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Policy Brief on Energy:

The Costs of Power Outages in the Philippines

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Introduction

Electricity is integral to many contemporary modes of production as well as leisure activities. More specifically, the increasing mechanization of manufacturing processes, the ever-growing prominence of computers in service industries, and the continuing emergence of increasingly complex domestic and international value chains have all contributed to ensure the centrality of electricity in the contemporary economy. The growing availability of electronic gadgets, the emergence of easily accessible online platforms for communication and amusement, and the unabated growth of online recreational material and activities have made electricity an indispensable component of leisure for many consumers. Any and all interruptions to the supply of electricity could thus be easily argued to translate to immense productivity and welfare losses. Protracted electricity outages will have severe, far-reaching, and deleterious consequences for the Philippine macroeconomy. Similarly, consumers stand to lose tremendous amounts of welfare should they experience power interruptions. Measuring the economic and welfare consequences of these power outages would thus serve to further underline the importance of putting forward measures to ensure the reliability of the energy supply – for the economy and Filipino consumers. In addition, the measurement of these losses would guide policy in the formulation of strategies to enhance system stability through redundancies.

Explicit and Implicit Costs of Power Outages

Consumers and producers incur various types of costs during a power outage. Munasinghe & Sanghvi (1988) developed a system to organize the types of losses that consumers and producers incur during a power outage. Table 1 is a summary of these losses.

Table 1: Types of Losses Incurred During Power Outages by End-User

Primary Electricity User	Direct Components of Outage Costs	Indirect Components of Outage Costs
Residential	• Welfare: Inconvenience, lost leisure, stress • Monetary: Spoilage and property damage • Health and safety effects	• Spillover effects: Household members and firms
Industrial, Commercial, and Agricultural Firms	• Opportunity costs of idle resources such as land, labor, and capital • Shutdown and restart costs • Spoilage and damage • Health and safety effects	• Spillover effects: Firms requiring intermediate goods • Welfare: Reduced supply of final goods • Health and safety related externalities
Infrastructure and Public Service	• Opportunity costs of idle resources • Spoilage and damage	• Spillover effects: Impact on consumers and firms • Health and safety externalities • Potential for social costs in terms of looting, vandalism, etc.

Source: Munasinghe & Sanghvi 1988, Centollela et al. 2006, additional inputs from the Office of Senator Win Gatchalian

Residential electricity users incur welfare losses from being unable to make use of their electronic devices for their leisure or comfort (e.g. television, air-conditioning units, cellular phones, personal computers, etc.). They could also incur costs from having to replace spoiled food and damaged electronics. Alternatively, they could incur costs from being compelled to purchase backup energy generators, portable batteries, and surge protectors. In addition, the risk of accidents could be viewed to increase during power outages (e.g. no traffic lights, no street lights, etc.). Residential electricity users could also be viewed to incur indirect costs. Stress, discomfort, and exhaustion brought about by the power outage could adversely affect their behavior at home and their performance at work.

Firms could be viewed to incur tremendous productivity losses during power outages. Power outages would grind production to a halt – especially in machine-intensive manufacturing firms. In addition, frequent restarts increase the rate of depreciation of machines (Munasinghe & Sanghvi 1988, Centollela et al 2006, Amadi & Okafor 2015). The cost of productivity interruptions are magnified if the firm belongs to a production chain. Put simply, if the production processes of producers of intermediary goods are interrupted then the entire production chain is interrupted.

Methods of Estimation

The preceding discussion on the costs of power outages suggests that developing a single metric to quantify the total cost of a single power outage could prove exceedingly difficult. The metric must account for direct and indirect costs. Put differently, the metric must look at both monetary costs and non-monetary costs – and attempt to aggregate both sets of costs.

One strategy would be to conduct surveys (Caves et al. 1990). Surveys would allow policymakers to gain insights into the manner in which electricity end-users formulate their power outage cost valuations. Policymakers can, for example, obtain information on the value of power-outage induced welfare losses. In addition, surveys can be designed to determine the costs that end-users incurred to protect themselves from power outages. Surveys, however, have pitfalls. Residential users might struggle with formulating valuations (Andersson & Taylor 1986, Woo et al., 1991). They might also encounter difficulties in mapping out and attaching a value to all indirect costs of power outages. It is also of note that consumers often ascribe a much higher monetary value on avoiding losses than on their willingness to pay for reliability – resulting in an asymmetrical valuation of losses and gains and greater volatility in the results of survey-based valuations (Coursey et al., 1987).

Another strategy would be to impute the cost of a power outage through readily observable and measurable statistics. The challenge then reduces into identifying viable proxy variables that could be used to implicitly estimate the cost of a power outage.

Data on the sales of backup generators, for example, could be viewed to constitute evidence for ‘revealed preference’ (Beenstock et al. 1987, Matsukawa & Fujii 1994). In purchasing a backup generator, firms and households, are in essence indicating their willingness to pay for additional energy security. The problem with proxies, however, is that they will not be able to yield additional information on consumer preferences. The results from proxies would most often just constitute lower bounds, upper bounds, or ranges. In addition, this strategy requires the enumeration and satisfaction of specific assumptions. The relationship between the actual variable and the proxy variable must be established and firmly situated within the context of the aforementioned assumptions. The applicability of any and all results gleaned from this strategy is thus limited within the specific parameters of its defined context.

More sophisticated models of estimation would involve the development of more rigorous empirical models. These empirical models could employ both survey data and measurable macroeconomic statistics. The resulting models could be designed to glean valuable insights into the manner in which end-users will value energy reliability. The nature of these models, however, necessitates the acquisition of tremendous amounts of data and careful planning in the formulation of the models. In addition, the level of specificity of these models indicates that their results will most likely not be generalizable.

Measuring the Impact of Power Outages on Economic Productivity

The recognition of the deleterious impact of power outages on economic productivity prompts us to ask the following question: How much would a one hour power outage cost the Philippine economy? Gross domestic product (GDP) estimates published by the Philippine Statistics Authority (PSA) could be treated as a starting point for a preliminary exploration of the costs of power outages here in the Philippines. In particular, the latest GDP estimate could be used to impute the value of lost production due to a power outage. Table 2 summarizes the 2016 first quarter estimates released by the PSA.

Table 2: Summary of 2016 First Quarter GDP by Major Industry Classification (In Million Pesos)

AGRICULTURE, HUNTING, FORESTRY AND FISHING	**334,224**
Agriculture and forestry	291,205
Fishing	43,020
INDUSTRY SECTOR	**1,015,659**
Mining & Quarrying	29,080
Manufacturing	664,232
Construction	211,389
Electricity, Gas and Water Supply	110,958
SERVICE SECTOR	**1,918,027**
Transport, Storage & Communication	217,110
Trade and Repair of Motor Vehicles, Motorcycles, Personal and Household Goods	546,683
Financial Intermediation	279,905
Real Estate, Renting & Business Activities	438,807
Public Administration & Defense; Compulsory Social Security	110,869
Other Services	324,652
GROSS DOMESTIC PRODUCT	**3,267,910**

Source: Philippine Statistics Authority

The definition of the GDP implies that the GDP estimate above corresponds to the monetary value of the production in the Philippines during the first quarter of 2016. Put differently, the GDP estimate above is the monetary value ascribed to production in the Philippines within a three-month period. As an initial exploratory exercise, this value will be used to obtain a rough, preliminary estimate of the monetary value of an hour's worth of production in the Philippines – and consequently, the value of production lost during a power outage that lasts for an hour. It is important to stress that what follows is an exploratory exercise. The purpose of the following exercise is to get a general idea of the cost of a power outage – not to pinpoint the exact cost of a power outage. The following exercise relies on the use of highly simplified assumptions. The results are for illustrative purposes only.

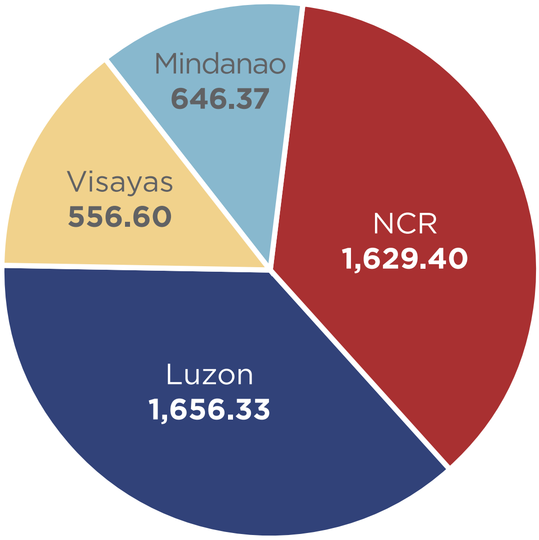
Table 3: Imputation of Hourly GDP Value Basedon 2016 First Quarter GDP (In Million Pesos)

AGRICULTURE + INDUSTRY + SERVICE	
First Quarter Gross Domestic Product - Total	3,267,910.42
First Quarter Gross Domestic Product - Hourly (10 hrs)	5,446.52
INDUSTRY + SERVICE	
First Quarter Gross Domestic Product - Total	2,933,686.16
First Quarter Gross Domestic Product - Hourly (10 hrs)	4,889.48
INDUSTRY + SERVICE - Mining/Quarrying - Construction	
First Quarter Gross Domestic Product - Total	2,693,217.12
First Quarter Gross Domestic Product - Hourly (10 hrs)	4,488.70

Source: Philippine Statistics Authority

Table 3 indicates that a power outage that affects the entire Philippines for an hour will cost the service sector and the industrial sector (sans mining/quarrying/construction) approximately 4.49 billion pesos. The PSA indicated in a 2014 report that the bulk of the Philippine GDP comes from NCR and the rest of Luzon (36.3% for NCR, 36.9% for the rest of Luzon for a total of 73.2%). Putting these figures together, a rough estimate of the cost of a one hour power outage in Luzon could be derived. More specifically, a one hour power outage that affects NCR and the rest of Luzon could thus be argued to cost the service sector and the industrial sector (sans mining/quarrying/construction) approximately 3.29 billion pesos (1.63 billion for NCR, 1.66 for the rest of Luzon). It is of note that the cost estimate remains large (1.64 billion) even if it is assumed that half of the firms possess backup generators.

Figure 1: Prospective Breakdown of GDP Loss Because of a One-Hour Power Outage



Source: Office of Senator Win Gatchalian, Philippine Statistics Authority

As mentioned in the preceding section, the use of proxy variables has its limitations. The basic procedure above has many caveats. In particular, the estimates put forward in this subsection does not capture ancillary welfare effects and spillover effects (i.e. how do we measure or impute the welfare loss from lost or diminished leisure time?). Moreover, the associated welfare and spillover effects could vary depending on the time of day and the season (i.e. the valuation of the welfare cost of a power outage would be expected to be higher during summer than during the rainy season). The preceding discussion cannot take into consideration the domino-effect on supply chains emanating from disruptions in upstream firms. An argument can be made that these estimates are underestimates. The paucity of data also prevented the specific mapping of industry sector values to each major island group. The true cost of a one hour power outage could be significantly larger upon accounting for these effects.

Conclusion

The preceding discussion places emphasis on the importance of energy to the economy. The immense cost of power outages should serve as sufficient impetus for both the government and the private sector to redouble existing efforts to guarantee energy sufficiency for the entire Philippine economy. There is an urgent need to craft a long-term strategy to ensure that the Philippines' energy generating capacity can keep pace with the growing energy demands of its economy. The overarching goal and motivation of this plan should be to develop a holistic and integrated energy infrastructure capable of providing sustainable, reliable, and affordable energy to Filipino firms and households.

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