

Economic Development: Energy and Ethical Issues in Bangladesh

SAKIB B. AMIN*

MS. SAANJAANA RAHMAN**

MR. FARHAN KHAN***

Abstract: *It is said that energy is the lifeblood of modern economies around the world. Almost every economic activity is backed by energy. Energy is also a factor which accelerates the socio-economic progress of a nation. Bangladesh is one of the fastest growing economies of the world. With the recent attribute of “New Asian Tiger” and the aim to become a middle-income nation by 2021, the country is also enlisted in the “Next Eleven” economies. To boost up the economic development energy can play a vital role in Bangladesh. Bangladesh has set forth ambitious plans for new energy architectures. However, there are some ethical issues regarding energy consumption as well as production process which are needed to be examined carefully to increase the development speed. To the best of our knowledge, no studies have been conducted on ethical issues regarding energy in Bangladesh. The aim of this paper is to discuss ethical problems concerning energy consumption and production in Bangladesh. In addition, we would emphasize on probable solutions to overcome the problems so that the development progress of the economy of Bangladesh can be accelerated in upcoming decades.*

1. Introduction

Energy is considered as the lifeblood of the economy. Energy demand and supply

* School of Business and Economics, North South University, Dhaka, Bangladesh
sakib.amin@northsouth.edu

** School of Business and Economics, North South University, Dhaka, Bangladesh
saanjaana.rahman@gmail.com

*** School of Business and Economics, North South University, Dhaka, Bangladesh
farhan.khan008@northsouth.edu

nurtures all aspects of life within the ecological world. The structure of energy is local as well as global issue, where nations need a deeper understanding of the broader implications of their actions. The recent landscape of the energy architecture is distant from how it was a decade ago and is expected to appear more distant and significantly different within the next ten years, with the emergence of new technologies to harness renewable energy.

There is no doubt that energy is vital for economic development, including Bangladesh, which has recently been attributed as the New Asian Tiger, with the target to become a middle-income nation by 2021. As of the case of Bangladesh, the country currently uses both renewable and fossil fuels for residential, commercial and industrial usage. Although there the modernistic policies globally prefer renewable energy over fossil fuel, the former and the latter both have negative effects on the society in the long run. Energy is an indispensable input for production and consumption of economic activities, which lead to economic development of the country.

However, an increase in Gross Domestic Product (GDP), trade, savings, etc. should not be at the cost of reduced food source, land entitlements, pollution or health issues. It is an ethical dilemma. With the frequent electricity shortages (especially during summer), coupled with high cost of electricity have historically lead to negative impacts on the economy and on the lives of people (especially rural people). Moreover, the fumes from car exhaust pipes, global warming have all lead people to start shifting to renewable energy.

However, renewable energy technologies like Photovoltaic Cells (PV), first generation biofuel and many others also have negative impacts and ethical issues to the society. Although many studies have been conducted on the nexus between the relationship of energy sources and economic development (Khalil 2016), (Masuduzzaman 2015), (Rezitis and Ahammad 2014) no work has been done on the grounds of ethical issues in Bangladesh. This paper sheds light on the research gap between the ethical issues of using different types of energy source, for both renewable and non-renewable. The aim of this paper is to evaluate ethical issues and bring about the effects of energy supplies for adequate energy policies. The aim of this paper is to evaluate ethical issues and bring about the effects of energy supplies for adequate energy policies.

The paper has the following structure. In section 2 we will discuss some of the literature. Overview of energy scenario of Bangladesh is discussed in section 3. In section 4 we widely discussed the ethical issues regarding energy consumption and production. Finally, section 5 presents the conclusion.

2. Literature Review

Dernbach and Brown (2010) argued that it is the ethical responsibility of the developed countries to reduce the energy consumption through energy efficiency and conservation as part of the global effort to reduce greenhouse gas emissions. Whereas this responsibility is borne by nations themselves, it has immense significance for the individuals living in those nations. On the other hand, they revealed that developing countries have different duties regarding energy consumption. Their responsibility to improve human quality of life will mean greater use of modern energy and also achieve efficiency in energy consumption.

However having an immense impact on social life, ethical issues regarding energy consumption has received less response. Existing literature find that there are two principle ways of reducing energy consumption: energy efficiency and energy conservation. The earlier one refers doing the same amount of work or producing the same amount of goods or services with less energy and the later one refers using less energy regardless of whether energy efficiency has changed.

According to Šimelytė and Dudzevičiūtė (2017) Energy consumption, its efficiency is very often associated with country's competitiveness in the international arena, especially industry. The implication of renewable energy is tremendously renowned all over the world. However, the impact of consuming renewable energy on the economy is very often disputable and controversial. Big wind power plants have reached a relative maturity; however, there is a lack of research on the profitability of medium wind turbines and their environmental perspective.

Bortolini *et al.* (2014) asserted that small and medium-size wind power plants require more investment compared to large ones. Thus, the cost of electricity made by small and medium-size wind power plant is usually higher than average. Indeed for sustainable development, renewable energy source is a good choice but some ethical issues are related to this matter. Renewable energy causes environmental degradation, such as land degradation, land use transformation, soil erosion and much more.

Yunus *et al.* (2012) highlighted that energy is central to sustainable development. On one hand it is the accelerator of socio-economic progress and economic productivity and on the other hand, it causes climate change, biodiversity loss, change in the ecosystem and human well-being. Thus it is very important to understand how to ensure the maximum amount of energy with efficiency and without hampering social and environmental aspects. They also indicated that introducing energy use cap would change the course of degradation. As a result,

fewer natural resources would be used across the globe, which would then ultimately lead to a rise in products and services with low energy and natural resource demand. Moreover, due to this process labor would become more competitive and more jobs would be created in the different sub-sectors of the economies around the world. Above all, this would lead to a good ecosystem.

Timmons *et al.* (2014) stated that the history of industrial civilization is a history of energy transitions. As economies develop and become more complex, energy consumption increased in a rapid speed. As a result, non-renewable energy sources became the dominating factor in energy production. As these fuels are affecting our environment with carbon emission, now focus is given to renewable energies.

However different ethical dilemmas are present in the context of using renewable energy sources. Such as how will renewable energy mixtures vary by location? What are the direct and external costs of the new renewable energy sources likely to be? How will renewable-energy realities change the way energy is used in the economy? What kind of engineering, economic, and policy adjustments will be needed to accommodate renewable energy sources, which are somewhat different from fossil fuels? Policy makers also face an ethical dilemma in terms creating policy framework as most of the capital stock and modern economic systems are based on fossil fuels and any transition can lead to disaster in the long run.

According to Gomerio *et al.* (2009), biofuels have lately been indicated as a promising source of cheap and sustainable energy. However large-scale conversion of crops, grasslands, the natural and semi-natural ecosystem may hinder social and ecological consequences. Different social concerns may arise such as, the problem of food security in developing countries which ultimately leads to higher food prices. Farm owners are establishing larger farm holdings for biofuel feedstock cultivation for extra profit. Ecologically biofuel can compete with grazing land for animals which is a great threat to concern. Moreover, soil fertility can decline by producing feedstock over and over again. Thus authors asserted that there is a need to conduct serious and deep analysis on the environmental and social impact of large-scale biofuels production before important energy policies are launched at the global level.

Ziegler (2013) argued against biofuels production because it directly contests with universal food production thus upsetting the global food security, as shown by the increase in food commodity prices alongside with increasing biofuels production. In addition, it will create a new demand for land use that ultimately leads to deforestation and causing additional environmental damages due to this practice.

Such case also being made against second-generation liquid biofuels by as the practice may increase land use and increases the current soil erosion occurred in arable lands. Another important finding by showed that introduction of biofuels into an agricultural economy does have an effect on food prices, even though changes in biofuels prices do not have a strong effect towards food prices

3. Overview of Energy Scenario in Bangladesh

Sustainable energy supply is needed for Bangladesh to prosper in the upcoming decades. As a result, if energy supply is not proliferated then there will be severe adverse consequences for the nation's economic as well as social development. The government of Bangladesh (GOB) is giving best effort to develop the indigenous resources of energy. The current energy requirement is taken care of by different types of fossil fuel, natural gas, coal etc. and is dependent on imports, making the economy vulnerable to any shocks coming from the international market. Bangladesh imports about 1.3 million tons are crude oil, 1.45 million tons' diesel, 380 tons' kerosene, 215 tons jet fuel and 155,000 tons' petrol and octane. (Wakil *et al.* 2012). It is worth to mention that importing such petroleum oils is a huge fiscal burden for the government.

After the oil shock of 1973 Bangladesh wanted to decrease import bill. As a consequence, the government of Bangladesh substituted to natural gas as a front-line energy source (Amin *et al.* 2012). In 2012, Bangladesh extracted about 772 million cubic feet natural gas and the whole amount was consumed by internal markets. Natural gas was started to be used in a different vehicle.

According to Petro Bangla (2015), recent reserve estimation, current gas production and consumption rates and future demand suggest that known recoverable reserves of gas will not be able to provide the growing needs of the country. Gas reserves are estimated to last till 2031. With this prediction, it is predicted that Bangladesh is on the critical stage or threshold level. At present, Petro Bangla is giving more focus on offshore gas well explorations with newer technology.

Moreover, expansion of Bibiyana gas field is also taken into the consideration. Petroleum is primarily used in the transportation sector as well as other sectors for economic activities. In Bangladesh, about 69% of the population currently has access to electricity. The remaining 31% represents the market yet to be brought under the national grid. According to Bangladesh Power Development Board (BPDB, 2017), present generation capacity is 15379 MW. However, this amount cannot be realized to its fullest due to the forced outage, maintenance activities

and above all fuel constraints i.e. gas supply shortage. According to Chowdhury *et al.* (2014) power outage in Bangladesh results in loss of \$1 billion. In Order to increase the development process, electricity is considered as a key factor around the world (Ferguson 2000). Keeping this in mind, the government of Bangladesh has taken an initiative that by 2021 Bangladesh will have 100% electricity access. To achieve 100% electricity access just grid electricity is not enough. Government is now encouraging off-grid electricity production. Such as Solar Home Systems (SHS), micro-hydro power plants, biomass energy etc.

Diesel is used in the agricultural sector for irrigation pumps. On the other hand, kerosene is used in the rural areas for lighting. In the transportation sector, petroleum products dominate. However, the popularity of petroleum fuels is decreasing due to policies encouraging CNG as a substitute fuel. An important structural change has been seen in oil sector from the year of 2012.

Use of oil has increased in the electricity sector. The total share of oil used in electricity generation rapidly increased from 6-8% in 2011 and 19% in 2012 and after that a huge jump to 28.38% in 2015 (Bangladesh Petroleum Corporation 2015). The share of oil in electricity generation increased due to private quick rental power plants. These power plants use oil as input and as a result, oil consumption in this sector has increased. The coal sector of Bangladesh is relatively underdeveloped nonetheless substantial amounts of coal reserves in seven fields have been discovered in the north-western part of the country. Estimation says that almost 1.756 G-ton can be extracted from the located site.

Table 3.1: Consumption of Petroleum Products (In Lion Liters)

Products	2008	2009	2010	2011	2012	2013	2014
Octane	90.02	78.26	85.54	97.26	107.15	110.85	117.45
Petrol	124.82	115.38	127.25	141.49	158.71	169.71	178.67
Kerosene	405.10	342.70	376.65	397.21	358.44	314.87	289.87
Diesel	2333.6	2301.3	2568.2	3239.3	3240.4	2964.60	3242.55
Furnace Oil	289.60	164.47	194.17	544.62	883.74	1076.42	1202.50
Lube	17.29	15.02	15.92	17.95	17.52	15.90	17.82
Other	366	310	390	430	448	443.65	435.09
Total	3626	3327	3257	4868	5214	5086	5484

Source: Bangladesh Petroleum Corporation 2015

Table 3.2: Comparative data of Bangladesh Electricity Scenario

Subject	2009	2010	2011	2012	2013	2014
Installed Generation Capacity	5719	5823	7264	8716	9151	10416
Derated Generation Capacity	5166	5271	6639	8100	8537	9821
Generation (MW)	3589	3883	3962	4805	5010	5320
Highest Generation	4162	4606	4890	6066	6434	7356
Electricity Demand (peak demand)	6066	6454	6765	7518	8349	9268
Access to Electricity	47	48.5	49	53	62	69
Per Capita Electricity Generation	183.26	200.32	211.86	231.65	248.89	270.83

Source: Power Division Bangladesh 2015

At present due to lack of natural gas reserves and increase in the cost of importing petroleum fuels, considering the environmental and social cost of using coal Bangladesh is giving more focus on renewable energies. Such as solar, hydro, biomass, biofuel etc. Renewable energy generates 3.47% of total electricity demand globally. Renewable energy helps in plummeting poverty (World Bank 2013, Alam *et al.* 2011).

It is an aid to recover energy shortage and environmental degradation such as carbon emission, desertification, biodiversity depletion and climate change (Power Division 2015). At present, Bangladesh receives energy supply from both renewable and non-renewable sources. It is essential to preserve the environmental balance by increasing the use of renewable energy and lessening the dependency on non-renewable energy. The renewable energy policy passed in December 2008. According to this policy, 5 % electricity generation will be done by 2015 and 10% by 2012.

4. Ethical Issues Regarding Energy Consumption and Production

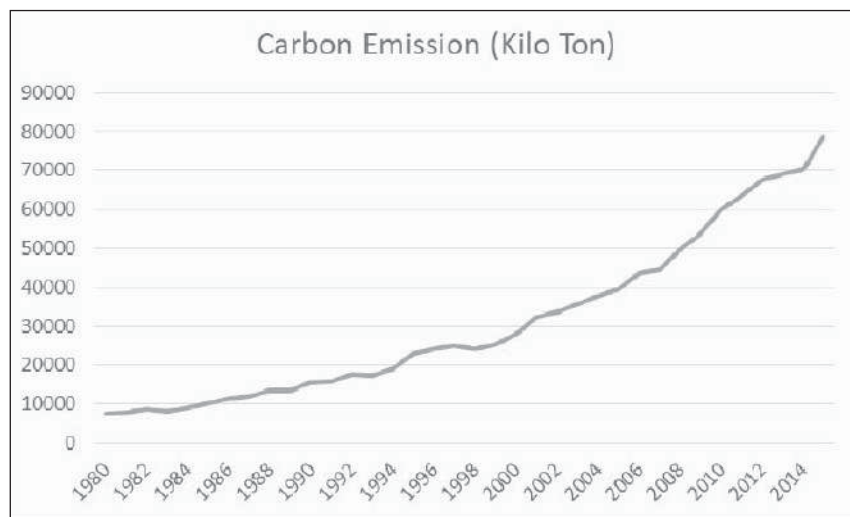
The sophistication of energy sources has increased steadily over the past century but the fundamentals have changed little. Actually, we are living in a world where people are calling energy as a part of the universal right. At the same time, an analysis of the different sources of energy (fossil fuels, nuclear and renewable

energy) demonstrates that each of them has undisputable weaknesses to which attention must be drawn.

Fossil fuels will remain the most widely used form of energy throughout the world for the next 100 years. They offer considerable advantages. The most obvious of which is ease of use as they are simple to process. We have shown in the earlier section that use of fossil fuels like diesel, petrol, octane etc. has increased in Bangladesh. The change in the consumption pattern is not neutral at all as it comes with some ethical dilemma. Fossil fuels are made of a carbon compound and when consumed or used in a production process, they release carbon dioxide and we all know CO₂ one of the responsible factor for increasing Green House Gas (GHG) Effect. Due to GHG effect, our climate is at risk.

The consequences of this are increasingly severe weather, such as storms, droughts, and floods. It also creates major impacts on human settlements, food production, disease patterns and natural ecosystems. The 1997 Kyoto Protocol, which set legally binding targets for reducing greenhouse gas emissions in industrialized countries but the result was not up to the mark. To overcome these problems, the idea is to slowly reduce the consumption of fossil fuels as well as bring efficiency in the use. Figure 4.1 shows the carbon emission in Bangladesh.

Figure 4.1: Carbon Emission (Kilo Ton per Year)



Source: World Development Indicator, WDI, 2015

On the other hand, Bangladesh is heavily depended on natural gas and extracts a huge amount of gas to fulfill the demand. As the reserve is decreasing, exploration new gas fields are in rapid speed. However, it can cause local detrimental impacts to soils, surface and groundwater's, and ecosystems. These impacts emerge mostly from the improper disposal of some of the large volumes of saline water. When gas is extracted from the gourd, due to different hydrocarbon reaction, saline water is created. Impacts of ground-surface disturbance can also arise from related activities such as site clearance, construction of roads, brine pits and pipelines, and other land modifications and drilling. Stated environmental problems directly affect the human livelihood of that particular area where extraction takes place. Different hydrocarbon chemicals affect human health badly, lands become less fertile and agricultural productivity declines. In all the structure of the society completely changes. One of the remedies can be to explore offshore gas wells. However, there is a high cost associated with it.

There is no doubt that renewable energies are far more efficient than nonrenewable engines in terms of sustainability. Unlike orthodox energy sources which require millions of years for formation, renewable energy sources (RES) are sources that continually renew throughout the human lifecycle. Nowadays, RES is a term used for electricity or heat generated from solar, hydro, wind, geothermal, biomass or biogas energy (Vezmar *et al.* 2014). The main advantages of RES are inexhaustibility and an impact on the environment. On the other hand, there are indeed some problems which stay behind the scene.

Table 4.1: Electricity Generation from Renewable Energy Sources Until 2014

Classification	Generation
Solar Home Systems (SHS)	150 MW
Solar Irrigation	1 MW
Biomass-based Electricity	<1 MW
Biogas-based Electricity	5 MW
Hydro Power	230 MW
Wind Energy	2 MW
Roof Top solar PV	14 MW
Total	403 MW

Source: Power Division 2015

At present Bangladesh is getting energy from both nonrenewable and renewable sources. Hydropower and Solar Home System are the two main sources dominates in the renewable section. From these two sources, 230MW and

150MW electricity are generated respectively (Power Division 2015). Biogas, biomass, wind energy are some other sources from which small amount of energy is extracted. First of all the solar cells are not cheap in Bangladesh. On the other hand, the cells contain hazardous materials most of which are used in cleaning semi-conductors for example hydrogen fluoride and acetone.

The intensity of these chemicals depends on the size of the PV cell. Those who work on manufacturing site, as well as installation, faces major health problem in the long run. The consumers face risk inhaling silicon dust which can be dangerous. PV cells also contain some toxic materials. If not disposed properly then these materials can generate a major environmental and public health threat in the areas where solar energy is highly used. To mitigate these problems solar panel manufacturers must follow rules and regulations set by international laws and take proper steps to ensure consumers and workers safety. Moreover, incentives should be given so that firms recycle the toxic materials and reuse in the production process.

Hydroelectric power plants are plants used for electricity production from water power. This means that it uses the conversion of potential and kinetic energy of water into electricity. Bangladesh has only one hydropower plant situated in Kapatai. Though it is a very good source of energy with almost zero carbon emission, it affects the biodiversity. It is responsible for creating a flood in the area where water is not needed and also gave rise of drought. It also changed the water course of the Kaptai river and the movement of different wild lives. One of the biggest sociopolitical problems in relation to hydropower is displacement of people from flooded areas. (Vezmar *et al.* 2014) which is absolutely unethical. In this regard, government must create a strong legal framework so that unplanned dam cannot be created anywhere. Proper rigorous research should be done to save the biodiversity as well.

Large land areas are needed to grow biomass in any of the forms which have a direct impact on the land as we know that Bangladesh is facing land constraint. Producing biofuels also need a huge amount of land for producing the feedstock. From the consumer's point of view, some ethical issues can be observed. For example, the noise of the generator and the smell of biogas and another organic compound can be very unpleasant to some people. Also if the by-products are not disposed of carefully, those can affect human health.

Another point which is worth mentioning is the disparity in access to energy between rural and urban areas. For instance, although 69% of Bangladesh is under electrification, the question is how much the rural people are getting? In the

rural areas of Bangladesh, load shedding is beyond imaginable. One of the main reasons behind the immense amount of load shedding is the use of decade-old machinery in the power substations. These machinery fail to distribute the allocated amount of electricity in the rural households. It not only affects the livelihood of the rural people but also affects the development speed. To ensure the parity of off-grid electricity is highly considered and also the government has to improve the power station machinery so that the total amount is utilized. Lastly, a decisive shift to energy mix may lead to sustainable growth and minimized harm to the society.

5. Conclusion

Ethical issues regarding energy are more noticeable in developing countries, such as Bangladesh. Like leading nations, Bangladesh must look deeper into the short and long-term effects before adopting to any new energy source. The frequent load shedding due to inadequate energy supply, pollution from transports, harmful particles from luxury items like air condition, have negatively affected the economy and the lives of people.

Moreover, the awareness of global warming has led people to reconsider the existing energy sources (i.e fossil fuel) and shift to renewable energy options to aggressively reduce emissions. On the downside, technologies linked to PV, nuclear power or first generation biofuel can also cause ethical problems to the society. Hence, there should be proper cost-benefit analysis on the short and long-term effects on the economy and community as a whole. Based on the ethical principles of utilitarianism, justice, disclosure, nonmaleficence, and autonomy, authorities need to take a sustainable approach to energy architecture to enhance risk management, transparency and open communication to the public.

Bangladesh, with the GDP growth rate of 7.24% has targeted to become a middle-income nation by 2021. Energy is closely connected to economic development and every aspect of human life. Bringing changes in human conduct and global economic system, distribution and production of energy wealth are extremely complex. In ensuring the need for energy sometimes gives birth to uncertainty and risk that lead to ethical problems. Problems persist in many cases because they are complex and connected to other questions. Thus, before addressing the questions we must need to revisit the different energy sources and their nature.

Bangladesh has set forth ambitious plans for new energy architectures. However, technological developments should be taken for advantages. By diversifying its composition of energy supplies, to meet existing and future energy demands, it

can increase its energy security as well as overcome the ethical issue. With the energy transition, co-designed policies will support the sustainability of energy policies.

Moreover, a credible commitment and motivation to this vision are critical towards creating a sustainable economic development. Furthermore, conceivable governance from government and support from private organizations would mean that the intent is in line with the vision in setting the country forward for progress. It also means that passing proper policies on to institutions that outlast government leaders. Stewarding investment to the most impactful areas will unlock and emphasize the capital required to fuel the transition.

This provides a clear and collaborative direction for all stakeholders and investors to work towards a common goal to improve the economic condition of the nation, without causing any ethical problem for the society. It is worth noting that ethics can't be in divorce from social realities, even when rationality is the preferred methodology. Getting adequate and credible data on ethics is difficult to find in Bangladesh due to difficulty in assessing it. However, this paper provides a way forward to readers to analyze the ethical complexities by using other factors. This paper can be further extended by pooling ethical issues related to the energy of other South Asian countries for better understanding the sustainable energy options and economic development.

References

- Amin, S.B., Ferdous, S.S., and Porna, A.K., 2012, 'Causal Relationship among Energy Use, CO₂ Emissions and Economic Growth in Bangladesh: An Empirical Study', *World Journal of Social Sciences*2(4), pp. 271-283.
- Alam, M.J., Begum, I.A., Buysse, J., Rahman, S., and Huylenbroeck, G.V., 2011, 'Dynamic Modeling of Causal Relationship between Energy Consumption, CO₂ Emissions and Economic Growth in India', *Renewable and Sustainable Energy Review*15, pp. hh3243-3251.
- Ahmed, B., Kamruzzaman, M., Zhu, X., Rahman, M.S., and Choi, K, 2013, 'Simulating Land Cover Changes and Their Impacts on Land Surface Temperature in Dhaka, Bangladesh', *Remote Sensing*5, pp. 5969-5998 doi:10.3390/rs5115969.
- Bangladesh Power Development Board, BPDB, Annual Report, 2011.
- Bangladesh Petroleum Corporation, BPC, Annual Report, 2015.
- Bangladesh Bureau of Statistics, BBS, Statistical Yearbook, 2015.
- Bortolini, M., Gamberi, M., Graziani, A., and Manzini, R., 2014, 'Performance and Viability Analysis on Small Wind Turbines in the European Union', *Renewable Energy* 62, 629–39. <https://doi.org/10.1016/j.renene.2013.08.004>
- Chowdhury, N.M., Uddin, S., and Saleh, S., 2014, 'Present Scenario of Renewable and Non Renewable Resources in Bangladesh: A Compact Analysis', *International Journal of Sustainable and Green Energy* 3(6), pp. 164-178.
- Dernbach, J.C., and Brown, D.A., 2010, 'The Ethical Responsibility to Reduce Energy Consumption', *HOFSTRA LAW REVIEW*37.
- Ferguson, R., Wilkinson, W., and Hill, R., 2000, 'Electricity Use and Economic Development', *Energy Policy*28, pp. 923-934.
- Gomiero, T., Paoletti, M.G., and Pimentel D., 2009, 'Biofuels: Efficiency, Ethics, and Limits to Human Appropriation of Ecosystem Services', *J Agric Environ Ethics*, DOI 10.1007/s10806-009-9218-x.
- Mahmud, W., Ahmed, S., and Sandip, M., 2009, 'Economic Reforms, Growth and Governance: The Political Economy Aspects of Bangladesh's Development Surprise', In Michael Spence and David Brady (eds.), *Growth and Leadership*, Washington DC, World Bank.
- PetroBangla Annual Report, 2015.
- Power Division Annual Report, 2015.

- Šimelytė, A., and Dudzevičiūtė, G., 2017, 'Consumption of Renewable Energy and Economic Growth', *CONTEMPORARY ISSUES IN BUSINESS, MANAGEMENT AND EDUCATION*, <https://doi.org/10.3846/cbme.2017.048>.
- Timmons, D., Harris, J.M., and Roach, B., 2014, *the Economics of Renewable Energy*, Global Development and Environment Institute, Medford, MA 02155.
- Yunus, M., Sukhdev, P., Weizsäcker, E.U.V., and Meadows, D., 2016, 'Why Energy Use Limitation Should Go Hand in Hand With Ensuring Sustainable Energy for All?' CEEweb for Biodiversity, Budapest, Hungary.
- Vezmar, S., Spajić, A., Topić, D., Šljivac, D., and Jozsa, L., 2014, *International Journal of Electrical and Computer Engineering Systems*5(2), pp. 47-55.
- Wakil, M.A., Ahmed, Z.U., Rahman, M.H., and Arifuzzan, M., 2012, 'Study on Fuel Properties of Various Vegetable Oil Available in Bangladesh and Biodiesel Production', *International Journal of Mechanical Engineering*2(5), pp. 2277-7059.
- World Bank, 2013, 'Toward a Sustainable Energy Future for All: Directions for the World Bank Groups Energy Sector', Washington DC, World Bank.