

Resource Development Foundation (RDF)

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Fundamentals of Renewable Energy (RE) in Bangladesh:

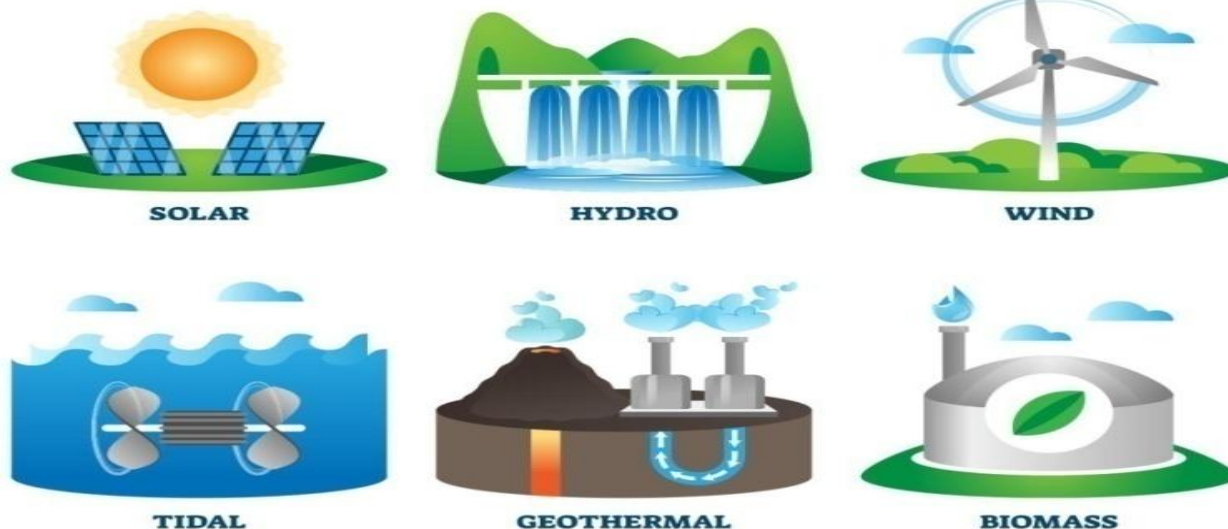
Renewable Energy is a term “favoring green energy supports that comes only from the natural sources”. It is referred to as environment friendly, pollution free & accumulation of smart technologies for sustainable green environmental solutions.

Creation of green energy has no affect on the earth through toxic green house gases. It is the best solution for lives, livelihoods as well as the clean earth in a greater perspective.

Renewable Energy is one of the thrust sectors of the Hon’ble Prime Minister of the Government Republic of Bangladesh. The sector has been growing very fast with its competent, potential, experienced, knowledgeable & committed personnel in its field of operation in Renewable Energy Sector.

Renewable Energy Sources and Resources like, Solar System, Hydro Power System, Wind System, Biogas & Biomass System, Geothermal System & Tidal Energy System are the natural sources as well as the contributing avenues of this thrust sector.

Contribution of the following Renewable Energy Sources in Bangladesh :

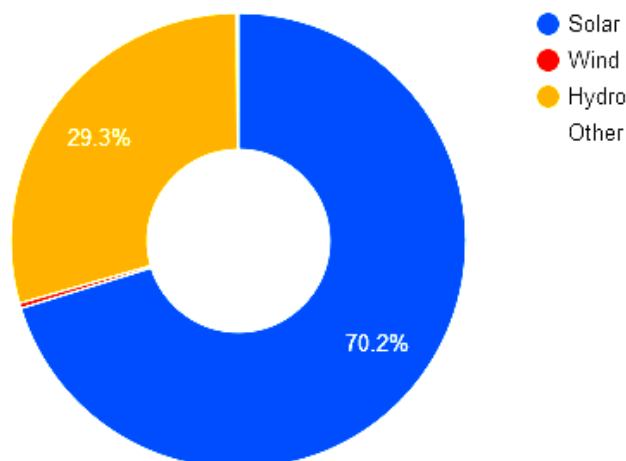


Contribution:

RE Sources	Total (MW)
Solar Systems	556.31
Wind System	2.9
Hydro System	230
Biogas & Biomass System	1.09
Geothermal System	0
Tidal Energies System	0
Total	790.54 (MW)

The above data indicates up to 3% energy contribution from renewable energy Sector out of the total existing power generation in Bangladesh.

Renewable Energy Share



To be understand the following

Visionary Policy and Planning of the Government of Bangladesh:

The visionary policy & planning of the Government of Bangladesh is called measureable Action Plan in the Renewable Energy Sector for accelerating its tremendous growth towards the development of Bangladesh by 2041.

a) 8th 5 years plan (2020-2025):

- a.1) Total power generation capacity up to : 30,000 MW
- a.2) RE sources contribution 10 % : 3,000 MW
- a.3) Solar sources contribution : 2,014 MW
- a.4) Other RE sources contribution : 986 MW

b) SDG-30 (2016-2030):

- b.1) Total power generation capacity up to : 40,000 MW
- b.2) RE sources contribution : 4,100 MW
- b.3) Energy consumption reduction 20% : 8,000 MW

c) Bangladesh Perspective Plan (2021-2041):

- c.1) Total power generation capacity up to : 60,000 MW
- c.2) RE sources contribution : 4,100 MW
- c.3) Energy consumption reduction 20% : 12,000 MW (by 2031)
- c.4) Energy consumption reduction 25% : 18,000 MW (by 2041)

d) National Solar Energy Action Plan (2021-2041):

- d.1) Total power generation capacity up to : 60,000 MW
- d.2) RE sources contribution : 4,100 MW
- d.3) Energy consumption reduction 20% : 12,000 MW (by 2031)
- d.4) Energy consumption reduction 25% : 18,000 MW (by 2041)

e) Mujib Climate Prosperity Plan (MCP):

- e.1) Total power generation capacity up to : 60,000 MW
- e.2) RE sources contribution 30% : 18,000 MW (by 2030)
- e.3) RE sources contribution 40% : 24,000 MW (by 2041)
- e.4) RE sources contribution 40% : 60,000 MW (by 2050)
- e.5) Temperature reduction up to : 1.5 degree (by 2041)

This plan will be achieved within the framework of national planning process (NPP) and will further strengthen the already foreseen the actions of: 8th five years plan, Bangladesh Delta Plan -2100, Vision-2041 and Nationally Determined Contributions. We the committed organizations are able to fulfill the Vision of the GoB.

“Our Hon’ble Prime Minister Sheikh Hasina expressed her views in the National Statement in 26th Session of the United Nations Framework Convention on Climate Change in Glasgow, Scotland on Monday November 1, 2021 to achieve 40% of our energy from renewable sources by 2041”.

Solar radiation depends on the atmospheric image e.g daytime & season of a year. Bangladesh could apparently meet its unprecedented demand as well as increasing energy supply for energy security by acknowledging the potential of solar-energy resources.

RDF Solar Irrigation Pumping System (SIPS)

Brief Background of SIPS in Bangladesh:

Bangladesh still an agro-based country faces so many difficulties in crops cultivation. The agricultural sector as a whole disrupted due to climate changes. Changes in rainfall patterns are such as excess rainfall and irregularity of rains, causing floods and droughts in the country every year. The agricultural sector of the country is being affected which causes less productivity.

Irrigation is the most vital element of crops cultivation. In Bangladesh, farmers have been using the diesel based irrigation system for long time which is not environment friendly as significant amount of green house gases is being emitted to pollute the environment as well as demandable electricity bound the government to expand huge foreign currency per year; which directly affected the economy through electricity commissioning purchase.

As per World Bank reports, 1 million MT diesel of worthing USD 900 million are being used every year for irrigation. Obviously, this is a massive demand for fuel which GoB subsidizes at the opportunity cost of other agricultural innovation. In order to drive agriculture sector and to provide access to continue energy supply as well as supports to the farmers, diesel & electricity based irrigation system needs to be converted by Solar Irrigation Pumping System (SIPS).

Primarily, Rahimafrooz Renewable Energy Limited (RRE) installed a 4” dia 5 KWP SIP experimental project at Vakurta, Savar in 2008. RDF has initially & practically installed & started its implementation activities in 2009 getting whole hearted inspiration & refinancing supports from the Ex-Governor (Then Governor) of Bangladesh Bank Dr. Atiur Rahman. According to his advice, Mutual Trust Bank financed on it in 2009 to start this challenging activities. RDF has been continuing the SIPS activities along with its trained & well organized farmer communities specially the tenants in the rural economy.

RDF in the mean time has installed a number of 144 SIPS pumps in Bangladesh which cover 3,166.54 acres of land ; 8,055 Community members/farmers working with it; 1,274 diesel pumps have already been removed; 8,44,900 liter diesel save /year which price is Tk. 5,49,18,500/year & Power generation is 2.22 MW/Day. The farmer communities are now organized & well trained in organizational management getting more benefit from multiple facilities. Well managed water supply, hassle free pump operations, increase in living standard, increase in income, increased more production & productivity by the said community. They have been getting need based training supports in their community mobilization & multiple managements

regularly, financed by IDCOL through RDF. Dr. Atiur Rahman inaugurated the first SIPS of RDF at Barguna on 17th July, 2009. He visited twice in his period & followed significant impact on agricultural production and behavioral change in the farmers level & positive impacts in the locality/community people.

The great success & achievements of SIPS are Community mobilization, pump/plant operation, water management & distribution, ploughing, seedling, harvesting, drying, husking, marketing & all other related activities are performing by the organized farmer communities themselves. Reducing cost of production, increase in productivity & crops diversifications, introducing HYV cultivation system, gaining expertise-experiences & knowledge, achieving community based agro activities are the key features of the farmer & tenant communities. Removing diesel & electric pumps, saving foreign currency for reducing imports of diesel & fuel are the environmental & economic impacts of SIPS

Present situation of SIPS in Bangladesh:

Solar based irrigation systems are innovative and environment friendly solution for the agro-based economy of Bangladesh. The program intends to provide irrigation facility to rural off-grid areas. Solar irrigation systems reduce dependency on fossil fuel and demand for electricity from national grid in irrigation seasons. The Solar irrigation pump also reduces carbon emission and at the same time saves millions of foreign currency. Moreover, the solar irrigation assists farmers by providing cheaper irrigation service compared to diesel-based pumps. Given the immense potential the program aims to install solar PV-based irrigation systems in areas where there are possibilities to produce three types of crops throughout the year, all the while staying safe from flooding, arsenic contamination and saline water. To work towards this end, IDCOL has now set a target of installing 10,000 solar irrigation pumps by 2027.

Up to June 2022, 2646 solar irrigation pumps are operational with an installed capacity of around 51.795 MWp (Source: SREDA Bangladesh).

Practical and physical contribution of Solar Irrigation Pumping System in Bangladesh.

No. of Pumps installed	Land Coverage (Bigha)	No. of Farmer Houses holds	No. of Beneficiaries	No. of Removed diesel Pump	Diesel Saved in Litter/YR	Real Save in Tk. Per year	Co2 emission Reduction per year (Tonne)	Total Power Generation (MW)
2,646	1,64,290	1,45,514	6,54,813	21,123	1,39,64,650	111,71,72,000	29,94,021	51.795

Social, Environmental & Economic Impacts of SIPS:

Social Impacts:

The use of SIPS for irrigation improved crops yield and decreased cost of crops production leading to increase savings for the smallholder farmers. These expected savings flourish the local markets and generates more benefits including poverty alleviation and improvements of the wellbeing and livelihood of the participating communities. Positive impacts of this system can be summarized as follow:

- ❖ Ensured effective management on cultivation getting essential training by the cultivators on yield management from IDCOL, DAE & RDF.
- ❖ Gathered knowledge & efficiency in technology transfer and crops diversifications by the cultivators as well as the beneficiaries.
- ❖ Trained in water distribution & utilization management through introducing & constructing underground buried piping system.
- ❖ Gathered practical knowledge and technical knowhow for growing more consumer foods and other exportable crops.
- ❖ Farmers are more experienced on seed storage management seedling germination management and marketing.
- ❖ SIPS has removed historical quarrel, conflict among the farmers' familiars.
- ❖ Long term entrepreneurship development attitude and technological ideas are taken place in farmer's level.
- ❖ Established family institutions giving more time in the family activities.
- ❖ Increased social values and relations among the beneficiaries in the society.
- ❖ Increased multiple cultivations system of by-products along with major crops.
- ❖ More experienced in operational as well as management solutions for the neighboring farmers.
- ❖ Creation of small businesses/employment across the value chain.
- ❖ Improved reliability of power systems.
- ❖ Increase agricultural economic output

Environmental Impacts:

The Sun is a huge source of energy and It provides immense resources which can generate clean, non-polluting and sustainable electricity, thus our SIPS Projects are resulting in no global warming emissions. If we are considering adding solar to our irrigation system, we don't just need to stop at the investment. It's also important that we considered the following advantages for our country, Bangladesh as well as for the world:

Climate change impacts:

- (a) Carbon (CO₂) emission is zero in the operational areas.
- (b) Solar Irrigation Pumping System (SIPS) addressing to remove climate vulnerability.
- (c) It has been playing significant role of reducing air pollution and ensuring pollution free environment for the nation.
- (d) Ensured sophisticated and easy operational technologies.
- (e) Hassel and risk free management & operations system.
- (f) Social, familiar and peaceful bonding established among the activity area.
- (g) No loss of land through installing buried piping system.
- (h) Established Green environment and pollution free irrigation system Solutions.
- (i) Removal of all diesel engines in the operational areas ensured free and friendly operations.
- (j) Tobacco cultivation decreases significantly.

Economic Impacts:

Agriculture is the most important sector of Bangladesh's economy, which contributes 12.09% of its GDP (BBS Report 2020-21). Contributing 64% of total labor force, agriculture is one of the major driving forces behind economic growth in Bangladesh. As a result, increasing food and agriculture production have always been major concerns for Bangladesh. Being a country located in tropical delta, irrigation plays a vital role in Bangladesh's agriculture. Almost 43% cost of cultivation associates to mechanized irrigation in Bangladesh.

There are around 1.34 million diesel operated irrigation pumps (DTW – 3000, STW – 1.2 mil., LLP – 0.14 mil) are working for irrigation, which covers 3.4 million hectares of land. Government has a target to install/replace diesel operated pumps by solar pumps which will ensure 150 MW energy generations from irrigation sector.

Major economic impacts:

- (a) Introduced HYV (High Yield variety) for growing more food exportable crops items in domestic consumption as well as exporting.
- (b) 30-35% production increased in the activity areas
- (c) 100% fuel consumption saved in the plants by removed diesel operated pumps.
- (d) About 35% Income of the beneficiaries increased by 3-4 cycle crops & farmers potentialities.
- (e) Low cost and need based water supply with efficient water management ensured minimum cost of production.
- (f) Saved huge (measurable) foreign currency for importing diesel.
- (g) 100% electricity consumption saved in the SIPS plants operated areas.
- (h) Ensured food security in the locality which creates significant value of peaceful living of the farmers.
- (i) Significantly increased productivity of land through well managed fertilizer using.
- (j) Employment generations of green engineers are measurably observing.

Solar Irrigation Pumping System (SIPS), its needs:

Benefits of using Solar Irrigation Pumping System (SIPS):

- ❖ Increased agricultural productivity
- ❖ Less maintenance cost
- ❖ The operating cost can be less than TK 350 per session
- ❖ Foods with high-value crops
- ❖ Ensure food security thus more income
- ❖ Improved water for irrigation reduces the Government's fuel subsidy for the agriculture sector,
- ❖ Reduced diesel imports
- ❖ Reduced bills of electricity
- ❖ Reliable water system
- ❖ Emissions reductions
- ❖ Increased crop yield
- ❖ Rural development
- ❖ Long durability

Challenges and Motivation:

1. In Bangladesh, Farmers are paying advance to purchase diesel and they need to wait sometimes 2 to 3 days to get water which effects on their cultivation by not supplying water in land on appropriate time.
2. Due to high price of diesel, farmers are growing crops in one season in a year instead of cultivating variable yields in three seasons in a year.
3. Irrigating by diesel driven pump, crops production cost is getting high, That's why farmers in our country are losing interest in cultivating rice and they are cultivating tobacco which is destructive for fertility of land.

Solar irrigation Pumping System (SIPS) is the only viable alternative solution in Bangladesh to overcome all major challenges mentioned above. By replacing Diesel pump with solar system, we can save environment, foreign currency, farmers' loss, national grid power for ensuring economic development.

Utilizing the natural resources will not only help save millions of foreign currency but also causes no negative impact on climate change.

Comparison Between Diesel Driven Pumping System (DDPS) & Solar Irrigation Pumping System (SIPS):



Diesel Driven Pumping System (DDPS):

- ❖ Diesel engine emits Co₂ (e.g. One litre of diesel produces 2.68kg of carbon dioxide when burned.)
- ❖ Maintenance of the diesel Motor including refueling, oil change, checking pressure, cleaning air filters, lubricating parts required; pump maintenance also need.
- ❖ Diesel engine has moving parts and need to replace after certain period.
- ❖ Farmer has to carry the pump to the field regularly,
- ❖ Diesel pump needs replacement in an around every 5 years.
- ❖ Diesel engine is required constant supply of diesel and mechanical parts which is difficult to manage in remote area.
- ❖ longer required to buy diesel from the market.
- ❖ Price hike of diesel will endanger our irrigation and thus food security.
- ❖ Safety risks associated with fuel storage and transport; fire risk at pump.
- ❖ Energy costs depend on the size of the pump.
- ❖ Per bigha irrigation cost of diesel driven pumping system is TK 4800-5000.

Solar Irrigation Pumping System (SIPS):

- ❖ Solar pump emits nothing harmful to air.
- ❖ Require very little maintenance. (It includes only cleaning of panel surface once in a month.)
- ❖ Solar panels have no moving parts and have a warranty of 20 years.
- ❖ Solar pump needs replacement in an around every 7 years.
- ❖ Applicable to remote/under develop/no grid connected area.
- ❖ As water supply is confirmed for 20 years, so food security is ensured.
- ❖ Limited safety risks with the operation of a solar irrigation pump
- ❖ There is no energy cost.
- ❖ Per bigha irrigation cost of solar irrigation pumping system is TK. 3000-3200.

Conclusion:

Solar irrigation pumping systems (SIPS) have been providing a great opportunity to the entrepreneurs in Bangladesh to replace diesel pumps in rural areas with a clean energy for reducing the GHG emissions from using diesel, which is harmful to human health and the environment. In addition, it can contribute to Bangladesh Government's target for achieving power generation from renewable sources. Moreover, solar irrigation pumping system will reduce the government's subsidy burden on imported diesel. Farmers will be benefitted from solar irrigation pumping system, because it is cheaper than diesel-based irrigation. They are no longer required to buy diesel from the market, carry the pumps to the field regularly, maintain boring and pumps, etc. All these extra works can be avoided if irrigated by SIPS.

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