



How does electricity insecurity affect businesses in low and middle income countries?

Andrew Scott, Emily Darko, Alberto Lemma and Juan-Pablo Rud



Key messages

- Electricity insecurity impacts the productivity of manufacturing SMEs negatively, but these impacts are often statistically insignificant and they can at times be positive.
- Electricity insecurity does not affect the cost-competitiveness of manufacturing SMEs, partly because electricity costs are usually a very small proportion of total costs.
- Electricity insecurity influences investment in and by SMEs, notably the location of investment, but evidence that it constrains investment is mixed.
- Policy makers can help to mitigate the impact of electricity insecurity on SMEs by ensuring that outages are planned and by facilitating access to alternative supplies of electricity, including generators and renewable energy.

Written by Andrew Scott (a.scott@odi.org), Emily Darko (e.darko@odi.org) and Alberto Lemma (a.lemma@odi.org), Overseas Development Institute and Juan-Pablo Rud, Royal Holloway, University of London. This briefing draws upon an ODI Report of the same title, and was funded by the Research and Evidence Divisions Policy Research Fund, DfID.

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Introduction

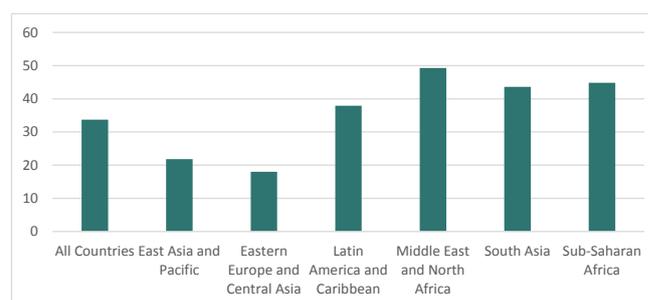
Around 90 million formal micro, small and medium sized enterprises (MSMEs)¹ provide over two-thirds of all jobs in the developing world. MSMEs vary widely in terms of size, sector and level of sophistication. The importance of increasing overall productivity in developing countries highlights the potential contribution to growth and job creation of expansion amongst manufacturing SMEs. Manufacturing sector SMEs account for 22% of all formal SMEs in developing countries².

The poor quality of electricity supplies in many developing countries is perceived by SMEs to impact their operations negatively. Voltage fluctuation and power outages can halt production, damage equipment and affect product quality. Enterprise development organisations, similarly, often regard insecure electricity supplies to be a serious constraint on SME development and expansion. This brief summarises evidence from recent research on the impact of electricity insecurity on manufacturing SMEs in developing countries³. The research, quantitative and qualitative, focused on four countries where the reliability of electricity is low – Bangladesh, Nepal, Nigeria and Uganda – and identified key areas of action to reduce the negative effects.

Electricity quality

Electricity access and costs have been identified as significant problems across sub-Saharan Africa and South Asia, in particular (Table 1). Electricity insecurity, caused by power outages and voltage fluctuation, contributes to the energy constraints felt by SMEs.

Figure 1: Proportion of firms identifying electricity as a major constraint by region (%)



Source: World Bank Enterprise Surveys

The frequency and duration of interruptions to electricity supplies are key factors in the assessment of the quality of electricity services. The most readily available, and most commonly used, information about the reliability of electricity supplies is provided by World Bank Enterprise Surveys, which report on perceptions of the challenges faced by a representative sample of firms in each country. The proportion of firms reporting electricity as a major constraint varies between regions, as shown in Figure 1. In the Middle East and North Africa, sub-Saharan Africa and South Asia approximately half of all firms perceive electricity to be a significant constraint.

The experience of unreliable electricity, measured by the frequency and duration of outages, also varies between regions, as shown in Figure 2.

Table 1: Electricity access and insecurity in sub-Saharan Africa and South Asia

	Sub-Saharan Africa	South Asia	High Income Countries
Cost to get electricity (as a percentage of income per capita)	4,736.9%	1,894.9%	79.1%*
Days to gain access	133	148	89*
Electricity losses as a percentage of output	10.8%	20.3%	6.2%
Hours for an average outage	5.3	2.4	0.99
Percentage of SMEs identifying electricity as a major constraint	49.3%	53.2%	26.0%

* OECD only.

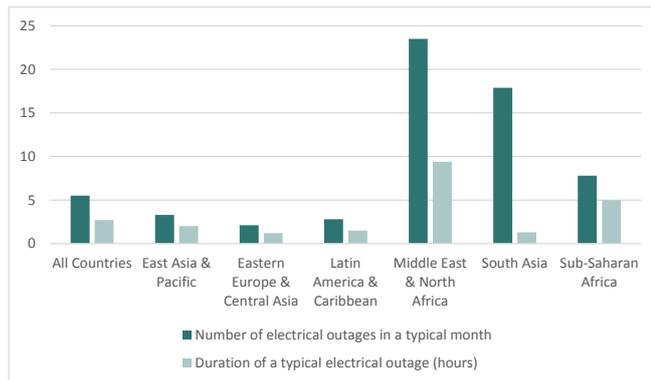
Sources: Doing Business 2014, World Bank; World Development Indicators, World Bank, 2010; World Bank enterprise surveys, accessed July 2014.

1 IFC MSME-CI does not define MSMEs; see this paper for how economies contributing data define MSMEs: <http://bit.ly/133tiEa>.

2 IFC MSME Country Indicators

3 Scott, A, E Darko, J-P Rud and A Lemma (2014) How does electricity insecurity affect businesses in low and middle income countries? 80 pp.

Figure 2: Frequency and duration of outages by region



Source: World Bank Enterprise Surveys

The impact of electricity insecurity on manufacturing SMEs

The empirical evidence of the impacts of electricity insecurity on SMEs indicates that it is not as big a constraint as perceptions suggest. This may be due to the on/off nature of the supply and the considerable stress and frustration of coping with electricity insecurity, magnifying its actual impact on firm performance. Firms that complain most about outages may do so because they experience more outages, not because of the impacts (Hallward-Driemeier and Aterido, 2009).

‘Without money, you can’t operate but without electricity you can find ways to cope’ (Bangladeshi stakeholder)

Conclusions from the evidence of the impact of electricity insecurity on manufacturing SMEs’ productivity, competitiveness and investment are summarised below.

Impact on productivity

Electricity infrastructure and consumption generally grow with productivity and growth, but causation is difficult to establish. A number of studies support the conclusion that electricity enhances productivity at the economy-wide and the firm level (Fedderke and Bogetic, 2006; Kirubi et al., 2009; Grimm et al., 2011). Many small manufacturing firms use electricity predominantly for lighting and communications (Mayer-Tasch et al., 2013).

Overall, firms with access to electricity tend to have higher productivity than firms without. However, pre-existing conditions (location, access to finance, and management competence) have a strong impact on how access to electricity affects an SME. Electricity access seems to have lower positive impact on productivity of micro enterprises. This may be partly because such firms do not use electricity-dependent machinery and processes,

and partly because they lack backup power capacity to cope with outages if they do increase their reliance on electricity-dependent processes post-electrification (World Bank, 2008; Grimm et al., 2011).

The impact of the quality of electricity supply on firm productivity is less well understood. Infrastructure quality overall has a significant impact, at least as important as factors such as crime and access to finance, and unreliable electricity supply seems to be the infrastructure element with the strongest negative effect on enterprise productivity, especially in Africa (Escribano et al., 2009). Electricity insecurity tends to negatively affect the total factor productivity and labour productivity of manufacturing SMEs. As with electricity access, the impact of electricity insecurity on productivity varies depending on factors related to both the external context that a firm operates in and its internal capabilities (World Bank, 2010; Cissokho and Seck, 2013).

In general, power outages seem to affect small firms more than large firms (Moyo, 2012). The duration of outages (typically measured by hours in a day) has far greater negative impact on firm productivity than the frequency of outages (days per month that outages occur). The impact of outages is not universally negative: a study in Senegal found that outages had a positive effect on manufacturing firms and SMEs, because outages stimulated better management practices to mitigate the negative impact of power cuts and less efficient, lower productivity firms had gone out of business (Cissokho and Seck, 2013).

Impact on competitiveness

The competitiveness of manufacturing firms that experience electricity insecurity might be expected to be affected by the additional costs they incur due to outages. However, there is little evidence that their unit costs of production are affected.

Analysis of data from the World Bank Enterprise Surveys and informants in four countries does not reveal a clear or strong relationship between unit costs and outages. Although one study found that firm performance is sensitive to the cost of indirect inputs (Eifert et al., 2008) and in electricity-insecure Nigeria the closure of manufacturing firms has been attributed to high infrastructure costs (Akuru et al., 2011), energy accounting for the largest share, electricity costs are on average a small proportion of manufacturing SMEs’ total production costs. Changes in electricity costs are not likely, therefore, to significantly affect unit costs and sales price. Materials costs, which can account for 80-90% of total production costs, will often be unaffected by outages.

Firm competitiveness is also dependent on product quality and the ability to meet orders on time, as well as unit costs. Electricity insecurity may impact both of these factors, e.g. by causing firms to resort to manual methods which reduce product quality, or to halt production and delay order delivery. However, there is an absence of empirical analysis and enterprise survey data does not capture this information.

‘Our prices are competitive among similar companies that are doing quality services but higher than small companies who don’t care about quality. This is a big challenge. We are losing clients to those low quality companies’ (Ugandan SME)

Impact on investment

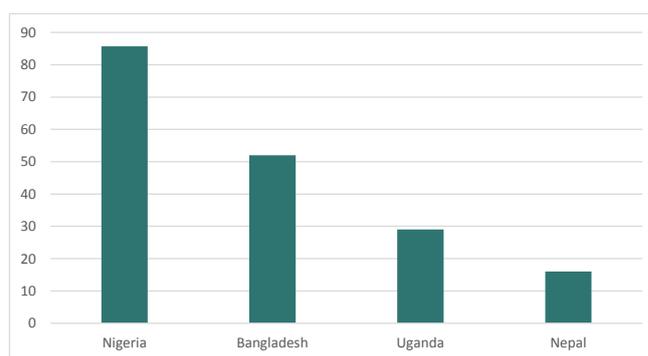
Electricity insecurity can influence investment decisions, but it is neither the only nor the most significant factor considered by SMEs in their operation and investment decisions, nor by external investors. Electricity insecurity seems to affect the growth of medium and large-scale firms more than small firms, and seems to influence the location of investments by SMEs.

Countries with high frequency of power outages have few small firms in electricity-intensive sectors (such as manufacturing) since only large firms are able to invest in generators to mitigate the effects of outages (Alby et al., 2011). Evidence from India suggests that in countries with high levels of electricity insecurity, firms may not have an incentive to move to productivity-enhancing industries or to grow larger, since doing so comes with the cost of having to rely on electricity (Abeberese, 2012). SME informants interviewed in Nepal corroborate this:

Last year I invested in a new machine what would help produce improved variety of soap. I made investment in a hope that the load shedding situation would improve, and there would be less power cut. However, load shedding hasn’t gone down. I had planned to buy more machines, but now I am not investing more as there is no adequate electricity. (Nepalese SME)

‘Investment decision has not much to do with electricity availability because our biggest problem in investing more is that we are not able to compete with cheap Chinese products’ (Nepalese SME)

Figure 3: Proportion of SMEs owning or using a generator in selected countries



Source: World Bank Enterprise Surveys

How SMEs cope

Generators

In countries with low electricity reliability, generators are the preferred mitigation option for many electricity-dependent businesses to sustain regular business operations (Attigah and Mayer-Tasch, 2013), although often generators are not used to provide much if any motive power during outages and the upfront purchasing costs and subsequent running costs make them prohibitively expensive, to smaller firms in particular.

Around 33% of SMEs in developing countries use a generator, which are the most common means to cope with electricity insecurity adopted by SMEs. In countries with low electricity reliability the proportion of SMEs using a generator is higher, reaching 86% in Nigeria (Figure 3). Generators owned by firms represent about 6% of installed generation capacity in sub-Saharan Africa and up to 20% in countries with very unreliable electricity (Foster and Steinbuks, 2008).

Firms with generators are more likely to be SMEs or sole-ownership firms, to be capital-intensive, and to be experiencing higher frequency of outages than firms which do not use generators. Generator ownership has been found to be most efficient for medium-sized firms and firms that are electricity-intensive (Steinbuks and Foster, 2010).

The cost of running a generator means that during power outages, electricity use is considerably reduced. Generators are sometimes only used for lighting and communications, not for motive power at all. Firms are rarely able to function at full capacity during outages, and stopping production is a common (often necessary) solution.

Operation changes

Rather than stopping production, some firms adapt processes to allow production to continue. They do this by switching part or all of their operation to manual labour, by using non-electric machinery (such as diesel engines) and by altering shift patterns to take into account load shedding schedules, when available.

SMEs are very used to coping and try to find ways to manage power outages. Many have to work at night because of load shedding during the day, but this is difficult – women have housework and childcare obligations in the evenings and for enterprises operating outside the home, factories and offices need to close for employees to go home. Nepalese Stakeholder

Renewable energy alternatives

Renewable energy offers the potential of reliable alternative electricity. However, upfront costs of sources such as solar PV or micro hydropower are perceived to be prohibitive for most SMEs, and where solar is used it does not provide motive power, instead it is used for lighting and communication. Examples of shared renewable energy were found to exist only in the context of cooperatives, typically for agri-business processes, and typically in rural areas.

Areas for action

Sharing generators could help, but needs to be coordinated

Sharing backup generators could help more SMEs to access and use backup power during outages. However, sharing generators requires good relationships and trust between firms and for some the distance from other firms may be a constraint. Where generator sharing does occur, a third party often oversees the arrangement – for example, in government-run industrial parks (as found in Nigeria), or where the sharing arrangement is formalised, such as through a cooperative or community organisation (mentioned by informants in Nepal and Nigeria).

Grid power improvement – firms are willing to pay

The best solutions for insecurity of grid electricity are to increase generation capacity and/or reduce transmission and distribution losses. Levels of investment in self-generation, which is generally more expensive than grid electricity, indicate a high willingness to pay for reliable power. This may provide an opportunity for government and private power companies to charge higher prices to firms in order to fund investments that will make power supply more reliable (Steinbuks and Foster, 2010).

If the quantity of electricity can't increase, improved quality and information about outages can help

In the absence of a better quality supply, governments and electricity suppliers can help SMEs by providing reliable load shedding schedules. This would enable them to plan production around outages. In order to provide load shedding schedules, it may be necessary to focus on reducing technical faults in existing transmission and distribution infrastructure as a short-term priority over the long-term necessity to increase generation capacity.

Support to access renewable energy

Increased information about renewable energy technology may facilitate its use by SMEs. However, the major constraint to renewable energy becoming a viable alternative during outages is cost or perception of cost. Sharing renewable energy capacity to achieve economies of scale could facilitate this, but as with generator sharing, would require good management. Reduction of the upfront costs of renewable energy to firms, through subsidies or credit schemes, could also enable SMEs to use renewable energy alternatives during outages.

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Overseas Development Institute
203 Blackfriars Road
London SE1 8NJ
Tel +44 (0)20 7922 0300
Fax +44 (0)20 7922 0399
www.odi.org
info@odi.org



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