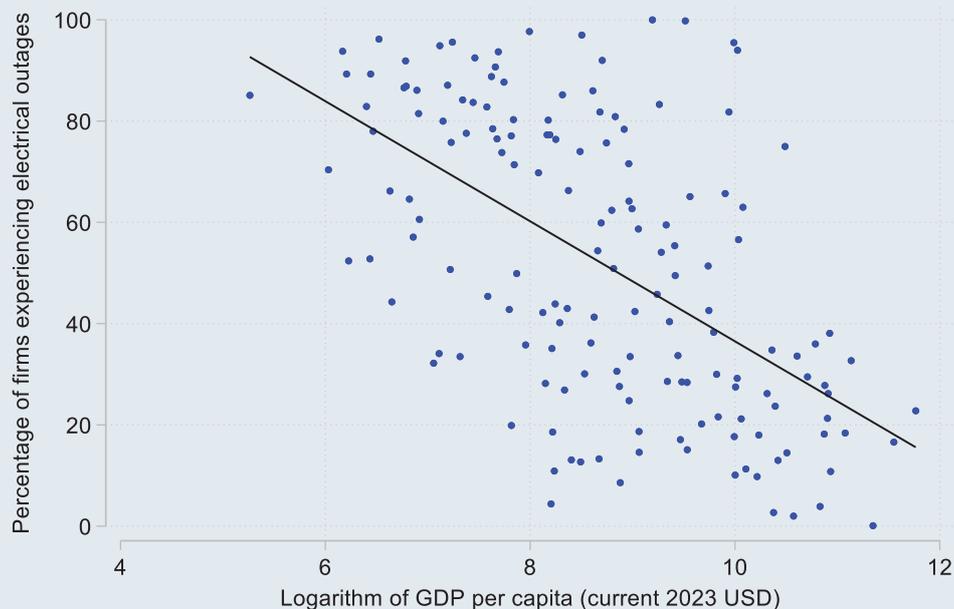
Source: World Bank Enterprise Surveys 2025 (World Bank 2025b).

Note: Data are from the latest collection cycle per economy at the time this Brief was prepared (January 2025). Depending on the timing of the most recent data collection exercise, the data span from 2006 to 2024. The sample includes 159 economies. For more details, refer to the WEBS webpage.

Figure 2 Outages are more frequent in South Asia but last much longer in Sub-Saharan Africa

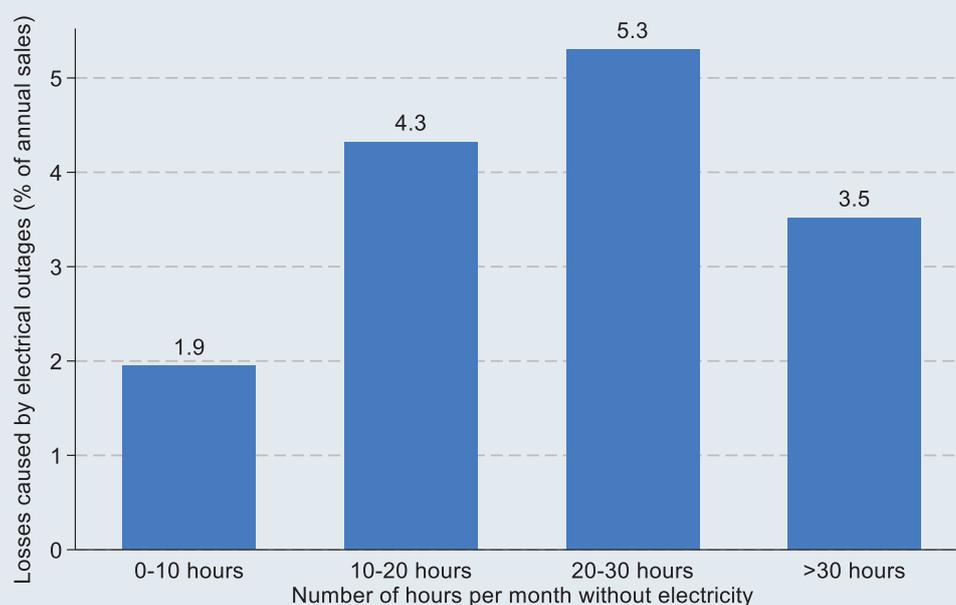
Source: World Bank Enterprise Surveys 2025 (World Bank 2025b).

Note: The variables represent the number of power outages in a typical month and the duration of power outages in hours, for those firms that reported outages in the last fiscal year. The sample includes 159 economies. Data are from the latest collection cycle per economy at the time this Brief was prepared (January 2025). Depending on the timing of the most recent data collection exercise, the data span from 2006 to 2024. For more details, refer to the WEBS webpage. Per the B-READY indicators, the duration indicator corresponds to the median.

Figure 3 Electricity quality and economic activity fuel each other

Source: World Bank Enterprise Surveys 2025 (World Bank 2025b); World Development Indicators 2025 (World Bank 2025a).

Note: Correlation coefficient between both variables is -0.5698 . The significance holds even after controlling for electricity access rate (2022) and the Energy Access Score from the World Bank's Regulatory Indicators for Sustainable Energy (RISE) project (2016). The Energy Access Score measures the governance and planning of electrification, as well as the existence of a framework for grid electrification, mini-grids, and off-grid systems, among other indicators. The Energy Access Score and the logarithm of Gross Domestic Product (GDP) per capita are significant at the 1 percent level. Electricity access rate is significant at the 10 percent level. R^2 is 0.5813. Data are from the latest collection cycle per economy at the time this Brief was prepared (January, 2025). Depending on the timing of the most recent data collection exercise, the data span from 2006 to 2024. For more details, refer to the WEBS webpage. The figure includes data for 156 economies, while the regression covers 91 due to missing information on access rates and the RISE series. USD = United States dollars.

Figure 4 Time (without electricity) is (lost) money

Source: World Bank Enterprise Surveys 2025.

Note: The number of hours per month without electricity is calculated multiplying the indicators of average monthly outages and average outage duration (in hours). Data are from the latest collection cycle per economy at the time this Brief was prepared (January 2025). Depending on the timing of the most recent data collection exercise, the data span from 2006 to 2024. For more details, refer to the WEBS webpage. The sample includes 36,224 firms in 159 economies, restricted to those that experienced outages and reported losses equal to or greater than zero.

A lower tolerance to service disruptions, especially among certain types of firms, might motivate firms to purchase generators. For instance, manufacturing firms tend to experience more significant negative impacts from power outages than firms in the service sector (Sosi and Atitianti 2021). Additionally, export-oriented firms might self-generate to comply with International Organization for Standardization (ISO) standards related to cold chains (Foster and Steinbuks 2009).

This Brief presents an estimation of the factors that affect the likelihood of a firm owning or sharing a generator. Some factors that drive this probability are whether a firm reported experiencing an outage in the previous fiscal year, firm size, whether it is a manufacturing or services firm, and whether its production is exported. The results indicate that experiencing outages is a significant factor in the reliance on generators, but it is not the only one (see table 1). Notably, the size of the firm is another important determinant. Larger firms face higher potential losses from operational disruptions, increasing their incentive to invest in generators to maintain continuity. Additionally, their stronger financial position allows them to absorb high upfront costs or secure credit to acquire a generator. The type of firm also matters. Manufacturing firms—especially those engaged in exporting—are more inclined to have generators than service firms. Country-specific factors also influence the likelihood of firms owning or sharing generators. A graphical representation in figure 5 helps illustrate how these different factors interact and jointly influence generator ownership among firms.

Conclusion and policy implications

Decentralized solar energy generation is a promising option for businesses

Decentralized (or distributed) solar generation produces energy near where it is consumed, reducing transmission and distribution losses compared to centralized systems. In recent years, distributed solar photovoltaic installations have boomed around the world. Their total capacity—including residential, commercial, and industrial customers—rose to more than 260 GW in 2023, almost half of total renewable capacity (IEA 2024). While government policies—such as tax incentives, rebates, and grants—contributed to the initial adoption of this technology, the rapid decline of equipment costs in recent years has played a decisive role in its continued growth. Between 2010 and 2020, solar module prices fell by up to 93 percent (IRENA 2025). Decentralized solar generation already benefits consumers by lowering electricity bills and reducing dependence on the electricity grid. As storage costs decline, solar energy is in a position to become a more viable and environmentally friendly alternative for businesses. To support this transition, economies need to adapt regulatory frameworks allowing for distributed generation—for instance, establishing clear technical requirements and processes for connection of distributed generation systems to the electric grid—and efficient compensation mechanisms that incentivize adoption, while ensuring utilities can pay for network infrastructure.

Making electricity services resilient should be a priority

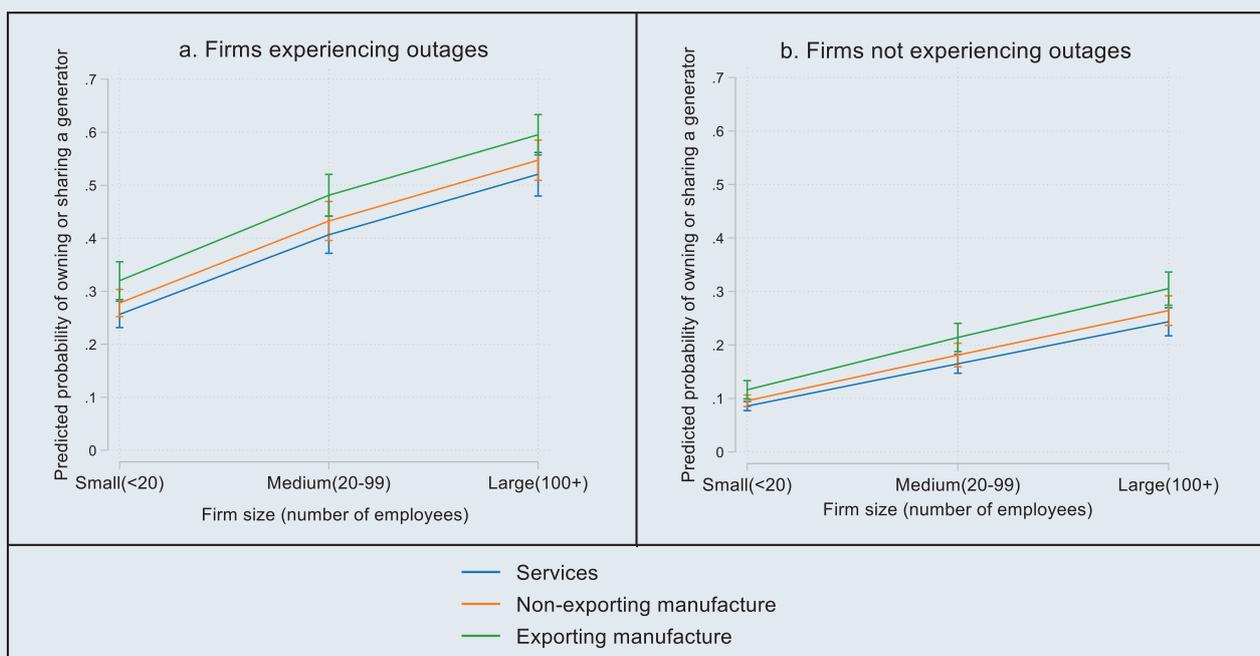
All economies, regardless of income level, should prioritize developing resilient electricity systems. Extreme weather events—such as heat waves, droughts, and heavy rainfall—have become more frequent and severe (Seneviratane and Zhang 2023), placing additional strain on electricity grids. Even in countries with currently reliable electricity, it is essential to adopt policy measures that enhance infrastructure resilience at three levels: assets, services, and users (Hallegatte, Rentschler, and Rozenberg 2019). Such an

Table 1 Estimation of determinants of generator ownership among firms

Firm characteristics (variables)	Marginal effects (Logit Model)	Coefficients (Linear Probability Model)
Experienced outage last year	0.159*** (0.00826)	0.194*** (0.0114)
Firm size		
Small (<20 employees)		
Medium (20–99 employees)	0.0975*** (0.00940)	0.0969*** (0.00930)
Large (100 or more employees)	0.185*** (0.0124)	0.182*** (0.0120)
Type of firm		
Services		
Non-exporting manufacture	0.0141* (0.00786)	0.0142* (0.00859)
Exporting manufacture	0.0425*** (0.0108)	0.0385*** (0.0116)
Country fixed-effects	Yes	Yes
Constant	-	0.303*** (0.0315)

Source: World Bank Enterprise Surveys 2025.

Note: The sample includes 99,843 observations in 159 economies. Data are from the latest collection cycle per economy at the time this Brief was prepared (January, 2025). Depending on the timing of the most recent data collection exercise, the data span from 2006 to 2024. For more details, refer to the WEBS webpage. Classification Accuracy ratio = 0.7660. The regressions have been estimated with robust standard errors and includes a constant and fixed-effects for economies. Standard errors in parenthesis. * p<0.10, ** p<0.05, *** p<0.01

Figure 5 Unreliable electricity is not the only factor driving the use of generators

Source: World Bank Enterprise Surveys 2025.

Note: The sample includes 99,843 firms in 159 economies. Data are from the latest collection cycle per economy at the time this Brief was prepared (January 2025). Depending on the timing of the most recent data collection exercise, the data span from 2006 to 2024. For more details, refer to the WEBS webpage.

approach requires investments in infrastructure that can better withstand natural hazards and the incorporation of redundancy to ensure the system can function if even one component fails (Blackman et al. 2024). In Europe, evidence suggests that investing in underground cables—especially for medium-voltage—reduces the exposure of assets to natural hazards and mitigates the risk of electricity service disruptions. Implementing appropriate levels of automation further enhances service resilience (Prettico, Marinopoulos, and Vitiello 2022).

A toolbox of policies can be utilized to address the needs of different types of businesses

Unreliable electricity services particularly affect small businesses. Considering that SMEs represent about 90 percent of businesses and generate more than half of global employment (World Bank

2025c), policies should focus on increasing electricity reliability for these smaller firms. For small businesses with low electricity intensity, distributed generation solutions, such as solar panels, can provide the necessary energy to maintain operations. Decentralized energy options are also important for remote areas, where encouraging the adoption of off-grid and mini-grid solutions can support the growth of firms without access to the main electricity network (Avordeh et al. 2024). For larger and more electricity-intensive businesses, governments can facilitate formalization of shared generators, particularly in industrial parks (Abdisa 2018) or improve access to credit for sectors where optimal technology relies heavily on electricity, such as chemical or textile industries (Alby et al. 2013). Additionally, keeping businesses informed of planned outages is a good practice, as it enables them to better adapt and minimize potential losses.

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