Research Topic:

Impact of Electricity on Economic Growth and Job Creation in Bangladesh

Training Course:

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Supervised By:

Mohammad Rafiqul Islam,
Director (Training), BPMI

Submitted by:

Engr. Rafsan - Bin - Anowar, Assistant Engineer, DESCO
Engr. Tanvir Rahat, Assistant Engineer, DESCO
Engr. Shadmanul Bari, Assistant Engineer, DESCO
Engr. Mobassear Ul Islam, Assistant Engineer, DESCO
Engr. Md Arifur Rahman, Assistant Engineer, DESCO
Engr. Md. Al Amin , Assistant Engineer, DESCO
Mr. Sm. Zahid Hasan, Assistant Manager, DESCO

bpmi
Bangladesh Power Management Institute
Plot No. 2, Road-104, Sector-4, Purbachal, Rupgonj, Narayangonj

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Abbreviations

➢ BBS	➢ Bureau of Statistics
➢ GDP	➢ Gross Domestic Product
➢ ILO	➢ International Labor Organization
➢ KW	➢ Kilowatt
➢ KWH	➢ Kilowatt-hour (Unit)
➢ LDC	➢ Least Developed Country
➢ LFS	➢ Labor Force Survey
➢ MW	➢ Megawatt
➢ SCADA	➢ Supervisory Control and Data Acquisition
➢ SDG	➢ Sustainable Development Goals
➢ UN	➢ United Nations
➢ USA	➢ United States of America

Chapter 1: Introduction

1.1 Background of the Study

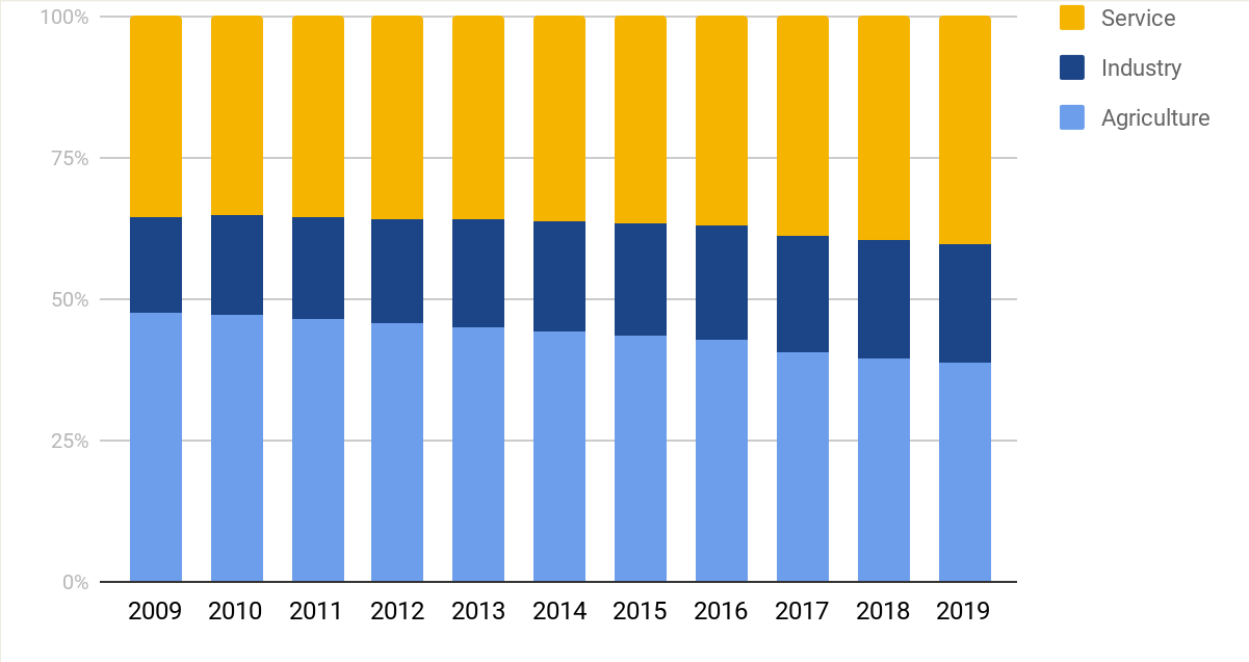
In recent times it is a widely discussed topic that whether electricity has a firm relation with economic growth and the job sector of a country. Electricity can really eradicate poverty to some extent but huge research is going all over the world about any direct correlation between them. Bangladesh is now one of the 47 least developed countries in the world but she is well on track for graduation to middle income countries in 2024.[1] Bangladesh is quite successful in acquiring SDG's first goal by reduction of poverty to a great extent. Bangladesh has reduced the poverty rate to 21% in 2017-2018 which was 40% in 2005 because of the government's huge success achieved in the economic sector in the last few years.[2] Bangladesh has achieved an economic growth rate of 8.2% in 2019 [3] which was 5.045% in 2009 [4].

Whether by bolstering million-dollar infrastructure projects or improving the living standard of the individual household, the power sector is the lifeblood of any economy. Over the past decade, Bangladesh's economy has grown at an annual rate of more than 6%, which supersedes the growth rate of many other Asian economies. To sustain its economic growth, Bangladesh will need to address certain power-related barriers- including low access to reliable and affordable power, limited availability of serviced land, rapid urbanization, and vulnerability to climate change and natural disasters. The United Nations (UN) has set 17 goals for 'Sustainable Development Goals' Program of which 'Affordable and Clean Energy' is the 7th goal.

Bangladesh is, at the same time, advancing rapidly towards achieving self-sufficiency in the power sector. Access to electricity has increased about 50% (From 47% in 2009 to 97% in 2020) [5]. Electricity consumption has been increasing even faster (At 10% a year) as it is used in most

of the economic activities [6]. Electricity consumption has increased from 220 kw/h per capita in 2009 to 512 Kw/h per capita in 2020. Forecasted power demand is going to exceed 50000MW in 2041 which was below 10000 MW in 2015[7].

Figure 1: Distribution of Employee by Economic Sector



On the other hand, unemployment rate has been down to 4.2% in 2019 which was 4.5% in 2010[8]. A recent survey by International Labour Organization (ILO) shows that the employment rate in Bangladesh has exceeded the global average and it is expected to remain so in the coming years in view of government's social protection measures. The unemployment rate is projected to remain at around 3.6 percent in 2020 which is below 5.6 percent, the global average [9]. They also reported that to meet the SDG by 2030, Bangladesh needs to ramp up its efforts on improving skills training, which is directly proportional to electricity facility.

Bangladesh Government is committed to ensuring access to affordable and reliable electricity for all citizens by 2021 (Planning Commission 2012, p.55). To improve the situation, the

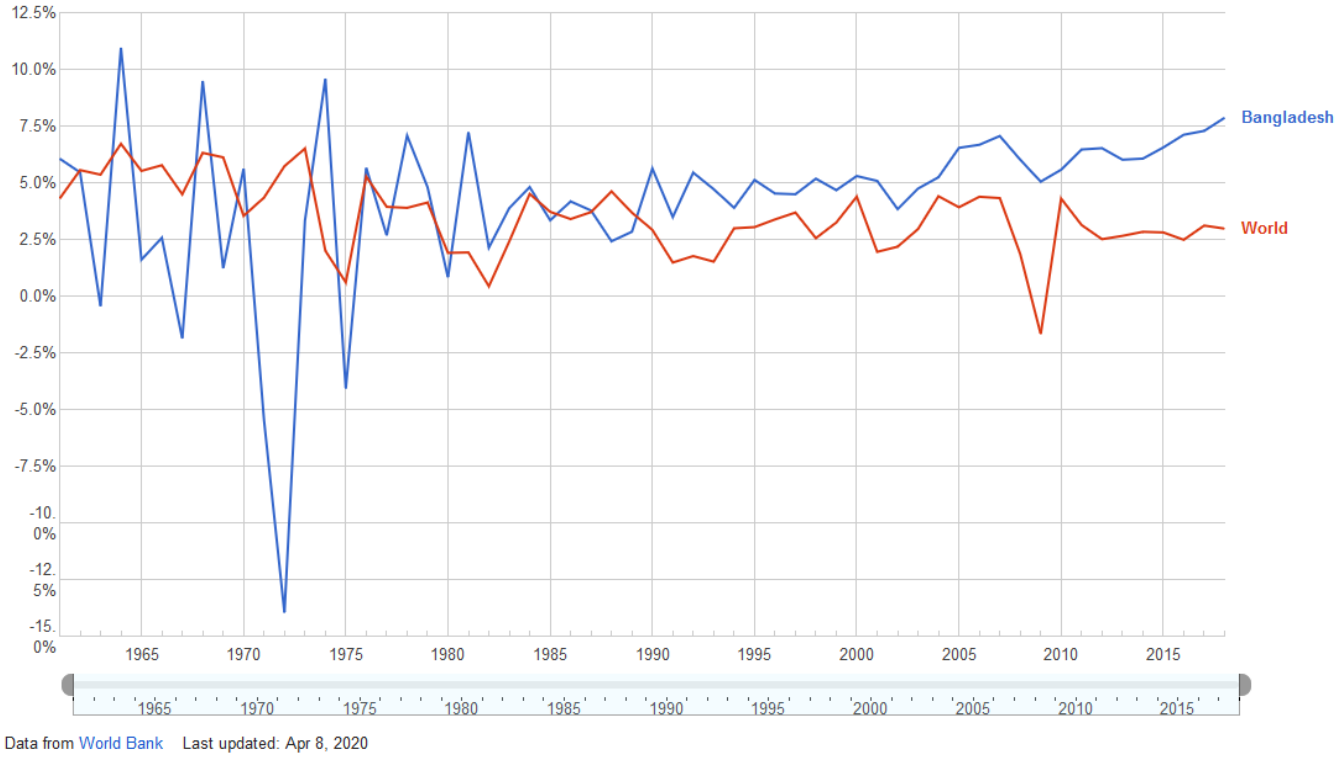
government has adopted a comprehensive energy development strategy to explore supply-side options along with demand management that conserves energy and discourages inefficient use. The thrust of the government's policy is to treat electricity as a private good such that its price reflects the cost of production and a fair return is generated on investment. The policy maintains that "social objectives like reaching out to the poor and rural community could be achieved through cross-subsidization as well as explicit budget subsidies" (Planning Commission 2011, p. 129). As such, a key policy reform for the government is to ensure proper pricing of electricity and power based on international best practices.

Our research aims to reveal the correlation between economic growth of Bangladesh and electricity consumption in recent years. It also focuses on how electricity impacts the employment rate of Bangladesh. Due to the prevailing Pandemic situation, we had to heavily rely on secondary data sources. Still we managed to collect some survey data from primary sources by distributing research questionnaires into the social platform. We took help from annual reports published from the Ministry of Finance and Power Division of Bangladesh. The sampling was inconsistent due to unavailability of huge primary sources and very much random people's opinion.

1.2 Problem Statement

Power system of Bangladesh has grown rapidly in the last 20 years. During the same timeline we see rapid growth in the economy as well. GDP growth of Bangladesh has never fallen below World average since 1990 [15].

Figure 2: GDP growth of Bangladesh and World 1960-2018



Power sector of Bangladesh has seen a rapid growth since 2005 and GDP growth has never fallen below 6% since 2004. During the same time, the unemployment rate has stayed below 5% despite a steady growth of population. A relation may therefore persist among power sector growth, GDP and employment. It is necessary to identify the degree of this relation and that relation must be verified with survey data. At the same time analysis of the survey data may reveal further impact on the economy.

1.3 Hypothesis

Since there is a positive trend in both the GDP and Power sector growth has been observed alone with overall employment there must be a significant correlation among these variables. At the same time, this trend must be significant for all the power sector growth parameters.

1.4 Objectives

After the invention of electricity, almost all of the technological equipment became highly dependent on electricity. Now, industrial revolution isn’t possible without sufficient and reliable supply of electricity. To ensure any country's advancement in economic growth as well as creating employment, electricity is a must. Hence, there must be a significant correlation among power system growth, GDP and employment of a country. The objective of this paper is to verify this hypothesis by finding correlation among the growth of GDP of Bangladesh and total employment in the labor force considering 5 factors relating to the electrical system, growth of power and its consumption in Bangladesh. It is clear that reliability of electric supply is vital for economic growth of a country. However, from the viewpoint of Bangladesh current electrical system, the proposal is that the future research should focus on identifying the causal effect of electricity reliability, infrastructure and access on economic growth. Overall, the aim of this paper is to exhibit the necessity and importance of electricity in sustainable development.

1.5 Significance of This Study

This study uncovers the degree of correlation between 5 key power sector parameters and the GDP growth rate of Bangladesh over the recent years. This also estimates the correlation between these key power sector parameters and the total employed population of Bangladesh for the recent years. The findings of these correlation analyses showcase the causal relationship that power sector growth has with economic growth and job creation in our country, thus highlighting the necessity and importance of electricity on the journey towards being a developed country within 2041. Data obtained from the survey provides an idea regarding the validity of the statistical relationships revealed in this study.

1.6 Limitations

The findings of this study, however, are subject to some unavoidable limitations. First, the BBS LFS survey is not conducted every year. As a result, the correlation found in this study may not reveal the real scenario. Second, the reliability of the data published in the Bangladesh Economic Review has often been questioned by many. And last, the survey data collected from primary sources, namely google sheet and Facebook groups is not as reliable due to the inconsistent sampling of the population of Bangladesh.

1.7 Delimitations

Due to time constraint, the scope of this study has been restricted only to correlation analysis. If we had more time, then the impact that electricity has on economic growth and job creation in Bangladesh could also be investigated through more reliable statistical tools such as co integration analysis and causality analysis.

Chapter 2: Literature Review

A number of empirical studies have been done in the field of causality between energy consumption and economic growth since the pioneering work done by Kraft & Kraft [26] in 1978. These studies produced different contradictory results for different countries and different time periods. Nevertheless, all the relevant studies are reviewed here briefly in terms of four separate regional segments- Bangladesh, South Asia, Developed, and Developing countries.

2.1 Literature Review of Bangladesh

In Bangladesh, few studies were done to investigate the relationship between energy or electricity consumption and economic growth in Bangladesh. The evidence of unidirectional causality running from electricity consumption to economic growth was found by Masuduzzaman (2013) [28], Ahmad & Islam (2011) [16] whereas the reverse result that economic growth causes energy consumption was claimed by Amin, Ferdous and Aroni, (2012) [19]. Alam & Sarker (2010) [18] got short run causality from electricity generation to economic growth in Bangladesh. On the other hand, Meerza (2012) [29] claimed that Growth causes Exports in case of Bangladesh.

2.2 Literature Review of South Asia

In India, Ghosh (2000) [24] found the evidence of unidirectional causality from economic growth to electricity consumption but the same author claimed the opposite result in 2009. A bi-directional causality between energy consumption and economic growth was found by Paul & Bhattacharya (2004) [34]. In Pakistan, Ahmad & Jamil (2010) [17] found unidirectional causality from economic growth to electricity consumption. In Sri Lanka, a bi-directional causality

between energy consumption and economic growth was found by Morimoto et al. (2004) [30]. In Nepal, Dhungel (2008) [20] claimed unidirectional causality that per capita coal, oil and commercial energy causes per capita real GDP whereas per capita real GDP causes per capita electricity consumption.

2.3 Literature Review of Developed countries

In the USA, Kraft & Kraft (1978) [26] found that growth causes energy consumption but the reverse result was found by Stern (2000) [37]. In Japan, Sami (2011) [35] found the causality from export and real GDP per capita to electricity consumption in the long run. Ghali, (2004) [22] claimed a bi-directional causality between energy consumption and growth in Canada, but growth causes electricity consumption was the findings of Narayan & Smyth (2005) [31] in the case of Australia. That electricity consumption causes growth in short run and bi-directional causality in the long run was found by Oh & Lee (2004) [33] in South Korea. But analyzing the G-7 countries, Soyatas & Sari (2003) [36] claimed that growth leads to energy consumption.

2.4 Literature Review of Developing countries

Unidirectional causality from electricity consumption to economic growth was found by Yuan et al. (2007) [40] in China. But the reverse result that economic growth leads to energy consumption was claimed by Twerefo et al., (2008) [39] in Ghana, Lin (2003) [22] in China. On the other hand, Tang (2008) [38] in China and Fatai et al., (2004) [21] in Philippines found bi-directional causality between economic growth and energy consumption.

The details of the previous causality studies are presented in Table- 1.

Table- 1: Summary of the previous causality studies

Country	Author(s)	Study period	Findings
Bangladesh	Masuduzzaman (2013)	1981-2011	-EC causes growth -EC causes Investment -Inv. causes growth
Bangladesh	Amin and Ferdous (2012)	1976-2007	-Growth causes EC -No causality between EC & CO2
Bangladesh	Ahmad & Islam (2011)	1971-2008	-EC causes growth
Bangladesh	Meerza (2012)	1973-2008	-Growth causes FDI & EXP
India	Paul & Bhattacharya (2004)	1950-1996	-Bi-directional causality
Pakistan	Ahmad & Jamil (2010)	1960-2008	-Growth causes EC
Sri Lanka	Morimoto et al., (2004)	1960-1998	-Bi-directional causality
Nepal	Dhungel (2008)	1980-2004	-Growth causes EC
USA	Kraft & Kraft (1978)	1947-1974	-Growth causes EC
Japan	Sami (2011)	1960-2007	-Export causes EC -Growth causes EC
Canada	Ghali et al., (2004)	1961-1997	-Bi-directional causality

Country	Author(s)	Study period	Findings
Australia	Narayan & Smyth (2005)	1966-1999	-Growth causes EC -Growth causes Emp
China	Yuan et al. (2007)	1978-2004	-EC causes growth
China	Tang (2008)	1972-2008	-Bi-directional causality
Libya	Khaled et al., (2010)	1980-2007	-Bi-directional causality

It is obvious that the empirical results of the existing literatures are very mixed, inconclusive and even vary for the same country. This is due to the application of different types of econometric methodologies, sample sizes and variables used. No study has been done yet in Bangladesh to find out the causality among Energy consumption, Job creation & Economic growth. That's why we have selected this topic for the study.

Chapter 3: Research Methodology

The study aims to analyze the degree of correlation among power sector growth, economic growth and job creation in Bangladesh. To conduct analysis, we have collected statistical data from secondary sources and survey data from primary sources. Primary data was collected through google sheet and Facebook groups. The primary data is not as reliable due to inconsistent sampling of the population of Bangladesh. Secondary data sources are Bangladesh labor forces studies conducted by Bureau of Statistics (BBS), Bangladesh Economic Review published by the Ministry of Finance of Bangladesh government and Annual Reports of Power Division. A survey was conducted online to gather data as well. Peoples experience and perception was collected to verify the statistical relationship.

3.1 Regression & Correlation Theory:

Regression: Regression analysis is performed so as to determine the correlation between two or more variables having causal effect relations and to make predictions for the topic by using the relation.

The regression using one single independent variable is called universal or univariate regression analysis. [10]

While the analysis using more than one independent variable is called multivariate regression analysis. Through multivariate regression analysis, the relation amongst a dependent variable and the independent variables are analyzed and the equation representing the relations amongst a dependent variable and the independent variables are formulated. So, the regression model with one dependent variable and two or more independent variables in such a way is known as

multivariate regression analysis. [11] The Multivariate regression is also known as multiple regression analysis.

Simple Linear Regression refers to a group of techniques for fitting and studying the straight-line relationship between two variables. Linear regression estimates the regression coefficients 0 and 1 in the equation.

$$Yj = \beta_0 + \beta_1 X j + \varepsilon_j$$

Where X is the independent variable, Y is the dependent variable, 0 is the Y intercept, 1 is the slope, and εj is the error.

In order to calculate confidence intervals and hypothesis tests, it is assumed that the errors are independent and normally distributed with mean zero and variance σ2. Also note that the equation predicts Y from X. The value of Y depends on the value of X. The influence of all other variables on the value of Y is lumped into the residual. [12]

In multivariate regression analysis with more than two independent variables an attempt is made to account for the variation of the independent variable synchronically. Multivariate regression analysis model is formed as-

$$Y= \beta_0 + \beta_1 X_1 + \ldots\ldots.. + \beta_n X_n + \varepsilon$$

Where, Y = dependent variable

X_i = independent variable

B_i = Parameter

ε = Error

The assumptions of multivariate regression are normal distributions, linearity, freedom from extreme values and having no multiple ties among independent variables. [13]

The simple data used in the research are obtained from various well-renowned website, Bangladesh authorized institutions survey data. In our multiple linear regression analysis, it was checked how the five independent variables are significantly predicting the growth of GDP and employed population which are the dependent variable for this research.

Correlation: Correlation is a statistical technique that can show whether and how strongly pairs of variables are related. [14] Once the relationship equation is formed and from the equation the intercept and slope have been estimated using least squares, various indices are studied to determine the reliability of these estimates. One of the most popular of these reliability indices is the correlation coefficient. The correlation coefficient, or simply the correlation, is an index that ranges from -1 to 1. When the value is near zero, there is no linear relationship. As the correlation gets closer to plus or minus one, the relationship is stronger. A value of one (or negative one) indicates a perfect linear relationship between two variables. Actually, the strict interpretation of the correlation is different from that given in the last paragraph. The correlation is a parameter of the bivariate normal distribution. This distribution is used to describe the association between two variables. This association does not include a cause and effect statement. That is, the variables are not labeled as dependent and independent. One does not depend on the other. Rather, they are considered as two random variables that seem to vary together. The important point is that in linear regression, Y is assumed to be a random variable and X is assumed to be a fixed variable. In correlation analysis, both Y and X are assumed to be random variables.

3.2 Survey:

In surveys, researchers typically measure the perceptions, attitudes, behaviors, or characteristics of a group (Creswell, 2005) [53]. Survey research can be used to examine topics such as the attitudes of general education teachers toward inclusion, the amount of time special educators devotes to paperwork, and the types of reading interventions used in resource rooms. Both surveys and qualitative research typically are considered descriptive research, in that their primary purpose is to describe or portray phenomenon.

Certain types of correlational research may also be used to fill voids in the experimental research literature. Relatively little experimental research is published in contemporary special education journals, likely because of the cost and difficulty in conducting experimental studies [54]. Survey and correlation can work hand in hand to figure out deeper relation among variables. All the survey questions are available in the Appendix.

Chapter 4: Data Analysis

4.1 Data Description

Power division of Bangladesh functions under the ministry of Ministry of Power, Energy and Mineral Resources. Annual report of the power division has been studied. This reveals the yearly increment in the power generation capacity of the country. Due to aging of power plants and equipment, generation capacity declines each year. Derated capacity of power generation capacity is available in power division annual reports. However, it will be more accurate to compare economic growth with yearly energy consumption rather than energy generation capacity. Total yearly electricity consumption and per capita energy consumption data was published in both Power Division annual report and Economic Review. BBS survey of Labour Force Survey (LFS) is conducted in an irregular interval. During 2008 to 2020, three LFS reports are available. The Ministry of Finance publishes Bangladesh Economic Review every year. The growth of the economy as in GDP is available from Economic Review. A table is given here showing the yearly economic situation, job market and corresponding power consumption and overall generation capacity.

Table 2: Power System, LFS and GDP data for 2009-2019[41-52]

Fiscal Year	Electricity Generation Capacity (MW)	Derated Electricity Generation Capacity, MW	Total Yearly Consumption (Million KWH)	Per Capita Consumption (KWH)	Population with Electricity (%)	Growth of GDP with Base Year 2005-06 (%)	Total Working age population (Mill)	Total Employed population (Mill)
2008-2009	4942	5166	26533	220	47	5.05	53.7	51
2009-2010		5271	29247			5.57	56.7	54.1

Fiscal Year	Electricity Generation Capacity (MW)	Derated Electricity Generation Capacity, MW	Total Yearly Consumption (Million KWH)	Per Capita Consumption (KWH)	Population with Electricity (%)	Growth of GDP with Base Year 2005-06 (%)	Total Working age population (Mill)	Total Employed population (Mill)
2010-2011		6639	31355			6.46		
2011-2012		8100	35118			6.52		
2012-2013	10264	8537	38229	321	62	6.01	60.7	58.1
2013-2014	10416	9821	42195	348	68	6.06		
2014-2015	11534	10939	45836	371	74	6.55	61.4	58.7
2015-2016	14565	11770	52193	407	76	7.11	62.5	60
2016-2017	15755	12771	57276	433	80	7.28	63.4	60.7
2017-2018	18753	15953	62678	464	90	7.86		
2018-2019	22051	18079	70533	510	94	8.13		

4.2 Correlation study

Correlation observed among power sector parameters and GDP in Table 2 are laid out in following table:

Table 3: Correlation between Power Sector growth and GDP

Power Sector Parameter	Study Timeline	Correlation
Electricity Generation Capacity	2009-2019	0.989
Derated Electricity Generation Capacity	2009-2019	0.934
Total Yearly Consumption	2009-2019	0.932
Per Capita Consumption	2012-2019	0.987

Power Sector Parameter	Study Timeline	Correlation
Population with access to Electricity	2012-2019	0.978

Correlation observed among power sector parameters and Total Employed population in Table-2 is laid out in following table:

Table 4: Correlation between Power Sector growth and Employment

Power Sector Parameter	Study Timeline	Correlation
Electricity Generation Capacity	2009-2017	0.960
Derated Electricity Generation Capacity	2009-2017	0.945
Total Yearly Consumption	2009-2017	0.940
Per Capita Consumption	2012-2017	0.975
Population with access to Electricity	2012-2017	0.888

Chapter 5: Findings

In the correlation study, we calculated correlation of GDP growth and job creation against a number of power sector growth parameters. The parameters are Electricity Generation Capacity, Derated Electricity Generation Capacity, Total Yearly Consumption, Per Capita Consumption, and Population with access to Electricity. While all the parameters showed significant correlation, per capita energy consumption has the strongest correlation 0.975 with job creation. GDP has the strongest correlation of 0.989 with total Electricity Generation Capacity. All the parameters have more than 0.95 correlations with GDP. This correlation is significant and depicts almost a linear relationship between growth in the power sector and growth in GDP in the last 10 years.

In an open survey only 23 people from 9 districts participated willingly. However, interesting patterns can be found in this data. Following are the survey findings:

1. 22% of participants face power outages more than once a day. But only 40% of them have a backup power supply (IPS/ Rechargeable instruments).
2. 48% of participants face power outages at least once a day. But only 18% of them have a backup power supply. These are the same people who face power outage more than once a day. This shows that the duration of power outages is not significant. But the area affected by the power outage daily is significant.
3. Of the participants who face power outages more than once a day only 27% are from the capital city of Dhaka. This implies that reliability is a zonal issue.
4. Access to electricity improves productivity for 87% participants.

5. Income depends on electricity for 52% of the participants. 57% things that they loses income due to power outage. This shows that our workforce is yet to be fully digitalized/automated.
6. 87% participants believe that access to electricity creates new employment opportunities.
7. 74% participants believe that economic development is dependent on electricity.
8. 56.5% participants would prefer uninterrupted electricity even if tariff goes up slightly.
9. 4.3% of participants would accept uninterrupted electricity at any cost.
10. Only 8.7% participants would accept cheaper electricity even if reliability falls.

This could imply a circular relationship among the variables. Growth in the power sector creates an environment where employment opportunity increases. This in turn increases per capita energy consumption and GDP. This growth in GDP again helps to grow the power sector. These statistics show that as per participants' experience there is a strong relation among GDP, employment opportunity and power system reliability. Moreover, the majority are ready for more reliable power which suggests that this trend of simultaneous improvement has room for going on for longer.

Chapter 6: Conclusion and Recommendation

Conclusion: The aim of our research was to check and verify if there is any correlation lying between energy consumption and economic growth or job creation of Bangladesh. Every relatable parameter of power consumption was considered in our research to correlate with GDP and employment. A questionnaire was distributed on social platforms for primary data. We found a high level of correlation between independent variable energy consumption and dependent variables GDP Growth and Employment Rate. Our survey data is also concurrent with the result obtained from secondary sources. The impact of our research result can be very influential in our national economy. Bangladesh is now one of the LDC countries of the world. But soon we will promote to the world of developing countries if we can continue our development process. Government is taking various projects to bring the whole population under electricity facility. We are getting more self-containment in production and distribution of energy. Now most of the power sector entities are corporatized for increasing efficiency and reliability. We are getting digitalized in the power distribution sector. A high correlative result can deduce that we are on the right track of development. Unemployment is now one of the major problems in our country. Not only was our research result highly correlative but also our survey data in this aspect was grave because we noted that around 87% people believe that electricity access and availability create more job opportunities for them.

Recommendation: Bangladesh is a country of limited natural resources. Certain steps should be taken to ensure clean and affordable energy to people of Bangladesh while maintain development of the economy:

- According to our survey around 4% people are interested in uninterrupted electricity at any cost. Also, in our data we find out that our per capita energy consumption is still quite low. In our country still a lot of people live below the poverty line. This reveals a necessity of serving electricity at a cheaper price. Efficient power generation scheme should be implemented to achieve this.
- Reliability must be improved as there is room for improvement here as 47% people face power outage on a regular basis.
- Although access to electricity has increased dramatically in recent times, we still could not have 100% access to electricity. Solar outreach program will be a cheaper alternative for remote areas.
- Our study also indicates that access to electricity improves productivity for more than 70% participants. At the same time 43% public demand is cheaper electricity. Hence improvement in power system must be done in an economical manner.
- Power supply outside of Dhaka city is not as reliable. In our research most people reported power outages from outside of Dhaka. Good quality electric poles and cables should be used to increase power reliability there.
- This survey had only 23 participants. Yet the statistics reveals a lot of important indicators into the actual situation of power sector in Bangladesh. But due to lack of time and participants, it is impractical to act on these results. Further study in large scale with improved questionnaire will benefit our understanding of the economy and public demand. Thus, future policy making will be more people friendly and development will be sustainable.

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Appendices

Figure

Figure 1: Distribution of Employee by Economic Sector

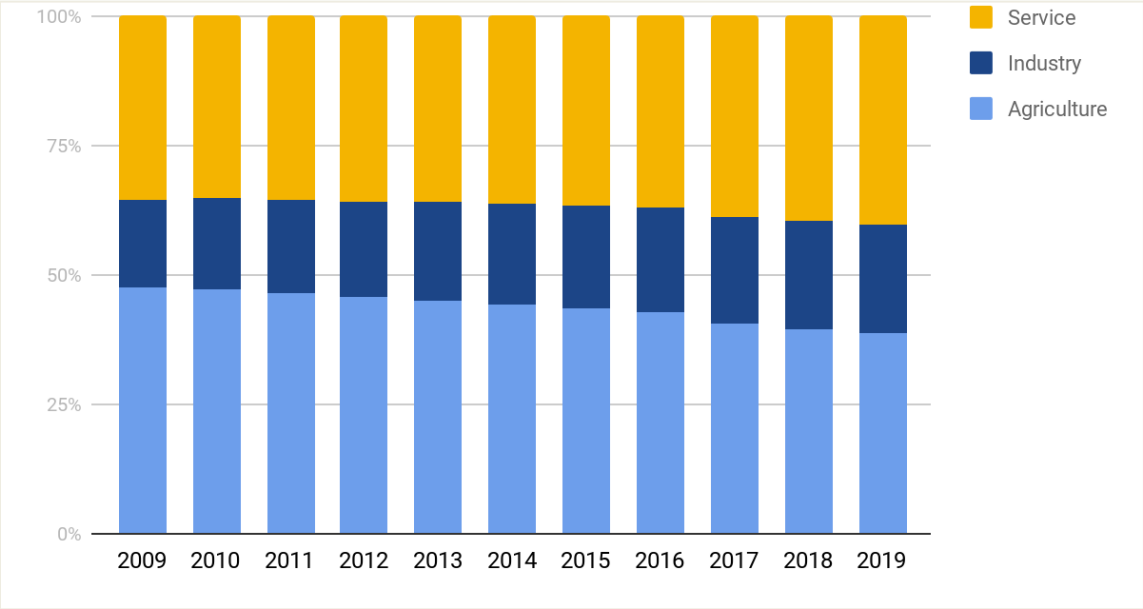
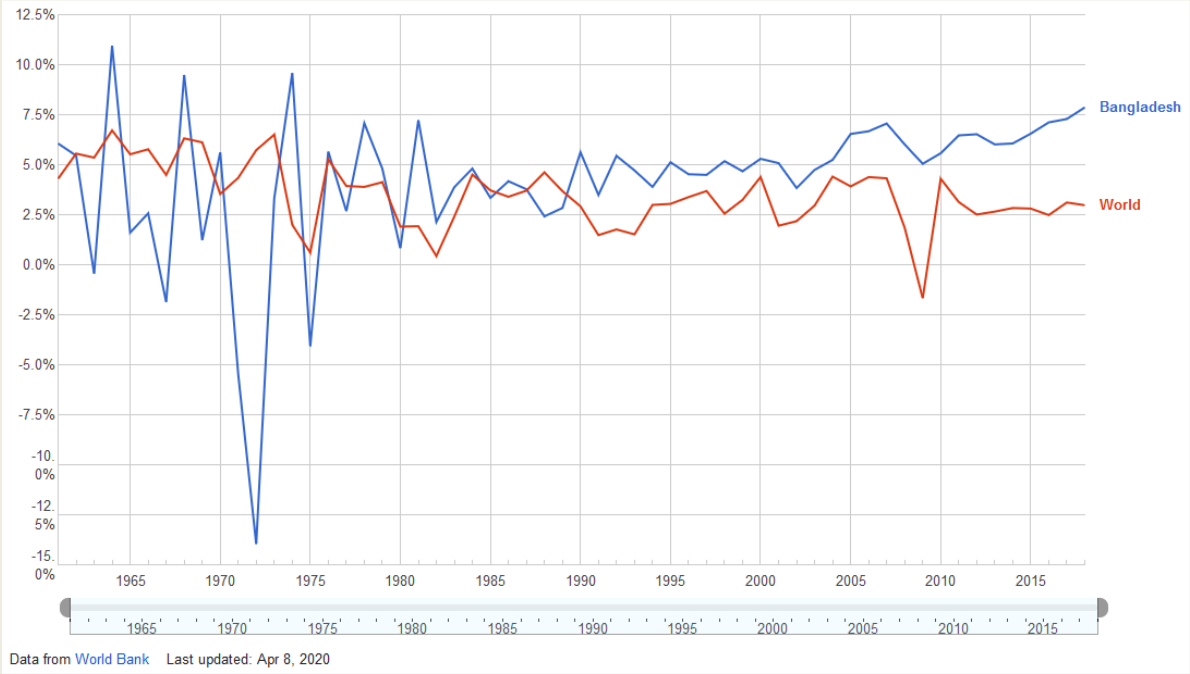


Figure 2: GDP growth of Bangladesh and World 1960-2018



Questionnaire

1. Which of the following electric sources/equipment is available at your home?
    a. Utility Power Line
    b. Stand by Generator
    c. Rechargeable Light/Fan
    d. IPS/Solar backup

2. How often do you face electricity outages on average?
    a. Few times Month
    b. Once a Day
    c. More than once a day
    d. Few times a week

3. By how much do you think electricity improves your productivity?
    a. Not at all
    b. May be a little
    c. Improves a lot
    d. It all depends on electricity

4. By how much do you believe access to electricity increases your income (directly or indirectly)?
    a. Not at all
    b. May be a little
    c. Improves a lot
    d. It all depends on electricity

5. By how much do you believe that your income is reduced due to power outage?
    a. My income is fully dependent on electricity
    b. Mostly depends on electricity
    c. It does not depend that much
    d. Not at all

6. Do you think access to power creates new jobs?
    a. No
    b. May be a few
    c. Job creation depends a lot on electricity
    d. Without electricity there would not be many jobs

7. Do you think more reliable electricity would increase your income?
    a. No
    b. May be a little
    c. Yes, it would increase a lot
    d. Yes, it would increase massively

8. Would you accept cheaper electricity if electricity supply was less reliable compared to now?
    a. Of course
    b. A little compromise is fine
    c. It is a bad idea
    d. Never

9. Would you accept more expensive electricity if electric supply never fails?
    a. Of course
    b. A little expanse is no problem
    c. It is a bad idea
    d. Never

10. How much do you agree on a scale of 1 to 4 that development depends on electricity?

11. How much do you agree on a scale of 1 to 4 that the standard of living has improved with power sector growth in Bangladesh?

Table

Table- 1: Summary of the previous causality studies

Country	Author(s)	Study period	Findings
Bangladesh	Masuduzzaman (2013)	1981-2011	-EC causes growth -EC causes Investment -Inv. causes growth
Bangladesh	Amin and Ferdous (2012)	1976-2007	-Growth causes EC -No causality between EC & CO2
Bangladesh	Ahmad & Islam (2011)	1971-2008	-EC causes growth
Bangladesh	Meerza (2012)	1973-2008	-Growth causes FDI & EXP

Country	Author(s)	Study period	Findings
India	Paul & Bhattacharya (2004)	1950-1996	-Bi-directional causality
Pakistan	Ahmad & Jamil (2010)	1960-2008	-Growth causes EC
Sri Lanka	Morimoto et al., (2004)	1960-1998	-Bi-directional causality
Nepal	Dhungel (2008)	1980-2004	-Growth causes EC
USA	Kraft & Kraft (1978)	1947-1974	-Growth causes EC
Japan	Sami (2011)	1960-2007	-Export causes EC -Growth causes EC
Canada	Ghali et al., (2004)	1961-1997	-Bi-directional causality
Australia	Narayan & Smyth (2005)	1966-1999	-Growth causes EC -Growth causes Emp
China	Yuan et al. (2007)	1978-2004	-EC causes growth
China	Tang (2008)	1972-2008	-Bi-directional causality
Libya	Khaled et al., (2010)	1980-2007	-Bi-directional causality

Table 2: Power System, LFS and GDP data for 2009-2019[

Fiscal Year	Electricity Generation Capacity (MW)	Derated Electricity Generation Capacity, MW	Total Yearly Consumption (Million KWH)	Per Capita Consumption (KWH)	Population with Electricity (%)	Growth of GDP with Base Year 2005-06 (%)	Total Working age population (Mill)	Total Employed population (Mill)
2008-2009	4942	5166	26533	220	47	5.05	53.7	51
2009-2010		5271	29247			5.57	56.7	54.1
2010-2011		6639	31355			6.46		
2011-2012		8100	35118			6.52		
2012-2013	10264	8537	38229	321	62	6.01	60.7	58.1
2013-2014	10416	9821	42195	348	68	6.06		
2014-2015	11534	10939	45836	371	74	6.55	61.4	58.7
2015-2016	14565	11770	52193	407	76	7.11	62.5	60
2016-2017	15755	12771	57276	433	80	7.28	63.4	60.7
2017-2018	18753	15953	62678	464	90	7.86		
2018-2019	22051	18079	70533	510	94	8.13		

Table 3: Correlation between Power Sector growth and GDP

Power Sector Parameter	Study Timeline	Correlation
Electricity Generation Capacity	2009-2019	0.989
Derated Electricity Generation Capacity	2009-2019	0.934
Total Yearly Consumption	2009-2019	0.932
Per Capita Consumption	2012-2019	0.987
Population with access to Electricity	2012-2019	0.978

Table 4: Correlation between Power Sector growth and Employment

Power Sector Parameter	Study Timeline	Correlation
Electricity Generation Capacity	2009-2017	0.960
Derated Electricity Generation Capacity	2009-2017	0.945
Total Yearly Consumption	2009-2017	0.940
Per Capita Consumption	2012-2017	0.975
Population with access to Electricity	2012-2017	0.888

Survey Result

Which district do you live in?		
District	Responses	Percentage
Pabna	1	4%
Dhaka	12	52%
Cumilla	3	13%
Sirajganj	1	4%
Rangpur	1	4%
Bagerhat	1	4%
Gaibandha	2	9%
Bogura	1	4%
Jhenaidah	1	4%
Total	23	

Which of the following electric source/equipment is available at your home?		
	Responses	Percentage
Utility Power Line	23	100%
IPS/Solar backup	3	9%
Rechargeable Light/Fan	1	4%
IPS/Solar backup	2	9%

How often do you face electricity outages on average?		
	Responses	Percentage
Few times Month	7	30%
Once a Day	6	26%
Few times a week	5	22%
More than once a day	5	22%
At least once a day	**11**	**48%**

By how much do you think electricity improves your productivity?		
	Responses	Percentage
It all depends on electricity	6	26%
Improves a lot	14	61%
May be a little	3	13%
Not at all	0	0%
Access to electricity improves productivity for	**20**	**87%**

By how much do you believe access to electricity increases your income (directly or indirectly)?		
	Responses	Percentage
Improves a lot	9	39%
May be a little	10	43%
It all depends on electricity	3	13%
Not at all	1	4%
Income depends on Electricity	12	52%

By how much do you believe that your income is reduced due to power outage?		
	Responses	Percentage
It does not depend that much	9	39%
My income is fully dependent on electricity	4	17%
Mostly depends on electricity	9	39%
Not at all	1	4%
Income suffers for power outages for	13	57%

Do you think access to power creates new jobs?		
	Responses	Percentage
Job creation depends a lot on electricity	15	65%
Without electricity there would not be many jobs	5	22%
May be a few	2	9%
No	1	4%
Positive Responses	20	87%

Do you think more reliable electricity would increase your income?		
	Responses	Percentage
May be a little	7	30%
Yes, it would increase a lot	16	70%
My income would increase way too much	0	0%
Not at all	0	0%

Would you accept cheaper electricity if electricity supply was less reliable compared to now?		
	Responses	Percentage
A little compromise is fine	9	39%
Never	3	13%
It is a bad idea	9	39%
Of course	2	9%

Would you accept more expensive electricity if electric supply never fails?		
	Positive Responses	Percentage
A little expanse is no problem	12	52%
Never	5	22%
It is a bad idea	5	22%
Of course	1	4%

How much do you agree that development depends on electricity?		
	Responses	Percentage
Fully Agree-4	16	70%
Mostly Agree-3	3	13%
Somewhat Agree-2	2	9%
Do not Agree-1	2	9%

How much do you agree that standard of living has improved with power sector growth in Bangladesh?		
	Responses	Percentage
Fully Agree-4	16	70%
Mostly Agree-3	6	26%
Somewhat Agree-2	1	4%
Do not Agree-1	0	0%