

Prospects of Renewable Energy with Respect to Energy Reserve in Bangladesh

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Abstract

Bangladesh is facing daunting challenges for electricity that will exceed domestic supply capabilities within a few years. Oil, Coal and Gas are the traditional sources of Bangladesh. It will be finished within 2100 centuries. But Bangladesh will face the problem immediately. Bangladesh basically depends on gas based electricity. Gas is the mineral sources in Bangladesh. This paper presents a comprehensive study on current energy scenario in Bangladesh and demonstrates the potential of renewable energy resources that could be integrated through national energy planning and therefore, be a step in the right direction for a sustainable development of the country. It will therefore, be necessary to tap all sources of renewable energy and to use these in an efficient converted form for benefit of the people. Primarily this will be done in remote inaccessible un-electrified area in a standalone system where grid expansion is expensive. This energy conversion will reduce pressure on the national power demand. This will not only save excessive grid expansion cost but will also keep environment friendly. Bangladesh is endowed with plentiful supply of renewable sources of energy. Out of various renewable sources solar, biomass, peat, and hydro-power can be effectively used in Bangladesh (Government of Bangladesh, 1991). Renewable energy practices in Bangladesh are: Solar Energy, Wind Energy, Biomass Energy and Hydro-power energy. The interest in renewable energy has been revived over last few years, especially after global awareness regarding the ill effects of fossil fuel burning. Energy is the source of growth and the mover for economic and social development of a nation and its people

Keywords: Prospects, Renewable Energy, Wind Energy, Biogas Energy, Solar Energy, Energy Reserve, Bangladesh.

I. Introduction

From the dawn of civilization energy is one of the most important needs to sustain and develop our daily life. There are different types of energy sources in the universe. They are of mainly natural and some of them are man-made. After all depending on energy regeneration, energy can be categorized into two main different sources which are renewable and nonrenewable sources. Renewable sources of energy are obtained from different natural sources. The sources are mainly sunlight, wind, tides, biomass and geothermal. Statistics has indicated that renewable sources of energy comprise approximate 16% of total global energy that is consumed on daily basis [1]. Nonrenewable sources of energy have continued to produce constant energy throughout the world. This is because of their high availability. Sources of nonrenewable energy can be attributed to natural sources that are not regenerated once the source is depleted. Sources include fossils fuels such as coal and petroleum products e.g. natural gas and diesels. The reservation of this fossil fuel is decreasing very sharply day by day and once it will exhaust. However, this fuel is not environmentally friendly since it emits most significant greenhouse gas CO₂ which causes the global warming due to the rising of temperature in the atmosphere and other detrimental effects results for the threats of our existence. The planet is warming, from North Pole to South Pole, and everywhere in between. Globally, the mercury is already up more than 1 degree Fahrenheit (0.8 degree Celsius), and even more in sensitive Polar Regions. And the effects of rising temperatures aren't waiting for some far-flung future. They're happening right now. Signs are appearing all over, and some of them are surprising. The heat is not only melting glaciers and sea ice; it's also shifting precipitation patterns and setting animals [21-24]. Bangladesh is situated in southern Asia and has borders with India in the west, north, and east, with Burma (also known as Myanmar) in the southeast, and with the Bay of Bengal in the south. With its population of around 160 million in a total land mass of 147,570 km², Bangladesh, an emerging nation having successfully maintaining an economic growth of 6.7%, since last decade led to a significantly high demand of electricity each year [1].

II. Methodology

II A.(i) Energy Crisis in Bangladesh:

Bangladesh has long been suffering from energy starvation with its humming population of 140 million, of which 80% live in villages. Bangladesh faces and will face in near future a crisis in energy sector. In the villages' fire wood, straws and cow dung are still the main source of energy. Natural gas discovery does not make any help to the villagers.

Extension of gasoline is out of question and LPG remains more a pious wish than a reality. Throughout the country trees are being fallen randomly by the thousands in order to burn brick which may give rise to horrible scene of deforestation and cause ecological imbalance in near future. With a view to solving the problems partially, it is time to think of renewable sources of [12-17,112].

energy as a supplement to the existing traditional resources. Nature provides us with a number of renewable sources of energy such as sunshine, wind and tidal power. Unlike fossil fuel energy from these resources can be utilized for ages. Science came forward with the idea of trapping the vast energy that the sun floods the earth everyday. A number of devices have been worked out for trapping and storing solar energy. Feasibility and utility of the renewable sources of energy should be studied with due consideration. It is required because fear of shortage in conventional energy sources. This is easily understood when we place a statistics on the energy resource availability, consumption and dependence on import of fuel [18-25]. BPDB has implemented an excellent Solar PV electrification project in the Chittagong Hill Tracts Regions of Bangladesh. The main reasons for undertaking this SPV project are [14]: The extension as well as the maintenance of the National Grid into these areas is very highly expensive, difficult and risky [26-39]. The people are enthusiastically purchasing the Solar Home Lighting Systems [40].

(ii) Energy Reserve in Bangladesh:

Natural Gas Total reserve (tcf) Recoverable reserve (tcf) Recovered Till Jan'2008 (tcf) Source : 22.935 : 13.73 : 2.885 : Petro-Bangla Resource Total Reserve Recoverable (million tons) (million tons) Coal 1753 703 Peat 600 600 Oil 1.6 1.6
Table 1.1 Sources: Statistical Yearbook of Bangladesh, 2007 [41-48,112].

1. Solar energy:

Solar energy is all sources of energy, viz; coal, petroleum, natural gas, hydraulic power, wind etc. with the exception of nuclear power derive energy from the sun. The main advantages of solar energy are that it is absolutely pollution free, inexhaustible and especially suitable for deserts and isolated places where other sources are not available. With the product of suitable low cost collector materials, solar energy can play a significant role in the future. In our country, solar PV application primarily concentrates on rural home lighting. Lack of awareness at the ground level and absence and absence of financing facilitators are the major handing factors against mass solarization in Bangladesh. Besides, govt. Bureaucracy and detrimental cost consciousness of some development agencies are also responsible [49-50,112].

Solar photovoltaic:

Solar photovoltaic (PV) systems are in use throughout the country with over 200,000 household-level installations having capacity of about 12 MW (June 2008). Scaling-up of solar PV systems assisted by the development partners are being implemented through the Rural Electrification Board (REB), Local Government Engineering Department (LGED), Bangladesh Power Development Board (BPDB) and other agencies implementing solar energy program. Renewable Energy Research Centre of the University of Dhaka has installed a model 1.1kW grid connected photovoltaic system. There is a strong potential for solar energy within the country. Solar Thermal Power/Concentrating Solar Power (CSP): The technology involves harnessing solar radiation for generation of electricity through a number of steps finally generating mechanical energy to run a generator. This technology needs to be disseminated in the country to supplement the power supply [112].

(iv) Solar Oven and Dryer

Different models of solar ovens have been designed and constructed with locally available raw materials. The institute of Food Science and Technology (IFST) has developed a cabinet dryer for drying fruits; vegetables etc. by simply spreading a transparent cover over a box [51-58]. These dryers are made of bamboo and polythene sheet [60].

(vii) Solar Water Heater

This heater is designed and constructed by IFRD. It consists of coated flat-plate which absorbs solar radiation, converts into heat and transfers the resulting heat to circulating water. This type of heater is useful for supplying low grade thermal energy at temperatures below 90°C [72-78].

II B. Wind Energy

Wind power was used for driving flower mills in many parts of the world. For many years wind power was harnessed for driving the ships that were sailing around the world. Because of the increasing fuel cost, interest has once again been generated for the improvement in the design of wind mills, especially for the areas where higher wind velocity is available for a considerable period of time [104-112]. In Bangladesh areas such as Anwara, Teknaf and Kutubdia average wind speed V is 5-6 m/sec [79-103]. Energy from wind is proportional. So, large amount of energy can be extracted from wind [17, 62-64]

II C Hydraulic energy:

The main disadvantage of a hydraulic power plant is its high initial cost and longer commissioning period. But these disadvantages are offset by the low cost of generation coupled with the control of floods and increased irrigation facilities[65-66]. For the generation of hydraulic power generally a dam is constructed at a suitable place to collect a large quantity of water during rainy season. The water so collected produces a pressure head. This is then released in a controlled manner to drive a turbine for generation of power. In Bangladesh potentials sites are at Kaptai, Sangu and

Matamuhuri. So far, hydropower generation is made at Kaptai [112-114]

II D. Alternative Technology for Biomass Energy

There are a few alternative technologies using in Bangladesh. These are improved stove, bio-gas technology etc. A short overview of these technologies is provided below more rapidly than that of Biomass fuel [67].

II E. Geothermal energy:

Geothermal energy is the natural heat of the earth. It is a renewable source of energy if the exploration process doesn't hamper the ecosystem or emit greenhouse gases[68]. There is a known hot salt water spring, known as Labanakhya, in Bangladesh at five kilometer to the north of Sitakunda (40 kilometer from Chittagong). Possibility of extracting energy from this site or any other unknown sites can be investigated by satellite remote sensing or physical surveys [112-113].

II F. Fossil:

Biomass is the most significant energy source in Bangladesh, which accounts for 65% of the total final energy consumption in Bangladesh. The main sources of biomass fuels are - (a) Trees -wood fuels, twigs, leaves, plant residues (b) Agricultural Residues - paddy husk, bran, bagasse, jute stick etc. and (c) Livestock -animal dung. A comprehensive study should be carried out to assess the biomass potential of the country for modern renewable energy applications like gasifiers. The main cities of Bangladesh are already over burdened with solid wastes from different sources. According to the World Bank study, the rural population generates only 0.15 kg per capita per day, while their urban counterparts generate 0.4 to 0.5 kg per capita per day [World Bank, 1998]. All city corporations, responsible for waste management, are unable to handle the solid waste properly. Waste-to-energy project should be given serious contemplation, which will not only provide electricity, but also reduce the overwhelming waste disposal problems of metropolitan cities of the country [69].

III. Barriers for Sustainability of Alternative Energy Technologies [70-71,114]:

Every energy resources have some sort of drawback or barriers. Similarly Alternative Energy Technologies has some barriers. Some of them are listed below:

- High initial cost
- Dependence on the weather
- Lack of awareness
- Lack of established high-volume supplier-dealer chains.
- High prices of the components.
- Lack of fund.

IV. Renewable Energy Technologies in Bangladesh:

1. Country Status:

Bangladesh is situated between 20.34 - 26.38 degrees north latitude and 88.01 - 92.41 degrees east, which is an ideal location for solar energy utilization. Daily average solar radiation varies between 4 to 6.5 kWh per square meter. Maximum amount of radiation is available on the month of April and May and minimum on December and January.

Bangladesh at a glance:

Area : 1,43,547 Sq. km.

Population : 140 million

Main occupation of the people: Agriculture

Number of district : 64

Number of Upazilla : 460

Number of Villages : 68000

Average temperature : 27 to 32 degrees

Average rainfall: 2250mm

Bangladesh is a country with one of the lowest per capita and faces formidable development problems. The economy of Bangladesh presents perplexing paradoxes. In spite of its huge manpower resource and fertile land Bangladesh is one of the underdeveloped countries in the world. Environmental degradation (especially indiscriminate cutting of trees), misuse of biomass, and drying up of water-bodies are creating constraints for the poor in the rural areas. Energy is vital for economic and social development of any country. Energy is considered to be one of the essential inputs for overall improvement. The applications of small-scale photovoltaic systems have been a very recent phenomenon in rural areas of Bangladesh. Over the years significant technological advances have been made in developing renewable energy technologies, especially in the field of solar photovoltaic and biogas energy. It is important to note that the approach of promoting photovoltaic technology in Bangladesh has been different from other countries like India, Nepal and countries in Latin America. One important difference is that Bangladesh has taken a more commercial than those

countries where number of systems installed are much higher but the programs are heavily subsidized by the government and donors.

2. Rural Energy needs:

More than 80% of total population of the country lives in rural areas. At present major portion of total energy needs is met by locally produced biomass fuels which is mostly consumed in the house hold sector for cooking, ongoing rural electrification program meets a small portion of total energy needs. For overall national development there is a need to pay special attention so that the energy needs of rural areas for subsistence and productive requirements (e.g. agriculture, industries and transport) are met on a sustainable basis. Different types of renewable energy technologies application suitable for Bangladesh are [112-113]:

3. Solar photovoltaic (SPV)

- o Solar home system (SHS)
- o Rural market electrification
- o School electrification
- o Health clinic/hospital electrification
- o Cyclone shelter electrification
- o . Micro enterprise
- o . ICT Training center electrification
- o Mobile phone charging

4. Solar thermal:

- o Hot water system for domestic use
- o Hot water system for commercial purpose
- o Dryer for preservation of vegetables, fish, fruit etc.

5. Biogas:

- o Bio gas for domestic cooking, lighting and fertilizer
- o Bio gas from poultry waste for electricity
- o Biogas gasifies

6. Hydropower:

The scope of hydropower generation is very limited in Bangladesh as the country consists of low and flat lands except some hilly regions in the north and northwestern part. The only hydro power station of the country, the Karnafuly Hydro Power Station with a generating capacity of 230 MW by 7 units, is located in Kaptai, across the river Karnafuly [112].

V. Conclusion

As Bangladesh is a populated country and 80% of people are living in villages. So, one of the fast growing renewable energies named solar home system in our country is more efficient and applicable nowadays. Most of the organizations who involved in solar energy business are working with Solar Home System. By using this solar energy technology, we can save a rich amount conventional fuel.

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References

- [1] K. A. Khan and M. M. Alam, "Performance of PKL (Pathor Kuchi Leaf) Electricity and its Uses in Bangladesh", *Int. J. SOC. Dev. Inf. Syst.* 1(1): 15-20, January 2010.
- [2] K. A. Khan, M. H. Bakshi and A. A. Mahmud, "Bryophyllum Pinnatum leaf (BPL) is an eternal source of renewable electrical energy for future world", *American Journal of Physical Chemistry* 2014;3(5):77-83, published, online, November 10, 2014 (<http://www.sciencepublishinggroup.com/j/ajpc>) doi:10.11648/j.ajpc.20140305.15, ISSN:2327-2430 (Print); ISSN: 2327-2449(Online), 2014.
- [3] K. A. Khan, "Electricity Generation form Pathor Kuchi Leaf (Bryophyllum pinnatum) ", *Int. J. Sustain. Agril. Tech.* 5(4): 146-152, July 2009.
- [4] K. A. Khan and Md. Eyashir Arafat, "Development of Portable PKL (Pathor Kuchi Leaf) Lantern", *Int. J. SOC. Dev. Inf. Syst.* 1(1): 15-20 January 2010.
- [5] K. A. Khan and Ranen Bosu, "Performance study on PKL Electricity for Using DC Fan", *Int. J. SOC. Dev. Inf. Syst.* 1(1): 27-30, January 2010
- [6] K. A. Khan and Md. Imran Hossain, "PKL Electricity for Switching on the Television and Radio", *Int. J. SOC. Dev. Inf. Syst.* 1(1): 31-36, January 2010

- [7] Shuva Paul, K. A. Khan, Kazi Ahad Islam, Baishakhi Islam and Musa Ali Reza, "Modeling of a Biomass Energy based (BPL) Generating Power Plant and its features in comparison with other generating Plants ", IPCBEE vol. 44 (2012) @ (2012) IACSIT Press, Singapore DOI: 10.7763/ IPCBEE. 2012. V44. 3
- [8] K. A. Khan, Shuva Paul, Md. Adibullah, Md. Farhat Alam, Syed Muhammad Sifat, Md. Rashed Yousufe, "Performance Analysis of BPL/PKL Electricity module ", International Journal of Scientific & Engineering Research Volume 4, Issue3, March-2013 1 ISSN 2229-5518
- [9] K. A. Khan, Shuva Paul, Asif Zobayer, Shiekh Saif Hossain, A Study on Solar Photovoltaic Conversion, International journal of Scientific and Engineering Research , Volume-4, Issue-3, March-2013, ISSN2229-5518, 2013
- [10] Tania Akter, M H Bhuiyan, Kamrul Alam Khan and M H Khan, "Impact of photo electrode thickness and annealing temperature on natural dye sensitized solar cell", Published in the journal. of Elsevier. Ms. Ref. No.: SETA-D-16-00324R2, 2017
- [11] K. A. Khan, Inventors, Electricity Generation from Pathor Kuchi Leaf (PKL), Publication date 2008/12/31, Patent number BD 1004907, 2008
- [12] K. A. Khan, Technical note "Copper oxide coatings for use in a linear solar Fresnel reflecting concentrating collector", Publication date 1999/8/1, Journal Renewable energy, Volume 17, Issue 4, Pages 603-608, Publisher – Pergamon, 1999
- [13] K. A. Khan, Shuva Paul, A analytical study on Electrochemistry for PKL (Pathor Kuchi Leaf) electricity generation system, Publication date 2013/5/21, Conference- Energytech, 2013 IEEE, Pages 1-6, Publisher, IEEE, 2013
- [14] T.A. Ruhane, M. Tauhidul Islam, Md. Saifur Rahaman, M.M.H. Bhuiyan, Jahid M.M. Islam, M.K. Newaz, K.A. Khan, Mubarak A. Khan, "Photo current enhancement of natural dye sensitized solar cell by optimizing dye extraction and its loading period" , Published in the journal of Elsevier : Optik - International Journal for Light and Electron Optics, 2017.
- [15] K .A.Khan, M S Alam, M A Mamun, M A Saime & M M Kamal, Studies on electrochemistry for Pathor Kuchi Leaf Power System, Published in the Journal of Bangladesh J. Agric. And Environ. 12(1): 37-42, June 2016
- [16] Mehedi Hasan, Lovelu Hassan, Sunjida Haque, Mizanur Rahman, Kamrul Alam Khan, A Study to Analyze the Self-Discharge Characteristics of Bryophyllum Pinnatum Leaf Fueled BPL Test Cell, Published in the Journal of IJRET, Vol-6 Iss-12, Dec-2017
- [17] J. Sultana, K.A. Khan, and M.U. Ahmed. "Electricity Generation From Pathor Kuchi Leaf (PKL) (Bryophyllum Pinnatum)." J. Asiat Soc. Bangladesh Sci., 2011, Vol. 37(4): P 167-179
- [18] M. Hasan, S. Haque and K.A. Khan, "An Experimental Study on the Coulombic Efficiency of Bryophyllum pinnatum Leaf Generated BPL Cell", IJARIE, ISSN(O)-2395-4396, Vol-2, Issue-1, 2016
- [19] Khan, Kamrul Alam, Akhlaqur Rahman, Md Siddikur Rahman, Aniqah Tahsin, Kazi Md Jubayer, and Shuva Paul. "Performance analysis of electrical parameters of PKL electricity (An experimental analysis on discharge rates, capacity & discharge time, pulse performance and cycle life & deep discharge of Pathor Kuchi Leaf (PKL) electricity cell)." In Innovative Smart Grid Technologies-Asia (ISGT-Asia), 2016 IEEE, pp. 540-544. IEEE, 2016.
- [20] Khan, Md Kamrul Alam, Shuva Paul, Md Siddikur Rahman, Ripon Kumar Kundu, Md Mahmudul Hasan, Mohammad Moniruzzaman, and Mohammad Al Mamun. "A study of performance analysis of PKL electricity generation parameters: (An experimental analysis on voltage regulation, capacity and energy efficiency of pathor kuchi leaf (PKL) electricity cell)." In Power India International Conference (PIICON), 2016 IEEE 7th, pp. 1-6. IEEE, 2016.
- [21] MM Hasan, MKA Khan, MNR Khan and MZ Islam, "Sustainable Electricity Generation at the Coastal Areas and the Islands of Bangladesh Using Biomass Resources", City University Journal, Vol. 02, Issue. 01, P. 09-13, 2016.
- [22] M Hasan and KA Khan, "Bryophyllum pinnatum Leaf Fueled Cell: An Alternate Way of Supplying Electricity at the Off-grid Areas in Bangladesh" in Proceedings of 4th International Conference on the Developments in Renewable Energy Technology [ICDRET 2016], P. 01, 2016. DOI: 10.1109/ICDRET.2016.7421522
- [23] M Hasan, KA Khan, MA Mamun, "An Estimation of the Extractable Electrical Energy from Bryophyllum pinnatum Leaf", American International Journal of Research in Science, Technology, Engineering & Mathematics (AIJRSTEM), Vol. 01, Issue. 19, P. 100-106, 2017.
- [24] K.A.Khan, Lovelu Hassan, A K M Obaydullah, S. M. Azharul Islam, M.A. Mamun, Tanjila Akter, Mehedi Hasan, Md. Shamsul Alam, M. Ibrahim, M Mizanur Rahman and M. Shahjahan , Bioelectricity: A new approach to provide the electrical power from vegetative and fruits at off-grid region, Published in the journal of Microsystem Technologies of Springer, manuscript number: 2018MITE-D-17-00623R2, Received: 14 August 2017/Accepted: 3 February 2018, Volumes-24, Issues-3, Impact Factor: 1.195, ISSN: 0946-7076 (Print) 1432-1858 (Online), Springer-Verlag GmbH Germany, Part of Springer Nature, DOI: 10.1007/s00542-018-3808-3, 2018.
- [25] M. K. A. Khan, M. S. Rahman, T. Das, M. N. Ahmed, K. N. Saha, and S. Paul, "Investigation on Parameters performance of Zn/Cu Electrodes of PKL, AVL, Tomato and Lemon juice based Electrochemical Cells: A Comparative Study," In Electrical Information and Communication Technology (EICT), 2017 3rd International Conference on, pp. 1-6. IEEE, 2017. DOI: 10.1109/EICT.2017.8275150, IEEE, Khulna, Bangladesh, Bangladesh, 7-9 Dec. 2017.
- [26] Md. Afzol Hossain, Md. Kamrul Alam Khan, Md. Emran Quayum, "Performance development of bio-voltaic cell from arum leaf extract electrolytes using zn/cu electrodes and investigation of their electrochemical performance", International Journal of Advances in Science Engineering and Technology, ISSN: 2321-9009, Vol-5, Iss-4, Spl. Issue-1, Nov-2017

- [27] K.A. Khan , M. A. Wadud , A K M Obaydullah and M.A. Mamun, PKL (*Bryophyllum Pinnatum*) electricity for practical utilization, IJARIE-ISSN(O)-2395-4396, Vol-4, Issue-1, Page: 957-966
- [28] K. A. Khan, A. Rahman, M. S. Rahman, A. Tahsin, K. M. Jubyer, and S. Paul, "Performance analysis of electrical parameters of PKL electricity (An experimental analysis on discharge rates, capacity & discharge time, pulse performance and cycle life & deep discharge of *Pathorkuchi Leaf* (PKL) electricity cell)," In *Innovative Smart Grid Technologies-Asia (ISGT-Asia)*, 2016 IEEE, pp. 540-544. IEEE, 2016.
- [29] M. K. A. Khan, S. Paul, M. S. Rahman, R. K. Kundu, M. M. Hasan, M. Moniruzzaman, and M. A. Mamun, "A study of performance analysis of PKL electricity generation parameters:(An experimental analysis on voltage regulation, capacity and energy efficiency of *pathorkuchi leaf* (PKL) electricity cell)," In *Power India International Conference (PIICON)*, 2016 IEEE 7th, pp. 1-6. IEEE, 2016.
- [30] M. K. A. Khan, M. S. Rahman, T. Das, M. N. Ahmed, K. N. Saha, and S. Paul, "Investigation on Parameters performance of Zn/Cu Electrodes of PKL, AVL, Tomato and Lemon juice based Electrochemical Cells: A Comparative Study," In *Electrical Information and Communication Technology (EICT)*, 2015 3rd International Conference on, pp. 1-6. IEEE, 2017.
- [31] M.M. Haque, A.K.M.A. Ullah, M.N.L Khan, A.K.M.F. F. Kibria and K.A.Khan, "Phyto-synthesis of MnO₂ Nanoparticles for generating electricity," In the International conference on Physics-2018, Venue-Department of Physics, University of Dhaka, Dhaka-1000, Bangladesh, Organizer-Bangladesh Physical Society(BPS, 08-10 March, 2018.
- [32] Lovelu Hasan, Mehedi Hasan, Kamrul Alam Khan and S.M. Azharul Islam, "SEM Analysis of Electrodes and measurement of ionic pressure by AAS data to identify and compare the characteristics between different bio-fuel based electrochemical cell, " In the International conference on Physics-2018, Venue-Department of Physics, University of Dhaka, Dhaka-1000, Bangladesh, Organizer-Bangladesh Physical Society(BPS, 08-10 March, 2018.
- [33] Mehedi Hasan and Kamrul Alam Khan, "Identification of BPL Cell Parameters to Optimize the Output Performance for the Off-grid Electricity Production, " In the International conference on Physics-2018, Venue-Department of Physics, University of Dhaka, Dhaka-1000, Bangladesh, Organizer-Bangladesh Physical Society(BPS, 08-10 March, 2018.
- [34] K.A.Khan, M.S. Bhuyan, M.A. Mamun, M. Ibrahim, Lovelu Hassan and M A Wadud, "Organic electricity from Zn/Cu-PKL electrochemical cell ", Published in the Souvenir of First International Conference of Contemporary Advances in Innovative & Information Technology (ICCAIAIT) 2018, organized by KEI, In collaboration with Computer Society of India (CSI), Division-IV (Communication). The proceedings consented to be published in AISC Series of Springer, 2018
- [35] M.K.A.Khan , A K M Obaydullah, M.A. Wadud and M Afzol Hossain, "Bi-Product from Bioelectricity", IJARIE-ISSN(O)-2395-4396, Volume-4, Issue-2, Page-3136-3142 , 2018
- [36] M.K.A.Khan and A K M Obaydullah , "Construction and Commercial Use of PKL Cell", IJARIE-ISSN(O)-2395-4396, Volume-4, Issue-2, Page-3563-3570, 2018
- [37] Md. Kamrul Alam Khan, "Studies on Electricity Generation from Stone Chips Plant (*Bryophyllum pinnatum*)", *International J. Eng. Tech* 5(4): 393-397, December 2008
- [38] Mr. K. Alam Khan, "Copper Oxide Coating for use in Linear Solar Fresnel Reflecting Concentrating Collector", Published in the journal. of Elsevier, *Renewable Energy*, An International Journal, WREN (World Renewable Energy Network), UK, RE: 12.97/859, 1998
- [39] K.A.Khan, M Afzol Hossain, A K M Obaydullah and M.A. Wadud, "PKL Electrochemical Cell and the Peukert's Law ", Vol-4 Issue-2, 2018 IJARIE-ISSN(O)-2395-4396, Page: 4219 – 4227
- [40] K.A.Khan, M.A.Wadud, M Afzol Hossain and A.K.M. Obaydullah, "Electrical Performance of PKL (*Pathorkuchi Leaf*) Power", Published in the IJARIE-ISSN(O)-2395-4396, Volume-4, Issue-2, Page-3470-3478 , 2018.
- [41] K.A.Khan, M Hazrat Ali, M. A. Mamun, M. Mahbulul Haque, A.K.M. Atique Ullah, Dr. Mohammed Nazrul Islam Khan, Lovelu Hassan, A K M Obaydullah, M A Wadud, "Bioelectrical Characteristics of Zn/Cu- PKL Cell and Production of Nanoparticles (NPs) for Practical Utilization" , 5th International conference on 'Microelectronics, Circuits and Systems', Micro2018, 19th and 20th May, 2018, Venue: Bhubaneswar, Odisha, India, Organizer: Applied Computer Technology, Kolkata, West Bengal, India, Page: 59-66, www.actsoft.org, ISBN: 81-85824-46-1, In Association with: International Association of Science, Technology and Management, 2018
- [42] M.M. Hassan, M. Arif and K. A. Khan, "Modification of Germination and growth patterns of *Basella alba* seed by low pressure plasma", Accepted in the " *Journal of Modern Physics*", Paper ID: 7503531
- References-2
- [43] Kamrul Alam Khan, "Copper Oxide Coating for use in Linear Solar Fresnel Reflecting Concentrating Collector ", *Renewable Energy*, An International Journal, Elsevier, WREN (World Renewable Energy Network), UK, RE: 12.97/859, 1998
- [44] S. J. Hassan & K. A. Khan, "Determination of Optimum Tilt angles of Photovoltaic panels in Dhaka, Bangladesh." *International J. Eng. Trach* 4 (3): 139-142, December 2007. Webiste : www. Gscience. Net , 2007
- [45] S.J.Hassan & K. A. Khan, "Design, Fabrication and performance study of Bucket type solar candle machine", *International J. Eng. Trach* 4 (3), December 2007. Webiste : www. Gscience. Net, 2007
- [46] M. A. Hamid Khan & Dr. Md. Kamrul Alam Khan, "Nuclear science and Applications. Vol. 14, No. 11 June 2005", *Nuclear science and Applications*. Vol. 14, No. 11 June 2005

- [47] Kamrul Alam Khan, "Prospect of Solar Energy for Food Supply in Bangladesh", Bangladesh Journal of Scientific and Industrial Research BJSIR, 37 (1-4), January-December, 2002
- [48] B.K.Sen, K.A. Khan, M.A. Hamid Khan, M.A. Awal, "Studies on Optical & thermal properties of black copper solar selective coating on copper substance", Jahang. Phys. Stud. Vol. 9, 2001, Department of Physics, Jahangirnagar University, Savar, Dhaka, Bangladesh, 2001
- [49] M.N. Ahsan, B.K. Sen, K.A. Khan & M.A. Hamid Khan, "Performance of a Low Cost Built-in-storage Solar Water Heater", Nuclear Science and Applications vol. 8 No. 1-2, Dec 1999
- [50] A.J. Khan, Kamrul Alam Khan, Z.H. Mahmood & M.Hossain, "Performance of an Intermittently Tracked Linear Solar Fresnel Reflecting Concentrator", The Dhaka University studies, part B (science) vol. 39 No. 2 July, 1991
- [51] K.A. Khan, A.J. Khan & K.S. Rabbani, "Design & performance studies of a Linear Fresnel Reflecting Solar Concentrator-Receiver System", Bangladesh J.Sci. Res. 16 (2): 143-146, 1998
- [52] Md. Kamrul Alam Khan, "Studies on Electricity Generation from Stone Chips Plant (*Bryophyllum pinnatum*)", International J.Eng. Tech 5(4): 393-397, December 2008
- [53] Saiful Islam, K.A. Khan, A.K. Sadrul Islam & M. Junab Ali, "Design, Fabrication & performance study of a Paraboloidal Solar Medical Sterilizer", Bangladesh J.Sci. Res. 18(2): 211-216, 2000 (December)
- [54] Md. Kamrul Alam Khan, Solar Selective Coating for use in Solar Concentrating Collector, Bangladesh J. Sci. Res. 16(2): 249-252, 1998 (December)
- [55] Md. Kamrul Alam Khan, The performance of a Fresnel Reflecting Concentrating Collector with Auxiliary Heating, Bangladesh J. Sci. Ind. Res. 34(2), 1999
- [56] Md. Kamrul Alam Khan, Production of Candles by Solar System in Bangladesh, Nuclear Science & Applications: vol. 7 No. 1,2: December 1998
- [57] Md. Kamrul Alam Khan, Field Testing of a Fresnel Reflecting Solar Concentrator, Nuclear Science & Applications: vol. 6 No. 1,2: December 1997
- [58] Md. Kamrul Alam Khan, A.J. Khan & K.S. Rabbani, Solar Thermal Steam Production & Distillation Device by Fresnel Reflecting Concentrator – Receiver System, Bangladesh J. Sci. Res. 16(2): 221-228, 1998 (December)
- [59] Md. Shahidul Islam and Md. Kamrul Alam Khan, Performance Studies on Single Crystal Solar PV Modules for Practical Utilisation in Bangladesh, International J.Eng. Tech 5(3): 348-352, September 2008
- [60] Md. Kamrul Alam Khan, Studies on Fill Factor(FF) of Single Crystal Solar PV Modules For Use In Bangladesh, International J.Eng. Tech 5(3): 328-334, September 2008
- [61] Md. Kamrul Alam Khan, Performance Studies of Monocrystalline PV module considering the shadow effect, International J.Eng. Tech 5(3): 342-347, June 2008
- [62] Md. Shahidul Islam and Md. Kamrul Alam Khan, Study the Deterioration of a Monocrystal Solar silicon PV module Under Bangladesh Climate, International J.Eng. Tech 5(2):263-268, June 2008
- [63] Sheikh Jafrul Hassan and Md. Kamrul Alam Khan, Design, Fabrication And Performance Study of a Single phase Inverter for use in Solar PV system, International J.Eng. Tech 5(1):212-216, March, 2008
- Md. Kamrul Alam Khan, Soap Production Using Solar Power, International J. Eng. Tech 6(1):414-419, March 2009
Website :www.gscience.net
- [64] Md. Kamrul Alam Khan, Wave and Tidal Power Generation: An Overview, International J. Eng. Tech 6(1):420-423, March 2009 Website :www.gscience.net
- [43] Md. Kamrul Alam Khan, Materials Used in Electricity Generation by Solar Thermal System, International J. Eng. Tech 6(1):515-520, June 2009 Website :www.gscience.net
- [65] Md. Kamrul Alam Khan, Comparative Study on Single Crystal and Polycrystalline solar pv modules for use in Bangladesh climate, International J. Eng. Tech 6(1):527-529, June 2009 Website :www.gscience.net
- [43] Md. Kamrul Alam Khan, Solar Thermal Studies Of Open Sun Drying (OSD) of various Crops Under Bangladesh Climatic Condition, Int. J. Sustain. Agril. Tech. 5(7): 85-94, October 2009
- [66] Md. Kamrul Alam Khan, An Investigation on Various Solar Cells Under the Climatic Condition of Bangladesh, International J. Eng. Tech. 6(3): 547-551, September 2009
- [67] Md. Kamrul Alam Khan and M. Saiful Islam, Studies on Performance of Solar Photovoltaic System Under the Climate Condition of Bangladesh, Int. J. SOC. Dev. Inf. Syst. 1(1): 37-43, January 2010
- [68] Md. Kamrul Alam Khan, Application of Solar Thermal Technology for Various Developing Countries, International J. Eng. Tech. Vol 6, Issue 6, July 2009
- [69] S. M. Saifuddin & Md. Kamrul Alam Khan, Performance Study of Hybrid SPV, ST and BPL/PKL electricity Generation and storage for Practical Utilization in Bangladesh, International J. Eng. Tech : ISSN 1812 – 7711, V – 7, Issue 2, 2010
- [70] S. M. Saifuddin & Md. Kamrul Alam Khan, Survey of Hybrid Solar Photovoltaic (SPV) and Solar Thermal (ST) Collectors in Bangladesh, International J. Eng. Tech : ISSN 1812 – 7711, V – 7, Issue 3, 2010
- [71] S. M. Saifuddin & Md. Kamrul Alam Khan, Performance Study of Solar Photovoltaic and Solar Thermal Hybrid System Utilized in India, International J. Soc. Dev. Inf. Syst. 1 (4) : 10 – 16, July, 2010
- [72] Jesmin Sultana, K.A. Khan and Mesbah Uddin Ahmed, Present situation of Solar Photovoltaic System in different countries, ASA University Review, Vol-4, Issue-2, December-2010, ISSN:1997-6925

- [73] Ashique Al Rahman and Prof. Dr. Md. Kamrul Alam Khan, The Present situation of the Wave energy in some different countries of the world, IJCIT, ISSN 2078 5828(print),ISSN 2218-5224(online),Volume 02. Issue 01, Manuscript code:110754
- [74] Hasnat A,Ahmed P,Rahman M and Khan K A, Numerical Analysis for Thermal Design of a Paraboloidal Solar Concentrating Collector, International Journal of Natural Sciences(2011),1(3) 68-74
- [75] Prof. Dr. Md. Kamrul Alam Khan & Abul Hasnat Rubel, Simulated Energy Scenarios of the Power Sector in Bangladesh, ASA University Review, Vol-5, No.2, Page: 101-110, July-December,2011. ISSN:1997-6925
- [76] Jesmin Sultana,Md.Kamrul Alam Khan and Mesbah Uddin Ahmed, Electricity Generation from Pathor Kuchi Leaf(Bryophyllum Pinnatum), J.Asiat.Soc.Bangladesh.Sci.,37(2):167-179, December 2011.
- [77]Mamun-Ar Rashid, Rashed-Al-Mamun,Jesmin Sultana,Hasnat A,Rahman M and Khan K A, Evaluating the Solar Radiation System under the Climatic Condition of Bangladesh and Computing the Angstrom Coefficients, International Journal of Natural Sciences (2012),2(1):38- 42. Received: November 2011, Accepted: March 28, 2012.
- [78] Jesmin Sultana, K.A. Khan and Mesbah Uddin Ahmed, The Present Situation of Solar Thermal Energy in the World, ASA University Review, Vol-4, Issue-2, December-2012,ISSN:1997-6925
- [79] Md. Kamrul Alam Khan, Md.Abdus Shatter,Shuva Paul,Shaniat Rahman Zishan,Md.Rashed Yousufe, A Study on Tidal Power Conversion for Use in Bangladesh, International Journal of Scientific Engineering Research, Volume 3, Issue 12,December-12, ISSN 2229-5518
- [80] M.S.A. Bhuiyan, K.A. Khan And M.A. Javed, A Computerized study on the metrological parameter conversions for rural agribusiness development, Journal of Innovation & Development Strategy (JIDS)(J. Innov. Dev. Strategy)J. Innov. Dev. Strategy 6(2):94-98(December 2012)
- [81]Md. Kamrul Alam Khan,Shuva Paul,Asif Zobayer,Shiekh Saif Hossain, A Study on Solar Photovoltaic Conversion, International journal of Scientific and Engineering Research ,Volume-4,Issue-3,March-2013,ISSN2229-5518 (IMPACT FACTOR: 1.4)
- [82] Md. Kamrul Alam Khan,Shuva Paul,Asif Zobayer,Shiekh Saif Hossain, A Study on Solar Thermal Conversion, International journal of Scientific and Engineering Research ,Volume-4,Issue-3,March-2013,ISSN2229-5518 (IMPACT FACTOR: 1.4)
- [83] M.S.A. Bhuiyan and K. A. Khan, Software Development Studies on the Metrological Conversions for Local Agri-Business Units of Area and Volume Weight Measures, Journal of Innovation & Development Strategy (JIDS), Canada, Volume:7 ,Issue: 1, April 2013. ISSN 1997-2571
- [84] M.N. Ahsan, S. Kumar, M. K. A.Khan, M. N. Khanam, R. Khatun, S. Akter., M.A.R.Aheikh, M.M. Islam, M. S.Islam, S.Saha and M. M. Alam, Study of Spatial Resolution of a Positron Emission Tomography(PET) System, Jagannath University Journal of Science, Volume: 2, Issue: 1, September 2013, ISSN 2224 – 1698.
- [85] Shuva Paul, Kamrul Khan and Ripon Kumar Kundu, Design, Fabrication and Performance Analysis of Solar Inverter, Published in the Proceedings of IEEE, ENERGYTECH 2013, USA, [Participated and Presented in the “EnergyTech2013Conference sponsored by the Institute of Electrical and Electronic Engineers(IEEE) at Case Western Reserve University in Cleveland, Ohio, USA, 21 may-23 May ,2013, USA.]
- [86] Shuva Paul, Kamrul Alam Khan and Ripon Kumar Kundu, Performance Studies of Mono-Crystal Silicon Solar Photovoltaic module with booster reflector under Bangladeshi Climatic condition, Published in the Proceedings of IEEE, ENERGYTECH 2013, USA.[Participated and Presented in the “EnergyTech2013Conference sponsored by the Institute of Electrical and Electronic Engineers(IEEE) at Case Western Reserve University in Cleveland, Ohio, USA, 21 may-23 May ,2013, USA.]
- [87] Ashique-Al-Rahman and Kamrul Alam Khan, Feasibility Studies on WEC (Wave Energy Converter) for use in Coastal Belt at Cox’s Bazar of Bangladesh under the Climate Condition of the Bay of Bengal, International Journal of Engineering and Innovative Technology,3660 East Bay Drive, Apartment no.116 Largo, Florida US,33771 (IMPACT FACTOR:1.895) (ISO 9001:2008 Certified)
- [88] K.A.Khan, A.Latif, S.Alam,Jesmin Sultana and Hazrat Ali, A Study on Internal Resistance of the Pathor Kuchi Leaf (PKL) Cell, Published in the journal of Agriculture and Environment. Vol.10,No. 1,June 2014,Page: 24-28.
- [89] M. N. Ahasan,D.A.Quadir,K.A.Khan and M. S. Haque, Simulation of a thunderstorm event over Bangladesh using wrf-arw model, Journal of Mechanical Engineering, Vol. ME 44, No. 2,December 2014 Transaction of the Mechanical Engineering Division, The Institute of Engineers, Bangladesh.
- [90] M. Kabir Uddin, M. Kamrul Alam Khan, M Abdus Sobhan, Farruk Ahmed, and M. Noor Nabi, On the Implications of Dynamic Wireless Spectrum Management Canons Issues in Uncertainty Use of Cognitive Radio, Published in the journal of the Bangladesh Electronics Society Journal (BESJ), Vol. 15,(1-2),17-24, 2015
- [91] M. Kabir Uddin, M. Kamrul Alam Khan, Farruk Ahmed, and M. Noor Nabi, A Concept of Potential Radio Spectrum Administration Seeking Easy Access Spectrum (EAS) Paradigm Figured on Signal to Interference Noise Ratio (SINR) and Interference Thresholds, Published in the journal of the Bangladesh Journal of Scientific and Industrial Research, 2015 (in Review)
- [92] M. Kabir Uddin, M. Kamrul Alam Khan, M Abdus Sobhan, Farruk Ahmed, and M. Noor Nabi, Dispensation of Commons Radio Spectrum Management Framework Issues in Implementation: Challenges and Opportunities, Published in the Journal of Electronic Engineering, 2015 (in Review)

- [93] M. Kabir Uddin, M. Kamrul Alam Khan, M Abdus Sobhan, Farruk Ahmed, and M. Noor Nabi, Dispensation of Commons Radio Spectrum Management Using Conceptual Benefit and Cost Analysis Framework Issues in Bangladesh, Published in the journal of the Chittagong University Journal of Science, 2015 (in Press)
- [94] M. Shamsuzzama, S.Sikder, T. Siddiqua, M.S. Rahman, M.M.H. Bhuiyan, K.A. Khan, and D.Paul, Standardization of Gamma Radiation Field for Characterizing Radiation Detecting Instrument at SSDL facilities in Bangladesh, Published in the journal of the Bangladesh Journal of Physics (BJP), Vol. 18, 65-72, December 2015, ISSN No.: 1816-1081, BPS
- [95] MU Kabir, MA Sobhan, M KA Khan, MA Rouf Khan, Broad Network Wide Statistics of TCP Indicator Measurements to Reassume the Status of the Wireless 3G Network Monitoring, Published in the journal of the Journal of the University of Information Technology and Sciences (UITS) Journal. Volume:4 ,Issue: 2, ISSN: 2226-3128
- [96] R.N. Sruti, M. M. Islam, M.M.Rana, M.M.H. Bhuiyan, K.A.Khan,M.K.Newaz and M.S. Ahmed, Measurement of Percentage Depth of a Linear Accelerator for 6 MV and 10 MV Photon Energies, Published in the journal of Nuclear Science and Applications, AEC, Dhaka, Bangladesh, Vol. 24, No. 1 & 2, Page No. 29-32 , 2105
- [97] M. Kabir Uddin, M., M Abdus Sobhan, Farruk Ahmed,M Kamrul Alam Khan and M. Noor Nabi, A potential Electrical and Electronic Debris Management Model and Ecological Impact and Awareness Issues in Bangladesh, Journal of the National University Journal of Science. Vol. 2, No. 1, January-June 2015, ISSN: 1994-7763
- [98] Md. Mehedi Hasan, Md. Kamrul Alam Khan, Md.Nasfiqur Rahman and Md.Ziaul Islam, Sustainable Electricity Generation at the coastal areas and the Islands of Bangladesh Using Biomass Resource Published in the City University Journal, Vol-2, No.-1, March-2016, PP 09-13,2016
- [99] M. U. Kabir, Prof. Dr. Farruk Ahmed, Dr. M A Sobhan And Kamrul Alam Khan, Dispensation of Commons Radio Spectrum Management Framework Issues in Implementation: Challenges and Opportunities, Published in the journal of the Bangladesh Electronic Society (BES), (ISSN: 1816-1510) Vol. 16 Number 1-2, June-December 2016 issue
- [100] K.A. Khan, M S Alam, M A Mamun, M A Saime & M M Kamal, Studies on electrochemistry for Pathor Kuchi Leaf Power System, Published in the Journal of Bangladesh J. Agric. And Environ. 12(1): 37-42, June 2016
- [101] Tania Akter, M H Bhuiyan, Kamrul Alam Khan and M H Khan, "Impact of photoelectrode thickness and annealing temperature on natural dye sensitized solar cell", Published in the journal. of Elsevier. Ms. Ref. No.: SETA-D-16-00324R2
- [102] Md. Kamrul Alam Khan, Performance of electricity generation from Bryophyllum Leaf for Practical Utilization, Abstract published and Presented in the APS April meeting, January 28-31,2017, Session T1(Page No.: 201), Washington DC, USA. Bulletin of the American Physical Society, VOL 62, No. 1
- [103] T.A. Ruhane, M. Tauhidul Islam, Md. Saifur, Rahaman, M.M.H. Bhuiyan, Jahid M.M. Islam, M.K. Newaz, K.A. Khan, Mubarak A. Khan, Photo current enhancement of natural dye sensitized solar cell by optimizing dye extraction and its loading period, Published in the journal of Elsevier : Optik - International Journal for Light and Electron Optics, Available online 6 September 2017, In Press, Accepted Manuscript — Note to users
- [104] K.A.Khan, M.A.Wadud, M Afzol Hossain and A.K.M. Obaydullah, Electrical Performance of PKL (Pathor Kuchi Leaf)Power, Published in the IJARIE-ISSN(O)-2395-4396, Volume-4, Issue-2, Page-3470-3478 ,2018
- [105] K.A.Khan, M Afzol Hossain, A K M Obaydullah and M.A. Wadud, PKL Electrochemical Cell and the Peukert's Law , Published in the IJARIE-ISSN(O)-2395-4396,Volume-4, Issue-2, Page:4219-4227,,2018
- [106] K.A.Khan, M Hazrat Ali, M. A. Mamun, M. Mahbulul Haque, A.K.M. Atique Ullah, Dr. Mohammed Nazrul Islam Khan, Lovelu Hassan, A K M Obaydullah, M A Wadud, 5th International conference on 'Microelectronics, Circuits and Systems', Micro2018, 19th and 20th May,2018,Venue: Bhubaneswar, Odisha, India, Organizer: Applied Computer Technology, Kolkata, West Bengal, India, Page: 59-66, www.actsoft.org, ISBN: 81-85824-46-1, In Association with: International Association of Science,Technology and Management, 2018
- [107] K.A.Khan, S.M.Maniruzzaman Manir, Md. Shafiqul Islam, Sifat Jahan, Lovelu Hassan, and M Hazrat Ali, Studies on Nonconventional Energy Sources for Electricity Generation, Internation Journal Of Advance Research And Innovative Ideas In Education Volume 4 Issue 4 2018 Page 229-244
- [108]K.A.Khan, Mahmudul Hasan, Mohammad Ashraful Islam, Mohammad Abdul Alim, Ummay Asma, Lovelu Hassan, and M Hazrat Ali, A Study on Conventional Energy Sources for Power Production, International Journal Of Advance Research And Innovative Ideas In Education Volume 4 Issue 4 2018 Page 229-244
- [109] Md. Kamrul Alam Khan ; Md. Siddikur Rahman ; Tanmoy Das ;Muhammad Najebul Ahmed ; Kaushik Nandan Saha ; Shuva Paul, Investigation on parameters performance of Zn/Cu electrodes of PKL, AVL, Tomato and Lemon juice based electrochemical cells: A comparative study, Publication Year: 2017, Page(s):1-6, Published in: 2017 3rd International Conference on Electrical Information and Communication Technology (EICT), Date of Conference: 7-9 Dec. 2017, Date Added to IEEE Xplore: 01 February 2018,ISBN Information:INSPEC Accession Number: 17542905, DOI: 10.1109/EICT.2017.8275150,Publisher: IEEE, Conference Location: Khulna, Bangladesh
- [110] Bapy Guha, Fakhrul Islam and K. A. Khan, Studies on Redox Equilibrium and Electrode Potentials, IJARIE-ISSN(O)-2395-4396, Volume-4, Issue-4, Page-1092-1102 , 2018
- [111] Fakhrul Islam, Bapy Guha and K. A. Khan, Studies on pH of the PKL Extract during Electricity Generation for day and night time collected Pathor Kuchi Leaf , IJARIE-ISSN(O)-2395-4396, Volume-4, Issue-4, Page-1103 -1113, 2018
- [112] Somiron Mistry, Prospect Of Solar Energy Use In Bangladesh, A Project Submitted to the Department of Mechanical Engineering in Partial Fulfillment of the Requirements for the Degree of Master Of Engineering In

Mechanical Engineering, Department OF Mechanical Engineering Bangladesh University of Engineering & Technology Dhaka, Bangladesh, 2009.

[113] Mehedi Hasan and K.A.Khan, Dynamic Model of Bryophyllum pinnatum Leaf Fueled BPL Cell: A Possible Alternate Source of Electricity at the Off-grid Region in Bangladesh, Accepted in the Microsystem Technologies, Springer, manuscript number, MITE-D-18-00800R1, 2018

[114] K.A.Khan, M.S.Bhuyan, M. A. Mamun, M. Ibrahim, Lovelu Hassan and M A Wadud, Organic Electricity from Zn/Cu-PKL Electrochemical Cell, Accepted in the Springer Nature, Series Title: Advs in Intelligent Syst., Computing, Volume Number:812, Book Title: Contemporary Advances in Innovative and Applicable Information Technology, Book Subtitle: Proceedings of ICCAIAIT 2018 , ISBN:978-981-13-1539-8, 2018

