**Electricity Reliability, Economic Output and Welfare[[1]](#footnote-1)**

Govinda R. Timilsina, Development Research Group, World Bank, Washington, DC

**Introduction**: Access to reliable electricity service is one of the key challenges to economic development and welfare in many developing countries. The sources of unreliability include deficit of generation, shortage or poor quality of transmission or distribution networks, frequency and magnitudes of natural hazards such as tropical storms and snow storms. Electricity outages can be classified into two types: unscheduled (or episodic) and scheduled (or rolling blackouts). While the former is common in both developed and developing countries, the latter occurs mainly in developing countries in South Asia and Sub-Saharan Africa. This papers first discusses various types of electricity supply outages including episodic, unscheduled and load shedding and their distribution across different countries. This is followed by discussion of economic costs of power sector outages estimated by existing literature. The paper concludes that policies to enhance reliable supply in electrified areas in developing world are as important as providing access to electricity in not yet electrified areas.

**Methodology and Data**: The study critically reviews existing literature on economic costs of unscheduled/episodic outages and chronic load shedding (or rolling blackouts). Data on unscheduled/episodic electricity outages are collected through the World Bank’s ‘Enterprise Survey’. The enterprise survey is a firm-level survey of a representative sample of a wide range of private sector establishments. Since 2002, the World Bank has collected data on electricity outages through face-to-face interviews with top managers and business owners in over 130,000 companies in 135 economies. Data on load shedding (or rolling blackouts) are collected from annual reports of electric utilities and other relevant documents available from countries suffering with load shedding.

**Results:** Between 1964 and 2005, there occurred 17 major power outages or blackouts in the affecting more than 195 million residential, commercial, and industrial customers in the United States, a developed country where electricity system is considered as one of the most reliable systems around the world (Amin 2005). Fifteen major global blackouts over the past few decades that have affected 1.28 billion people around the world (Sovacool and Dworkin 2014). Based on the data collected by the World Bank’s enterprises survey, we find that Middle East and North Africa (MENA) region which has almost 100% electrification rate suffers the highest number of power outages. At the country level, Bangladesh tops all countries in terms of outage frequencies with more than 60 electricity outages in a typical month. Other countries with high frequency of power outages (20 times in a typical month) include Yemen, Lebanon, Iraq, Pakistan, Guinea, Central African Republic, Nigeria, Democratic Republic of Congo and Nigeria). Most of these countries are currently undergoing through civil wars or political conflicts. In Iraq, when power supply gets interrupted, it lasts more than 50 hours.

Many countries especially in South Asia and Sub-Saharan Africa are currently suffering with chronic load shedding that causes huge discomfort to households and large economic losses due mainly to loses of industrial production. For example, some rural areas in India do not get electricity for more than 16 hours a day. In Burundi, Gambia, Nepal, Rwanda, Tanzania and Zimbabwe, load shedding exceeds 16 hours a day in some months.

The economic costs of electricity outages vary across countries depending upon the how sensitive their economy on uninterruptible supply of electricity. The cost estimates also vary across the methodologies used for the assessment. Several studies compare the costs of power outages with electricity supply costs to indicate the economic rationale to avoid the outages (e.g., Adenikinju, 2005; Jyoti et al. 2006; Abdullah and Mariel, 2010). For example, de Nooij et al. (2007) estimates that a one-hour daytime electricity supply interruption in Netherlands on a weekday would cause damages of worth €120 million for firms and the government (lost value added) and of €37 million for households (lost leisure/welfare). The USDOE estimates that power outages and power quality disturbances cost customers as $150 to $400 billion annually (Swaminathan and Sen 1998). Based on survey of 400 residential consumers, Akter (2008) estimates that power outages cause US$4.2 million economic loss in the residential sector alone in Dhaka, Bangladesh. The costs of electricity outages would be many folds higher compared to the average price of electricity supplied by a system thereby presenting a strong economic case of investment on enhancing power system reliability. The estimates of economic costs of rolling black out or load shedding are limited. However, there are ample evidence on how load shedding constraint economic growth and welfare loss. The WBG’ enterprise survey points out that lack of reliable electricity supply is one of the most important barriers to do business for small and medium size enterprises in developing world (IFC, 2013).

**Conclusions:** Poor quality of electricity supply is a big challenge to get reliable electricity services. Electricity consumers in many developing countries in Sub-Saharan Africa and South Asia (e.g., Burundi, Gambia, Nepal, Rwanda, Tanzania and Zimbabwe) do not get electricity services more than 15 hours a day despite the fact that they have been already connected to distribution networks. Such long hours of electricity outages or load shedding becoming a primary bottleneck to their economic development and welfare. Besides, Middle East and North Africa region where the electrification rate is almost 100%, are suffering with very high frequency of unscheduled electricity outages. The economic costs of unscheduled electricity outages are many folds higher than loss of electricity sale loss. Energy policies targeting on the accessibility will not be successful to provide quality energy services unless reliability of the energy supply system is improved at the same time.

**References**

Abdullah, Sabah and Petr Mariel (2010), Choice experiment study on the willingness to pay to improve electricity services, Energy Policy, Vol.38, pp. 4570–4581.

Adenikinju, Adeola (2005), Analysis of the cost of infrastructure failures in a developing economy: The case of the electricity sector in Nigeria, AERC Research Paper 148, African Economic Research Consortium, Nairobi.

Akter, Sonia (2008), Understanding the Power Outage Cost of Residential Consumers in the City of Dhaka, South Asian Journal of Management; Vol. 15, No. 1; pp. 64-75.

Amin, Massoud. (2005), ‘Energy Infrastructure Defense Systems, Proceedings of the IEEE 93, No. 5 (May 2005): 863.

International Finance Corporation (2013), Assessing Private Sector Contributions to Job Creation and Poverty Reduction, IFC, Washington, DC.

Jyoti, R., Ozbafli, A., and Jenkins, G. (2006). The Opportunity Cost of Electricity Outages and Privatization of Substations in Nepal. Queen’s Economics Department Working Paper No. 1066, Queen’s University, Canada.

Sovacool, BK and MH Dworkin (2014). Global Energy Justice: Problems, Principles, and Practices Cambridge University Press.

Swaminathan S, Sen RK. (1998), Review of power quality applications of energy storage systems. Report No. SAND98-1513. Sandia National Laboratories, United States.

1. This paper will be presented in a special session on ‘Energy, Economic Growth and Poverty Reduction’. The special session has been approved by the organizing committee of the 38th International Conference of IAEE. [↑](#footnote-ref-1)