

How did the 2012-2015 power crisis affect small and medium manufacturing firms in Ghana?



In brief

- This study analysed the impact of Ghana's 2012-2015 power crisis on the productivity of small and medium manufacturing firms.
- Researchers found that the power outages have a significant negative impact on productivity. Estimates suggest that reducing the number of days in a month with outages from the average of about ten in Ghana to zero, has the potential to increase productivity by 10%.
- They also found that firms' coping strategies – such as using generators – were ineffective in reducing the negative impact of outages on productivity.
- Results also show that firms are willing to pay more to avoid power outages, suggesting that key national investments in electricity generation, production, and distribution infrastructure will be worthwhile even if it means rises in electricity tariffs.

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What are the key issues?

The quest for industrialisation has been essential to the economic development agenda of Ghana since independence. Access to reliable and affordable electricity is deemed a key input for competitive manufacturing in Ghana. However, power supply in most low and middle economies is largely unstable and interrupted, with firms and households experiencing regular and unplanned outages. Such uncertainties and access constraints have implications for firm output and productivity.

In 2012, Ghana embarked an electricity rationing programme that lasted until 2015. The rationing of electricity resulted from shortfalls in power generation due to factors including poor rainfall that hampered electricity production from hydro sources and disruption to gas supply for thermal power plants. At the height of the crisis, consumers were guaranteed 12 or 13 hours of power supply within a 36-hour period. In addition to the rationing programme, there were unscheduled power outages as a result of damage to equipment from a wide array of causes.

The impact of this crisis is widely understood to be very severe. However, precise estimates of the effects based on scientific evidence are not available. In addition, evidence on the specific channels through which the energy crisis affected businesses and how businesses reorganised their activities are also non-existent. The study sought answers to the following questions:

1. How did the energy crisis affect the productivity of manufacturing firms?
2. How large was this effect if any?
3. How did the energy crisis affect employment in manufacturing?
4. What strategies did firms adopt to cope with the energy crisis and how effective were these strategies?
5. Are firms willing to pay more to avert power outages and if so, how much more?

What did we analyse?

The study surveyed small and medium-sized manufacturing firms in Ghana in August and September 2016. The survey collected firm-level data from 2011 to 2015. Using the first phase of the Integrated Business Establishment Survey (IBES phase I) as a sampling frame, we selected all small and medium-sized manufacturing firms located in the four main industrial clusters in the country – Accra, Tema, Kumasi, and Sekondi-Takoradi. Of the 1,244 eligible firms, we surveyed 885 firms. Of the remaining 359 firms, 73 refused to participate in the survey, 55 had folded up at the time of the survey, and 231 could not be located using the contact information from the Ghana Statistical Service. The survey collected information on the characteristics of the firms, production, employment, capital, investment, raw materials, electricity consumption and generation, and financing.

An overwhelming proportion of the firms surveyed (95.9%) are small-scaled, with less than 30 employees. 42.6% of the firms were located within the Kumasi Metropolis, 36.9% in the Accra Metropolis. Sekondi-Takoradi and Tema accounted for 11.5% and 9.1% of the surveyed firms respectively. In terms of industry, 58.3 % of the firms were engaged in the manufacture of textiles and garments and 20.3% in wood processing activities.

We analysed the impact of electricity shortages on firm on total factor productivity and labour productivity using regression analysis. We measure electricity shortage using the average number of days a firm experienced power outages in a month. We also analysed the impact of the electricity shortages on employment. Finally, we examine the various strategies adopted by firms to cope with the crisis and their effectiveness.s.

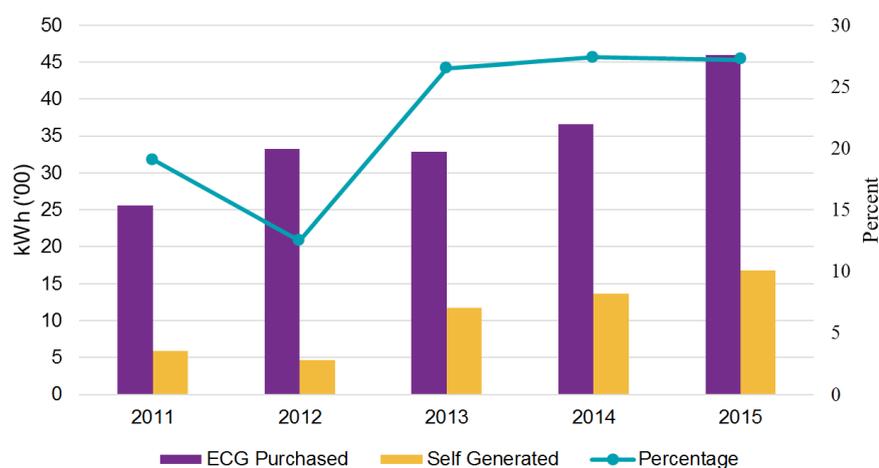
Table 1: Distribution of firms by size, location, and industry

Firm size	Percent
Small	95.9
Medium	4.1
Location	
Accra	36.9
Tema	9.1
Kumasi	42.6
Sekondi-Takoradi	11.5
Industry	
Food & Beverage	13.3
Textile & Garment	58.3
Wood Processing	20.3
Other	8.1

What did we find?

Figure 1 shows firms' electricity consumption patterns during the period under study. Average firm consumption of electricity from the Electricity Company of Ghana (ECG) increased from 2559.1 kWh to 4594.2 kWh between 2011 and 2015. We find a slight dip in firms' purchase of electricity from ECG in 2013 when the shortage was at its peak. However, firms' consumption of self-generated electricity increased steadily from 591.8 kWh to 1677 kWh over the same period. The increase in the reliance on self-generated electricity is further evidenced by the increase in the share of self-generated electricity to total electricity consumption of the firms. Between 2012 and 2013, when the crisis peaked, the share of self-generated electricity to total electricity consumption increased from 12.5% to 26.5%.

Figure 1: Electricity consumption patterns



Source: Authors' survey, 2016

How did the power outages affect productivity and employment?

We found that the energy crisis had significant negative effect on labour productivity and total factor productivity. Specifically, we found that one extra day of outages each month results in about a 1% reduction in labour productivity and total factor productivity. Since the average number of days with outages in a month was ten, this means that reducing this number to zero could have increased productivity by of these firms by 10%. In other words, the power crisis led to a 10% fall in monthly productivity of these manufacturing firms. This is a very large effect.

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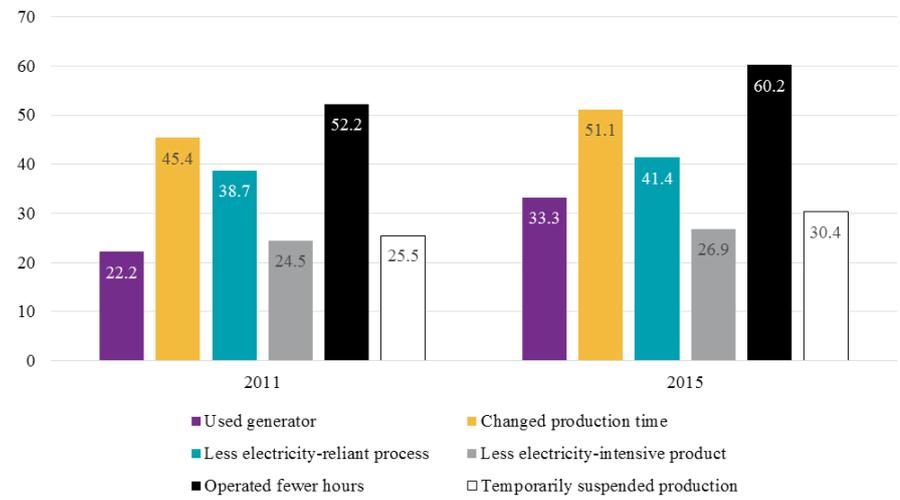
We try to understand the channels of this negative productivity effect by looking at the effect of the crisis on output and production inputs. We find that while output falls due to outages, there is no significant impact of outages on the number of workers used by the firm. However, the electricity shortages led to a reduction in raw materials and some reduction in the firm's stock of machinery. These findings suggests that while firms may flexibly alter inputs such as machinery and raw materials in response to electricity shortages, some inputs such as labour tend to be less flexible potentially owing to rigidities in the labour market. In particular, the reduction in labour productivity may stem from the reduction in the amount of capital available to workers.

How did the firms cope with the outages?

The survey asked firms about strategies adopted to cope with power outages. Figure 2 shows the top six coping strategies adopted by firms in response to the power outages in 2011 and 2015, respectively. The most common strategy used by more than half of firms is operating fewer hours.

Other common coping strategies adopted included changing production time and changing to a less electricity-reliant production process.

Figure 2: Firms' coping strategies for power outages



Source: Authors' survey, 2016.

We find that firms were likely to use a generator, changed the time of day during which production took place, changed their production process to a less electricity-reliant one, stopped producing electricity-intensive products, operated fewer hours, and temporarily suspended production in response to power outages. While firms stopped producing electricity-intensive products, they were unlikely to start producing less electricity-intensive products suggesting that it is more feasible for firms to reduce rather than expand their product scope.

In addition, there was no change in the number of workers used by the firm, neither were firms likely to lay off workers in response to power outages. Although unable to lay off workers, firms were able to modify the amount of labour used by cutting down the number of hours of operation. Other strategies unlikely to be used by firms included changing location, taking an insurance policy, and reducing shifts.

Overall, firms appear to cope with electricity outages by producing their own electricity via generators, reducing the amount of time they operate and reducing their reliance on electricity by changing their production processes and dropping products.

Were the coping strategies effective?

Were the coping strategies effective in mitigating the negative impacts of power outages? To answer this question, we analysed how the different coping strategies addressed the productivity. We find that none of the coping strategies were effective in reducing the negative impact of outages

on output. Indeed, we find that total factor productivity fell for firms that used generators as a coping strategy. This suggests that while the addition of generators increased the capital stock, the amount of electricity firms were able to generate themselves was inadequate for boosting output significantly.

Are firms willing to pay more for uninterrupted power?

One of the main policy issues resulting from the recent energy crisis and the measures adopted by the government to address them is the cost of electricity. The study sought to estimate relative costs of buying electricity from the national grid and generating electricity internally by firms. Specifically, we asked to see monthly electricity consumption from actually electricity bills and asked firms to estimate, using current generation costs, the total cost of generating monthly electricity consumption internally. Our results show that the average monthly cost of buying from ECG is significantly lower than the cost of producing this same amount internally. For small firms (firms with 5-30 employees), the estimated cost of producing their monthly energy consumption is more than twice the cost of purchasing it from the ECG (GHC 1630.33 versus GHC 811.00). For medium-sized firms the cost of generating all their monthly electricity needs is more than 1.5 times the cost of buying from the ECG (GHC 16,277.86 versus GHC 9742.85).

The study then sought to inquire about firms' willingness to pay extra to ensure uninterrupted access to electricity. Specifically, we asked firms: "How much more (in percent) would you be willing to pay per month for electricity to ensure that there are no power outages?" The responses show that the average firm in our sample is willing to pay 12.6% more to ensure that there are no outages. Small firms are willing to pay slightly more than medium-sized firms (12.6% versus 11.3%). Interestingly, despite the significantly higher cost of self-generating electricity, the premium firms are willing to pay for uninterrupted electricity from the public grid is lower than the premium for self-generation of electricity.

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Table 2: Willingness to pay for reliable power and electricity costs

	Willingness to pay (%)	Average monthly cost – ECG (GHC)	Average monthly cost-self generated (GHC)
Small (<30 employees)	12.6	811.16	1630.33
Medium (30-100 employees)	11.3	9,742.85	16, 277.86
Total	12.6	1,150.89	2,519.06

Source: Authors' survey, 2016.

What are our conclusions?

The power crisis of 2012-2015 had a huge negative effect on manufacturing firms. Reduction in labour productivity and total factor productivity was one of the main channels through which the negative impact of the crisis was felt. Our estimates suggest that reducing the number of days in a month with outages from the average of about ten in Ghana to zero, has the potential to increase productivity by 10%. While substantial, this is an underestimate of the full cost of the power crisis on these firms.

Manufacturing firms adopted many different strategies to cope with the crisis. However, these strategies did not insulate them from the negative productivity impacts of these outages. In fact, we find that one of the most common strategies employed worldwide, the use of a generator, is unable to alleviate the negative productivity impact by potentially diverting firm resources from direct productive uses to in-house generation of electricity, which tends to be far costlier than purchasing electricity from the public grid due to the substantial economies of scale in electricity generation.

Surviving firms did not cope with the crisis by laying off workers, they used less of other inputs – less raw materials and underutilisation of install capacity. However, this does not mean that the crisis did not lead to job losses. Our fieldwork indicated that 4.4% of eligible firms had folded-up in the six months between the completion of the first round of the IBES and the field data collection for this study. In addition, another 18.5% of eligible firms could not be located. While we do not have information to attribute these exits to the power cuts, it is likely to be at least a contributing factor.

We find that as long as there will be a stable and reliable electricity supply, firms were willing to pay up to 12.6% more for uninterrupted power supply. This is because the cost of generating electricity internally is very high for firms.

What are our policy recommendations?

From our finding, we recommend that key investments in generation, production, and distribution infrastructure are made to improve the reliability of power supply through the national grid, even if it means raising electricity tariffs. Since firms report a willingness to pay a premium for uninterrupted electricity, they are likely to tolerate higher tariffs if they are confident that there will be no frequent unplanned interruptions.

However, we note that the premium firms report they are willing to pay for uninterrupted electricity, while substantial, is far lower than the premium of generating electricity themselves. This suggests a potential lack of trust in the public grid that policymakers should consider addressing. This is not surprising given the persistent complaints that previous tariff increases

have not been matched by the promised improvements in reliability of supply. Perhaps a greater involvement of the private sector in the generation and distribution of electricity will be necessary for overcoming the trust issues with the public grid. In view of this, we also caution that substantial improvement in the reliability of power supply should precede any attempts to raise tariffs.