

Present Situation of Renewable Energy in Bangladesh: Renewable Energy Resources Existing in Bangladesh

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Abstract

Bangladesh is a developing country, it has probability to progress towards increasing the demand of energy. Now a day, Bangladesh is facing energy crisis. In Bangladesh, around 70

Index terms— renewable energy, solar energy, biogas energy, wind energy, hydro-power energy, geo-thermal energy, tidal energy, bangladesh, ocean wave energy, radia

1 Introduction

Bangladesh is a developing and a probabilities country. In Bangladesh, there are many natural resources such as coal, gas, petrol. The main source of energy in Bangladesh is Natural gas (24%) which is likely to be depleted by the year 2020 [1]. Then Bangladeshis people will be faced some problem. In these case renewable energy helps the people of Bangladesh. People have a large unsatisfied demand of energy, which is growing by 10% yearly [1]. Bangladesh has a vast potential for renewable energy and the natural availability of alternative energy creates opportunities of Growth in power sector. Not only the technologies should be developed to produce energy in an environment friendly manner but also enough importanceshould be given to conserve the energy in most efficient form. The government has issued its vision and policy statement in February 2000, to bring the entire country under electricity service by the year 2020 [2]. Recently it has the lowest per capita consumption of commercial energy in south Asia.

Presently total generation capacity is 6727 MW. In this capacity 3534 MW is from the public sector which is 53% and 47% respectively of the total generation capacity. To meet the cumulative demand of electricity coal, gas, diesels, are being used to produce electricity. But it is also insufficient. In order to lessen the pressure of power demand on our conventional power plant, renewable energy like wind and solar power can be used [3]. The potential non-exhaustive source of energies, available in the form solar, biogas, hydropower and wind can be harnessed to provide an environmentally sustainable energy security, as well as an affordable power supply to the off-grid rural areas of the country. To this end, effective utilization of renewable energy resources has been adopted as a policy of the Government of Bangladesh. [4]. Different government and nongovernment organizations working separately or jointly to disseminate renewable energy technologies (RET) throughout the reported in the recent literature [5,6] however, prospective planning and comprehensive understanding of this dynamic field requires as well as regressions, in this sector should be continually scrutinized. Motivated by these objectives, we present in this paper a present scenario of the renewable energy related activities in Bangladesh. Based on fieldwork, covering discussions with key figures of the public and private sector, and exhaustive literature review, we demonstrate here the advancement in this field with respect to physical progress, research activities and infrastructural development. Also a comparison of these forms of renewable energy resources in Bangladesh has been drawn on the basis of the output power calculation of each sector.

2 II.

Bangladesh is a subtropical country, 70% of year sunlight is dropped in Bangladesh. For this reason, we can use solar panels to produce electricity largely. Solar radiation varies from season to season in Bangladesh. Bangladesh receives an average daily solar radiation of 4-6.5 kWh/m². Maximum amount and minimum on November-

44 December-January in the following figure1 [7]. Pabna-6600, Bangladesh. E-mails : saydurpstueee@gmail.com,
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46 3 SOLAR ENERGY IN BANGLADESH

47 Energy can be a great source for solving the power crisis in Bangladesh. Bangladesh is situated between 20.30
48 and 26.38 degrees north latitude and 88.04 and 92.44 degrees east which is an ideal location for solar energy
49 utilization.

50 Fig. ?? : Monthly average solar radiation profile in Bangladesh At this position, the highest and the lowest
51 intensity of direct radiation in W/m^2 are also shown in the following figure2 [8]. So Bangladesh is in a
52 perfect location. In fact, the Bangladesh government has recently taken many steps to encourage people to
53 use photovoltaic energy. Almost every newly built apartment buildings are now using solar panels along with the
54 grid connection to get support during the load shedding period. Even in the rural areas, some NGO's have been
55 working to provide solar panels to the villagers at a cheap price. . Shows that the approximate division wise
56 SHSs installation. The figure3.illuminates that the distribution of the SHSs is highest in Dhaka district whereas
57 lowest in the Sylhet. Now solar power can be calculated from the following equation: Solar power, $P_{solar} =$
58 $(Area\ per\ sq-ft \times watts\ per\ sq-ft)$. Wind power is the conversion of wind energy by wind turbines into a useful
59 form, such as electricity or mechanical energy. The power is directly proportional to the velocity of the wind.
60 Large scale wind farms are connected to the local power transmission network with small turbines used to provide
61 electricity to isolated areas. Bangladesh is in the midst of a severe energy and power supply crisis, one of the
62 worst in South Asia. Bangladesh has a 724km long coastline and many small islands in the Bay of Bengal, where
63 strong southwesterly trade wind and sea-breeze blow in the summer months and there is a gentle northeasterly
64 trade wind and land breeze in winter months [11]. Along the coastal area of Bangladesh, the annual average wind
65 speed at 30m height is more than 5 m/s [10]. Wind speed in northeastern parts in Bangladesh is above 4.5 m/s
66 while for the other parts of the country wind speed is around 3.5 m/s [10,12]. Some measurements were made by
67 F. Rahman in some coastal areas followed by a year's measurement in Patenga (Chittagong) at a height of 20 m
68 in 1995. It was found that wind speed is higher than the values obtained by the meteorological department. This
69 led to a year-long systematic wind speed study at seven coastal sites in 1996-1997 at a height of 25 m. speed, till
70 to date, at the Muhuri Dam areas is found to be as 6.50 m/s and the wind power density varies from 100 to 250
71 Watt/m² in the coastal regions of Bangladesh. For the financial viability of the grid connected wind turbines,
72 the required annual average wind speed is 6 m/s. So, the wind speeds aren't charging for the grid connected
73 wind energy projects in the areas of the Muhuri Dam, Feni. This site is large enough for the larger wind energy
74 projects. Bangladesh Power development board (BPDB) implemented a 1000kW capacity wind battery hybrid
75 power project on the kutubdia island (Bay of Bengal) in the Cox's bazaar district. Under this project, total 50
76 nos. Of 20 kW capacity stand-alone type wind turbines are being installed. The total capacity of all the wind
77 turbines being stored in a battery bank. WBHPP was officially started on ??arch 30,2008[14]. In another project,
78 Bangladesh power development board (BPDB) has implemented a 0.90MW capacity of the grid connected wind
79 energy (GCWE) at the Muhuri Dam areas in the Feni district in 2004. This is the first ever GCWE project in
80 Bangladesh. Thus generating electricity from wind in the coastal areas can be transmitted to other regions of
81 the country through the high voltage transmission lines. Very little operation and maintenance will be required
82 during the whole life time of wind turbines and no fuel will be required for generating electricity from wind
83 [15]. Biogas is one kind of a gas which produced by the biological breakdown of organic matter in the absence
84 of Oxygen. Organic wastes such as dead plant and animal material. Animal dung, and Kitchen waste can be
85 converted into a gaseous fuel called biogas. Biogas originates from biogenic material and is a type of biofuel
86 ??16]. Major components of biogas are 40-70% methane (CH₄), 30-60% carbon dioxide (CO₂) and other gases
87 (1-5%) [17]. It also contains several trace gases like Hydrogen sulfide (H₂S), Nitrogen (N₂), Ammonia (NH₃).
88 and Carbon monoxide (CO) [18]. A biogas based electricity generation system consist of a digester, a biogas
89 collection tank, a generator as well as the piping and controls required for successful operation. The biogas is
90 produced in the anaerobic digester, where anaerobic fermentation takes place which is provided every day with
91 livestock manure in the form of cattle dung. Poultry droppings etc. Grameen Shakti is one of the most uttered
92 NGO in the field of biogas. They have completed 13,500 biogas plants [19]. Recently Seed Bangla Foundation
93 has proposed a 25 KW Biogas based Power plant in Rajshahi [20]. IDCOL. A Government owned investment
94 Company fixed a target to set up 37,669 biogas plants in Bangladesh by 2012, under its National Domestic Biogas
95 and Manure Programmers (NDBMP). It has also set a target of 25% of the total target of biogas plants in the
96 northern region which is yet to be brought under the national gas grid [21]. Besides working in partnership with
97 IDCOL. Some organizations have constructed domestic biogas plants with their own funds. These are Greameen
98 Shakti (3,664 plants), BRAC (3,664 plants of their own), and some other private organizations which promote
99 biogas plants independently [23]. Moreover, since May 2011, IDCOL along with its partner organizations has
100 installed 18,713 biogas plants in different parts of Bangladesh [22].

101 4 V.

102 Ocean wave energy is generated directly from the waves of the oceans. It is another special type of renewable
103 energy which helps to decrease the harmful emissions of greenhouse gases associated with the generation of

104 power. It can be potentially a significant source of electricity in Bangladesh. Though the main purpose of
105 ocean wave energy is electricity generation, it can also be used for the pumping of water, water desalination
106 etc. [24].”The oscillating Water Column method is technically feasible and becoming economically attractive in
107 this purpose. This type of wave energy harnessing device is being commissioned by several countries such as
108 the United Kingdom (500KW), Ireland (3.5MW), Norway (100KW), India (150 KW) etc. Bangladesh has ocean
109 wave energy from the Bay of Bengal.

110 5 VI.

111 Tidal power can be generated in two ways, 1. Tidal stream generators 2. Barrage generation. The power
112 created though tidal generators are generally more environmentally friendly and causes less impact on established
113 ecosystems. Similar to a wind turbine, many tidal stream generators rotate under water and is driven by the
114 swiftly moving dense water Tidal power or Tidal energy is a form of hydropower that converts the energy of tides
115 into electrical power. As the tides are Year more predictable than wind and sunlight, tidal energy can easily be
116 generated from the changing sea levels. The coastal area of Bangladesh has a tidal rise and fall of between 2
117 to 5 meters [25]. Among these coastal areas, with 5 meter tides experienced, sandwip has the best prospect to
118 generate tidal energy [25]. Bangladesh can generate tidal power from these coastal tidal resources by applying
119 Low head tidal movements and Medium head tidal movements, Low head tidal movements which uses tides of
120 height within 2m to 5m can be used in areas like Khulna, Barisal, Bagerhat, Satkhira and Cox’s Bazaar regions
121 and the height tidal movements which use a more than 5m of tides can be mainly used in Sandwip. So we can
122 say that with suitable tidal height available, this can be a great source of energy for Bangladesh.

123 6 VII.

124 7 GEOTHERMAL ENERGY

125 Geothermal energy is a very powerful and efficient way to extract a renewable energy from the earth through
126 natural process. This can be performed on a small scale to provide heat for a residential unit, or on a very
127 large scale for energy production through a geothermal power plant. Geothermal power is cost effective, reliable
128 and environmentally friendly but it has previously been geographically limited to areas near tectonic plate
129 boundaries. With this technology, we can use the steam and hot water produced inside the earth’s surface to
130 generate electricity. Geothermal energy is generated about 4,000 miles below the surface, in the earth’s core [26].
131 The process takes place due to the slow decay of radioactive particles, the high temperature produced inside
132 the earth and it happens in all rocks [26]. About 10,715 megawatts (MW) of geothermal energy is generated in
133 24 countries worldwide [26]. The northern districts of Bangladesh show the prospect to explore the geothermal
134 resources. The demand for electricity in urban as well as in the rural areas is increasing, but our production
135 of electricity is not increasing. The rural demand for electricity can be covered by the production of electricity
136 through geothermal energy. The electricity demand of urban areas can be met then by these saved electricity
137 which is supposed to be provided in the rural areas. Geothermal energy can balance the electricity consumption
138 in these two areas. According to Reference [27], a Dhaka based private company namely Anglo MGH Energy
139 has initiated a project to set up the country’s first geothermal power plant with a capacity to produce 200 MW
140 of electricity close to Saland in Thakurgaon district. They have planned to set up 28 deep tube wells to lift
141 hot steam and the lifted steam will be used to run a turbine and the turbine is connected to the generator to
142 generate electricity [27]. From the above discussion it is clear that geothermal energy can also be a great source
143 of harnessing electrical energy in Bangladesh.

144 8 VIII.

145 9 HYDRO POWER

146 Kinetic energy from flowing or falling water is exploited in hydropower plants to generate electricity. Hydropower
147 plants are classified into two categories: 1. Large hydropower plants (>10 MW), usually with reservoirs, that can
148 not only produce electrical energy Continuously, but also are able to adjust their output according to electricity
149 demand and 2. Small hydropower plants (<10 MW) that are less flexible with respect to load or demand
150 fluctuation due to their dependence on the water resource [28]. In Bangladesh about 1.4 trillion cubic meters
151 (m³) of water flows through the country in an average water year. Major rivers of the country have a high rate
152 of water flow of about 5 to 6 months during monsoon season, which is substantially reduced in winter season.
153 More than 90% of Bangladesh’s rivers originate outside the country, due to which proper planning of water
154 resource is difficult without neighboring countries’ cooperation. Downstream water sharing with India is a highly
155 contentious issue in Bangladesh. The annual average rainfall is about 2,300 mm, which varies from 1,200 mm
156 in the north-west to 5,800 mm in the northeast. Most of the rainfall (about 80%) occurs during the months
157 of May/June to September/October [29]. At present only 230 MW of hydro power is utilized in Karnaphuli,
158 Rangamati hydro station, which the only hydroelectric power plant operated by BPDB [30]. Micro-hydro and
159 mini-hydro have limited potential in Bangladesh, with the exception of Chittagong and the Chittagong hill tracts.

12 CONCLUSION

160 Hydropower assessments have identified some possible sites from 10 kW to 5 MW but no appreciable capacity
161 has yet been installed [31].

162 10 IX.

163 11 CALCULATION OF THE TOTAL POWER

164 The individual power equations and total power equation are given below: Solar power, $P_{\text{solar}} = (\text{Area per sq-ft}$
165 $\times \text{watts per sq-ft})$ Wind power, $P_{\text{wind}} = (1/2) \times \rho \times A \times V^3$ Where, A=area perpendicular to the direction of
166 flow (m^2), V=wind velocity (in ms^{-1}), ρ =density of air which is about 1.2 Kgm^{-3} . Hydro power, $P_{\text{hydro}} (W)$
167 $= H \times Q \times g \times 1000$ Where, H=Gross water head (in meter), Q=Flow of water (in m^3/sec) and g=Gravitation
168 force i.e. 9.81 (ms^{-2}) Now, The total power, $P_T (W) = P_{\text{solar}} + P_{\text{wind}} + P_{\text{hydro}} + P_{\text{biogas}}$.

169 12 CONCLUSION

170 The summary of this paper exhibits that, there is a considerable opportunity of Bangladesh to meet its future
171 power demand and thus economic growth through renewable resources. Renewable energy sources discussed
172 above can help Bangladesh to produce more power in order to reduce Load-shedding problem. Time has come to
173 look forward and work with these renewable energy fields to produce electricity rather than depending wholly on
174 conventional method. With the help of these resources Bangladesh can generate electricity & may be able to meet
175 the required demand in the future. Therefore, the Government and the Private sector should work hand to hand
to emphasize more on renewable energy sources to produce electricity to solve our power crisis problem. ^{1 2}



Figure 1: Fig. 2 :

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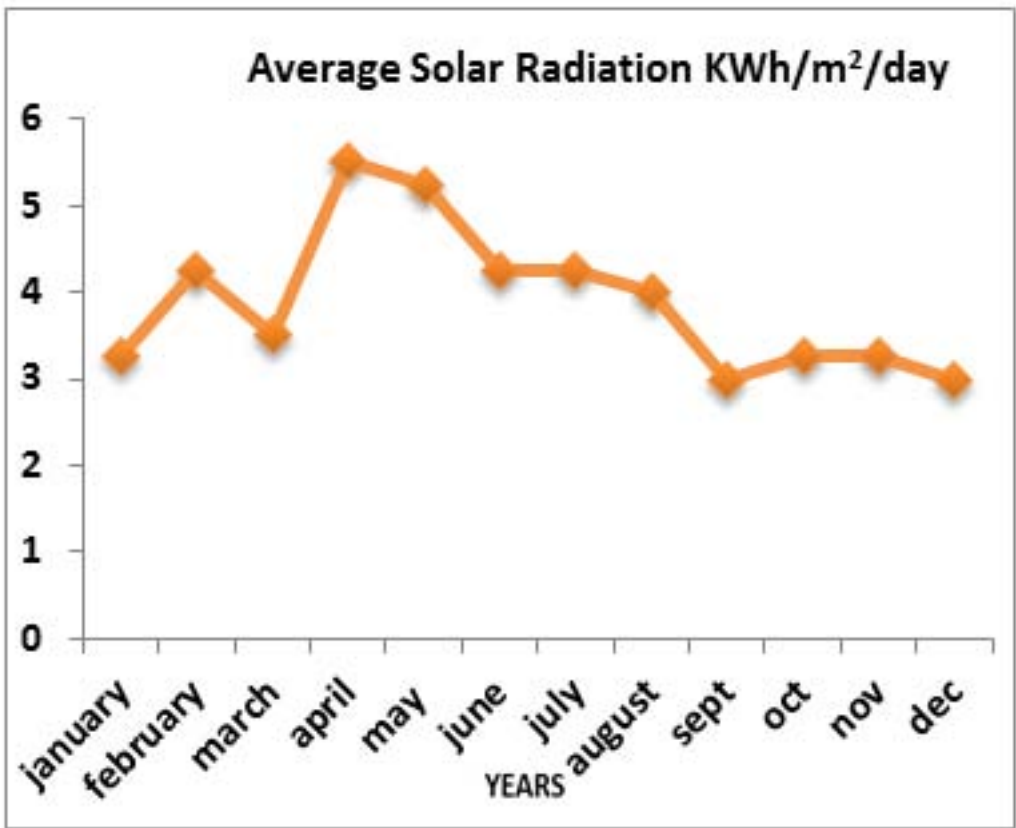
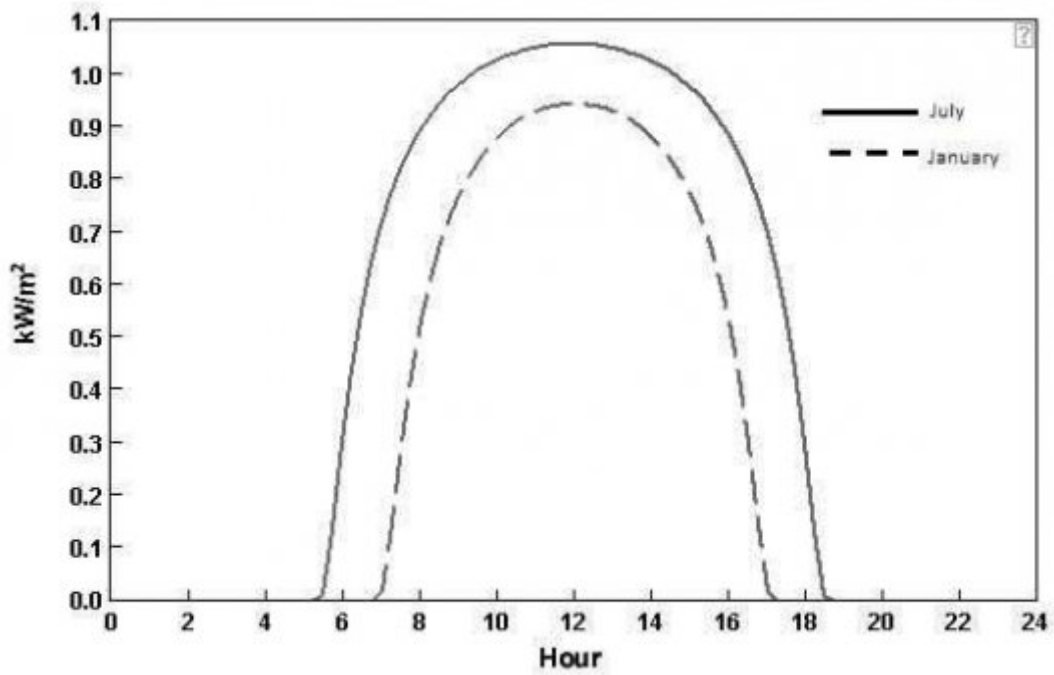
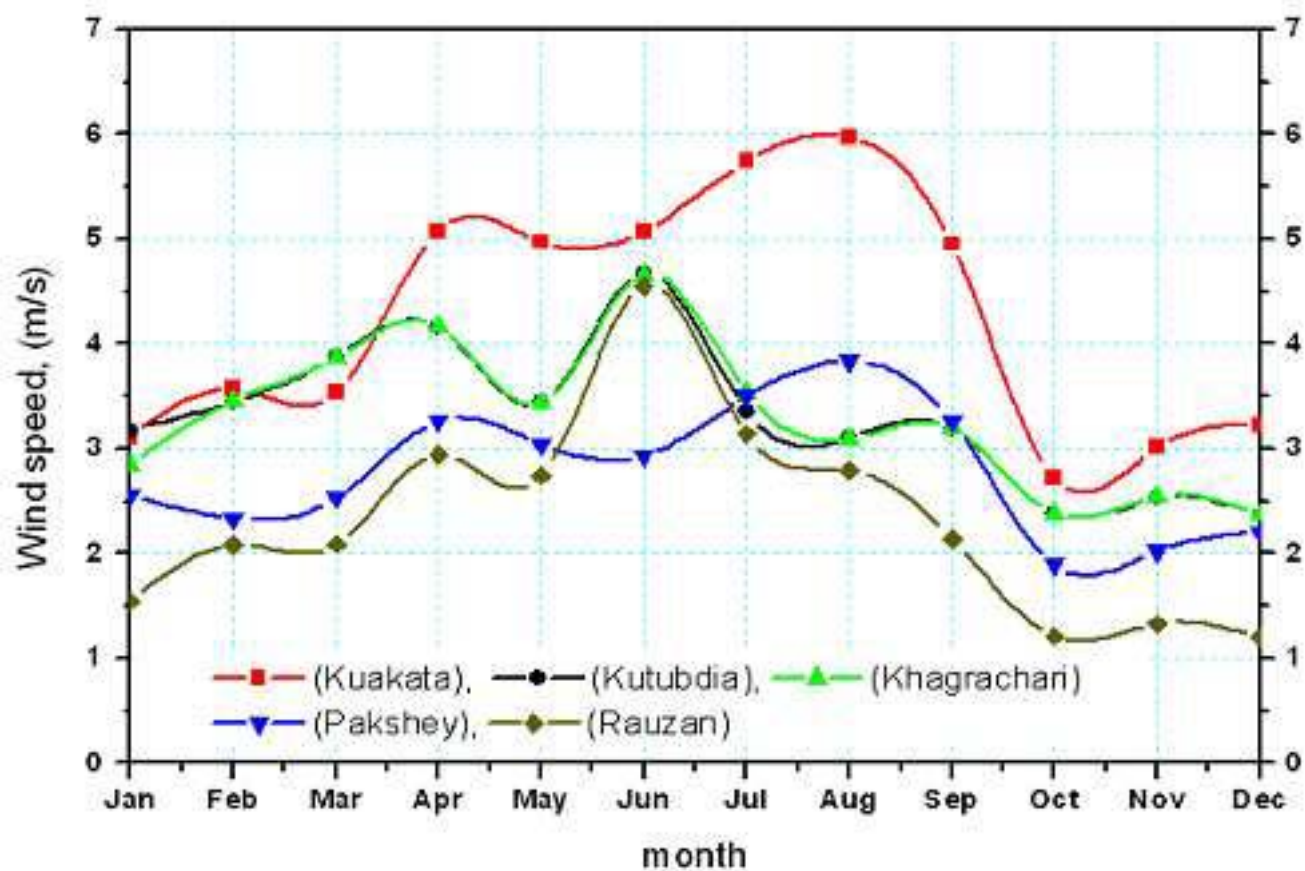


Figure 2:



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Figure 3: Fig. 4 :



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Figure 4: Figure 5 :



67

Figure 5: Fig. 6 :Fig. 7 :

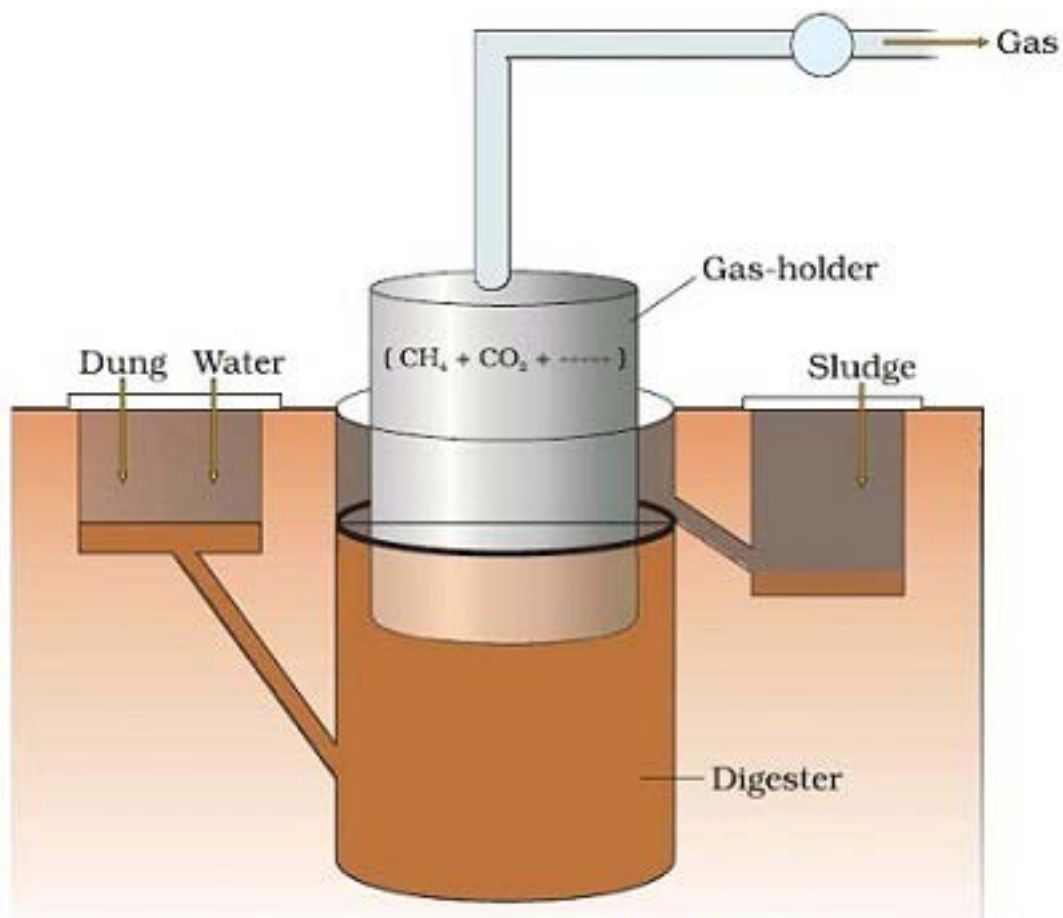


Figure 6: F

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Site	Reference height(m)	Annual average wind speed(m/s)
Cox's Bazar	10	2.42
Sandip Island	5	2.16
Teknaf	5	2.16
Patenga Airport	5	2.45
Comilla Airport	6	2.21
Khepupara	10	2.36
Kutubdia Island	6	2.09
Bhola Island	7	2.44
Hatia Island	6	2.08

Figure 7: Table 1 :

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