

# **STUDY ON RENEWABLE ENERGY FUTURE FOR BANGLADESH**

**A thesis submitted in the fulfillment of the requirement of the award of  
degree of Bachelor of Science in Electrical and Electronic Engineering.**

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# Certification

This is to certify that this project and thesis entitled “**Study On Renewable Energy Future for Bangladesh**” is done by the following students under my direct supervision and this work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on 31 October 2020.

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## APPROVAL

This Thesis titled “**Study on Renewable Energy Future for Bangladesh**” Submitted by MD. MIJANUR RAHMAN to the Department of Electrical and Electronic Engineering, Daffodil International University, has been found as satisfactory and accepted for the partial fulfillment of the requirement for the degree of Bachelor of Science in electrical and Electronic Engineering.

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Author

Md. Mijanur Rahman

**Dedicated to**

**Our Parents**

## **ABSTRACT**

This paper reviews and some analysis the prospects of available renewable energy resources along with various private and government future project plans to incorporate renewable energy sources and their potentials as per context of Bangladesh. According to the approved renewable energy policy, the Government of Bangladesh (GOB) is devoted to facilitating investment in both public and private sectors in renewable energy projects to substitute contemporaneous non-renewable energy resources and to escalate the contributions of renewable energy based electricity generation. A plan has been initiated by the GOB to generate 5% of the total energy from renewable energy resources within 2015 and 20% by the year 2020. Electrical energy is versatile and considered as the backbone of our daily life. Actually, renewable energy is generated from natural resources like sunlight, wind, tide, geothermal heat, ocean energy etc. that are renewable. Energy is a mandatory endeavor for economic growth and human development that builds a link between both economic development and energy use Sustainable. In Future Rural Development Most Important Effects Renewable Energy Because Huge Land Property Is Unused We Used Smartly and Developed Our GDP

# CONTENTS

<b>List of Tables</b>		<b>xi</b>
<b>List of Figures</b>		<b>x</b>
<b>Acknowledgment</b>		<b>iv</b>
<b>Abstract</b>		<b>vi</b>
<b>Chapter 1: ABOUT RENEWABLE ENERGY</b>		<b>1-4</b>
1.1	Introduction	1
1.2	History	1
1.3	Type of Renewable Energy	2
1.3.1	Solar Energy	2
1.3.2	Wind Energy	2
1.3.3	Hydro Energy	2
1.3.4	Tidal Energy	2
1.3.5	Geothermal Energy	2
1.3.6	Biomass Energy	3
1.4	Integration into the Energy System	3
1.5	Policy	3
1.6	The Benefits of Renewable Energy in Bangladesh	4
<b>Chapter 2: RENEWABLE ENERGY IMPACT</b>		<b>5-13</b>
2.1	Solar Energy	5
2.1.1	Merits of Solar Energy	6
2.1.2	Demerits of Solar Energy	6
2.2	Wind Energy	7
2.2.1	Merits of Wind Energy	8
2.2.2	Demerits of Wind Energy	9
2.3	Hydro Energy	10
2.3.1	Merits of Hydro Energy	11
2.3.2	Demerits of Hydro Energy	11
2.4	Geothermal Energy	12
2.4.1	Merits of Geothermal Energy	13

2.4.2	Demerits of Geothermal Energy	13
<b>Chapter 3:</b>	<b>NATIONAL DATABASE OF RENEWABLE ENERGY</b>	<b>14-19</b>
3.1	Solar Home System	14
3.2	Biogas Plant	15
3.3	Wind Project System	17
3.4	Hydro Project	17
3.5	Biogas Large Projects	19
<b>Chapter 4:</b>	<b>FUTURE PLANNING AND TARGET</b>	<b>20-32</b>
4.1	Renewable Energy Yearly Target and Planning	20
4.2	Electricity from municipal Waste	21
4.3	Some Information on Municipal Solid Waste (MSW) in Bangladesh	22
4.4	Fuel saving schooling program	23
4.5	Fuel efficiency and conservation	25
4.5.1	Current status	25
4.5.2	Future plans and goals	25
4.5.3	Solar home system	26
4.5.4	Solar rooftop (roof surface) solution	27
4.5.5	Solar pump Drinking water	28
4.5.6	Solar Irrigation	29
4.5.7	Power from Mymensingh solar plant to national grid	30
4.5.8	Biogas	31
4.5.9	Electricity from waste	32
<b>Chapter 5:</b>	<b>FINANCING SCHEME AND PROGRAMS</b>	<b>33-51</b>
5.1	RE financing scheme and programs	33



5.1.1	Solar home system (SHS) Program	33
5.1.2	Domestic Biogas Program	35
5.1.3	Solar Irrigation Project	35
5.1.4	Solar Mini /Micro Grid Project	36
5.1.5	Biogas Based Power Project	36
5.1.6	Biomass Based Power Projects	37
5.1.7	Other Renewable Energy Projects	37
5.2	Bangladesh Bank Re-Financing Scheme	38
5.3	Area of the Scheme	39
5.4	Re-financial loan payment period	41
5.5	Financing Projects For Energy Efficiency And Conservation Enhancement Activities	42
5.5.1	Background	42
5.5.2	Project Overview	42
5.5.3	Project Strategy	43
5.5.4	Progress	44
5.5.5	Impact of fuel conservation	47
5.5.6	Future prospects	48
5.6	100% Renewable Energy In Bangladesh	49
5.6.1	100% Renewable Energy Review	49
5.6.2	Activities of Renewable Energy	50
5.6.3	100% Renewable Energy for Bangladesh	51
<b>Chapter 6:</b>	<b>CONCLUSIONS AND RECOMMENDATIONS</b>	<b>52-53</b>
6.1	Conclusion	52
	<b>References</b>	<b>53-54</b>

## LIST OF FIGURES

<b>Figure</b>	<b>Figure Caption</b>	<b>Page</b>
2.2	KUTUBDIA Wind Turbines, Bangladesh's first Wind Power Generation Project	7
2.3	KAPTAI dam	10
2.4	Geothermal Plant	12
4.2	Handover of Feasibility Study Report to Honorable State Minister	21
4.3	Type Of West In Bangladesh	22
4.4	Bangladesh Scaling-up Renewable Energy Project	23
4.5.3	Solar home system	26
4.5.4.a	Rooftop solar system on the roof of Bangladesh Bank	27
4.5.4.b	Rooftop solar system on the roof of Wapda building	27
4.5.5	Solar powered drinking water distribution system in SATKHIRA	28
4.5.6.a	Solar Irrigation project in BARGUNA	29
4.5.6.b	Solar Irrigation project SHIKAPUR, PANCHAGAR	29
4.5.7	The solar-based power plant under construction in Mymensingh	30
4.5.8	Biogas plant	31
4.5.9	Electricity from waste	32
5.5.3	Mechanism of Energy Efficiency and Conservation Promotion Financing Project	43
5.5.4	Examples of Energy Efficient Industry Equipment	46
5.6.1	Renewable energy process in house	49
5.6.2.a	Activities Meeting Of Renewable Energy	50
5.6.2.b	Activities Meeting Of Renewable Energy	51

## LIST OF TABLE

<b>Table</b>	<b>Table Caption</b>	<b>Page</b>
3	Renewable Energy Installed Capacity	14
3.2	Wind Projects System	16
3.3	Hydro Projects	17
3.4	Biogas Large Projects	18
3.5	Biomass to Electricity	19
4.1	Target and Planning of Renewable Energy	20
4.3	MSW Generation Scenario in urban areas of Bangladesh	22
5.1.1	Solar Home System Program Particulars	34
5.1.2	Domestic Biogas Program	35
5.1.3	Solar Irrigation Project	35
5.1.4	Solar Mini /Micro Grid Project	36
5.1.5	Biogas Based Power Project	36
5.1.6	Biomass Based Power Projects	37
5.1.7	Different Renewable Energy Projects	37
5.5.4	List of Sub-projects under EECPE Project	45
5.5.5	Expected Energy Conservation Effect of EECPE Project	47

# Chapter-1

## About renewable energy

### **1.1: Introduction**

Renewable energy is energy that's collected from renewable resources, which is like sunlight, wind, rain, tides, geothermal heat and waves. it's comes from in natural sources. in order that are constantly replenished. Energy insufficiency is obstructing the socio-economic and industrial improvement of Bangladesh. Renewable energy contributes about 648.95 MW of the entire electricity production of 20,813MW September 2020 which may be a sustainable solution to the demand-supply crisis. Renewable energy in Bangladesh refers to the utilization of renewable energy to get electricity in Bangladesh. the present renewable energy comes from biogas that's originated from biomass, hydro power, solar and wind

### **1.2 History:**

Renewable energy policy of Bangladesh has been effective since 2009 the govt of Bangladesh has found out an idea to get 5% of the country's total electricity from renewable sources within 2015 and 10% within 2020. However, within 2015 the country has been ready to generate only 3.5% of the entire electricity from renewable sources. In terms of renewable energy sources like solar, biomass, wind etc. Bangladesh is basically blessed many supply. But there's a topic of distress that, Bangladesh isn't still capable of make the right use of its resources for creating the facility accessible for the people. Though lower operating expenses are in concern, this feature is an economically noticeable. The advantage of renewable energy is that's gracious with environment and really suitable for developing countries like ours which is within the risk of climate contamination.. Some private companies try to strap up the large probable of the renewable energy in Bangladesh.

## **1.3: Type of renewable energy**

### **1.3.1 Solar Energy:**

Solar energy is radiant light and warmth from the Sun that's harnessed employing a range of ever evolving technologies like solar heating, solar thermal energy, solar architecture molten salt power plants and artificial photosynthesis

### **1.3.2 Wind Energy:**

Wind power or wind energy is that the use of wind to supply the mechanical power through wind turbines to show electric generators and traditionally to try to to other work, like milling or pumping.

### **1.3.3 Hydro Energy:**

Hydropower or water power is power derived from the energy of falling or fast-running water, which can be harnessed for useful purposes.

### **1.3.4 Tidal energy.**

Tidal power or tidal energy is obtained by converting energy from tides into useful types of power, mainly electricity using various methods. Although not yet widely used, tidal energy has the potential for future electricity generation. Tides are more predictable than the wind and also the sun

### **1.3.5 Geothermal energy:**

Geothermal energy is that the thermal energy generated and stored within the Earth. Thermal energy is that the energy that determines the temperature of matter. The heat of the crust originates from the first formation of the earth and from decay of materials.

### **1.3.6 Biomass Energy:**

Biomass is plant or material used for energy production, or in various industrial processes as raw substance for a variety of products. It are often purposely grown energy crops, wood or forest residues, waste from food crops, horticulture, food processing, animal farming, or body waste from sewage plants.

### **1.4 Integration into the energy system:**

Renewable energy production from some sources like wind and solar is more variable and more geographically spread than technology supported fossil fuels and nuclear. While integrating it into the broader energy system is possible , it does cause some additional challenges. so as for the energy system to stay stable, a group of Measurements are often taken. Implementation of energy storage, employing a big variety of renewable energy technologies, and implementing a sensible grid during which energy is automatically used at the instant it's produced can reduce risks and costs of renewable energy implementation. In some locations, individual households can prefer to purchase renewable energy through a consumer green energy program.

### **1.5 Policy:**

The Government of Bangladesh to succeed in national goals within the field of renewable energy within the country. The Renewable Energy Policy of Bangladesh was released in 2008 by the Ministry of Power, Energy, and natural resource . Bangladesh currently features a target of meeting 10% of power demand from renewable energy resources by 2020, although current generation of renewable energy is a smaller amount than 1% of total electricity generation.

Various government regimes have drafted such policies to supplement the Electricity sector in Bangladesh. The country faces mismanaged distribution and provide of electricity, which is why it faces up to 2000 megawatts of electricity shortage. This has force dhundred of producing firms across the country to pack up taking a toll on the national GDP.

## **1.6 The benefits of renewable energy in Bangladesh:**

Expanding capacity within the electricity sector are often achieved cost-effectively through clean energy options (renewables and energy efficiency), which not only reduce greenhouse emission emissions, but also increase jobs and improve human health by reducing pollution . consistent with a report from the Low Emission Development Strategies Global Partnership (LEDS GP) and supported detailed modelling analysis, the advantages of accelerating clean energy in Bangladesh's power generation mix relative to 'business-as-usual' could generate the subsequent cumulative results by 2030:

Reduce greenhouse emission emissions by up to twenty

Generate domestic employment of up to 55,000 full-time equivalent jobs

Potential to supply additional electricity of 30 GW from solar PV and 53 gigawatt (GW) of electricity potential from all solar sources.

Save up to 27,000 lives, and over US\$5 billion (BDT 420 billion)

# Chapter-2

## Renewable energy impact

### 2.1: Solar energy

Off-grid solar home systems are improving living standards for people in rural areas of Bangladesh.

Bangladesh has one among the world's largest domestic solar power solar energy is changing the lives of 20 million people in rural areas, who can now work, study and leave after dark.

Bangladesh has one among the world's largest domestic solar power which has changed the lives of 20 million people



Fig 2.1: Use Solar Energy in daily life



### **2.1.1: Merits of Solar Energy**

Efficient and Effective: As we all know that the solar power is renewable so it's very efficient in terms of fulfilling the requirements of individuals in terms of energy and along side that it's environment friendly also . solar power are going to be accessible as long as we've the existence of the sun.

Low cost of Maintenance: Solar panels generally don't require much cost within the maintenance. After the installation they're very reliable and more solar panels are often added as per the wants .

Installation: Another interesting thing to understand is that the solar panels don't require any wire or cords to be connected. they will be easily installed in any remote area and may be wont to produce energy.

### **2.1.2 Demerits of Solar Energy**

Reliability: one among the main disadvantage of solar power is that it can only be available during the day time in presence of sunlight. Environmental factors also effects tons to the solar power systems.

High Initial Cost: The purchasing and installation cost of the solar panels are very high which makes an individual believe to start out with the method. As new technologies emerge, the value of solar panels is probably going to decrease.

Location: because the solar power requires the daylight so it's very essential to take care while choosing the situation for fixing the solar panels. It reduces its effectiveness within the places where it remains cloudy for many of the time.

## 2.2: Wind Energy

Bangladesh is suffering severely from power crisis in past few years. Fossil fuels are becoming diminished day by day. Bangladesh should search for renewable sources of energy. Wind are often an answer to the present problem. Wind may be a propriety of renewable energy. Bangladesh features a long coastal area. Wind blows in several patterns in several seasons. Wind turbines should have the capacity to face up to against 250 km/hr wind in coastal zones. Previously collected data are analyzed to guage the potential of wind energy in several spots of Bangladesh. Feasibility to determine wind turbines in several zones in mass scale to supply electricity and for irrigation purpose are described briefly. working rule and style considerations to put in wind turbines also are discussed during this paper. Effect of height in average wind speed and probable power generation is shown here. an attempt has been made to estimate the relevant costs regarding establishment of a turbine



Figure 2.2: KUTUBDIA Wind Turbines, Bangladesh's first Wind Power Generation Project

### **2.2.1 Merits of wind energy**

Clean and Environment friendly Fuel Source:

At doesn't pollute air like power station counting on combustion of fuel . It doesn't produce atmospheric emissions that cause acid precipitation or Green House gases (carbon dioxide (CO<sub>2</sub>) or methane (CH<sub>4</sub>)). Noise and visual pollution are both environmental factors, but they don't have a negative effect on the world , water level or the standard of the air we breathe.

Renewable and Sustainable: Winds are caused by heating of atmosphere by the sun, earth surface irregularities and therefore the rotation of the world . For as long because the sun shines the wind blows, the energy produced are often harnessed and it'll never run out, unlike the Earth's fuel reserves.

Wind Cost Effective: Wind energy is totally free. There's no marketplace for the demand and provide of wind Energy's It are often employed by anyone and is one among rock bottom price renewable technologies available today, depending upon the wind resource and therefore the particular Project's financing.

Industrial and Domestic Installation: turbines are often built on existing farms or ranches where most of the simplest wind sites are found. Wind turbines uses only a fraction of the land which causes no trouble in work for the farmers and rancher, providing landowners with additional income paid by the owners of the wind generation plants. Many landowners prefer to install smaller, less powerful wind turbines so as to supply a part of a domestic electricity supply.

Job Creation: Jobs are created for the manufacture of wind turbines, the installation and maintenance of wind turbines and also in wind energy consulting. consistent with the Wind Vision Report, wind has the potential to support quite 600,000 jobs in manufacturing, installation, maintenance, and supporting services by 2050.

## 2.2.2 Demerits of Wind Energy

**Wind Fluctuation of Wind and Good Wind Sites:** Wind energy features a drawback that it's not a continuing energy source. Although wind energy is sustainable and can never run out, the wind isn't always blowing. This will cause serious problems for turbine developers who will often spend significant time and money investigating whether or not a specific site is suitable for the generation of wind energy. For a turbine to be efficient, the situation where it's built must have an adequate supply of wind energy.

**Wind Noise and Aesthetic Pollution:** Wind turbines generate noise and visual pollution. One turbine is often heard from many meters away. Although steps are often taken to site wind turbines faraway from dwellings, many of us just like the look of wind turbines, others don't and see them as a blot on the landscape.

**Not a Profitable use a Land:** Alternative uses for the land could be more highly valued than electricity generation.

**Birds Threat to Wildlife:** Birds are killed by flying into spinning turbine blades. However it's believed that wind turbines pose less of a threat to wildlife than other artificial structures like telephone masts and radio towers. Most of the issues are resolved or greatly reduced through technological development or by properly siting wind plants.

## 2.3 Hydro Energy

A brief reconnaissance occurred in 1906 when the KARNAFULI HYDRO power plant was first contemplated. A second study was administered in 1923. In 1946, E. A. Moore recommended the proposed project at BARKAL about 65 KILOMETER Upstream of present dam site at KAPTAI In1950,

The primary purpose of the dam and reservoir was to get hydroelectric was completed in 1962. The generators within the 230 megawatts hydroelectric power plant were commissioned between 1962 and 1988. it's the sole hydroelectric power plant in Bangladesh.



Figure 2.3: KAPTAI dam

Turbine:

2 x 40 MW (54,000 HP),

3x 50 MW (67,000 HP)

Installed Capacity: 230 MW (310,000 HP)

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### **2.3.1 Merits Of Hydro Energy**

Hydropower may be a fueled by water, so it is a clean fuel source. Hydropower doesn't pollute the air like power plants that burn fossil fuels, like coal or gas . Hydropower could be a domestic source of Energy, produced within the us . Hydropower relies on the water cycle, which is driven by the sun, thus it is a Renewable power source. Hydropower is usually available engineers can control the flow of Water through the turbines to supply electricity on demand. Hydropower plants provide benefits additionally to scrub electricity.

#### **Impoundment**

Hydropower creates reservoirs that provide a spread of recreational opportunities, notably fishing, swimming, and boating. Most hydropower installations are required to supply somePublicaccess to the reservoir to permit the general public to require advantage of those opportunities. Other benefits may include installation and control

### **2.3.2: Demerits of Hydro Energy**

Fish populations are often impacted if fish cannot migrate upstream past impoundment dams to spawning grounds or if they can't migrate downstream to the ocean. Upstream fish passage are often aided using fish ladders or elevators, or by trapping and hauling the fish upstream by truck. Downstream fish passage is aided by diverting fish from turbine intakes using screens or racks or maybe underwater lightsand sounds, and by maintaining a minimum spill flow past the turbine. Hydropower can impact water quality and flow. Hydropower plants can cause low Dissolved oxygen levels within the water, a drag that's harmful to riparian (riverbank) habitats and is addressed using various aeration techniques, which Oxygenthe water. Maintaining minimum flows of water downstream of a Hydropower installation is additionally critical for the survival of riparian habitats. Hydropower plants are often impacted by drought. When water isn't available, the Hydropower plants can't produce electricity.

## 2.4 Geothermal Energy:

There is an excellent chance to get power from heat from the northern districts of Bangladesh. it's also one among the extensively used energy round the world. About 10,715 megawatts (MW) of heat is generated in 24 countries worldwide. The Dhaka-based company plans to dig 28 deep tube wells to lift hot steam, whose temperature are a minimum of 12 degree Centigrade . The lifted and pressured steam are going to be channeled into a turbine which is linked to a generator for turning it to supply electricity. Officials of the corporate said they need found ideal sites in Thakurgaon to get 200 MW, which they are saying will greatly reduce acute power shortages in northern districts. We are now expecting the government's approval for exploration license," Md Abdur Rahim, a director of the corporate , said. He said the corporate has done primary feasibility studies on the plan and can conduct a final one shortly on a span of 3555 hectares. A 200 MW gas fired power station can cost \$150-200m. against this , a geothermal power station with similar capacity are often found out at one third of that cost, consistent with officals. Rahim said the corporate has recently applied to the facility and energy ministry, seeking a licence to supply geothermal power. the corporate has secured favourable opinions from the Geological Survey of Bangladesh, the Ministry of Water Resources and therefore the Ministry of Environment and Forest.

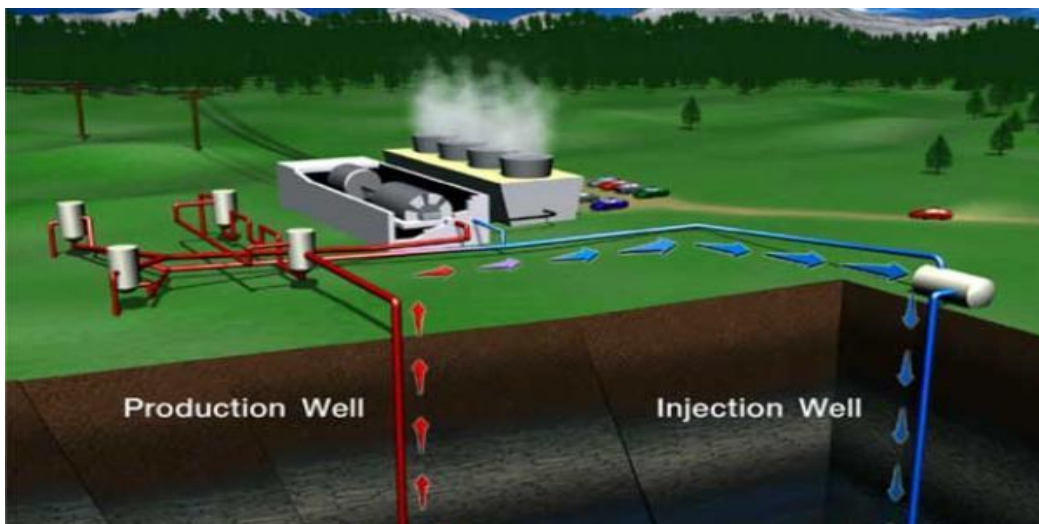


Figure 2.4: Geothermal Plant

### **2.4.1 Merits of Geothermal Energy**

Geothermal energy is usually considered environmentally friendly and doesn't cause significant amounts of pollution.

Geothermal reservoirs are naturally replenished and thus renewable (it isn't possible to exhaust the resources).

Excellent for meeting the bottom load energy demand (as against other renewables like wind and solar).

Great for heating and cooling – even small households can benefit.

Harnessing heat doesn't involve any fuels, which suggests less cost fluctuations and stable electricity prices.

Small footprint ashore – are often built partially underground.

Geothermal energy is out there everywhere, although just some resources are profitably exploitable.

### **2.4.2 Demerits of Geothermal Energy**

There are some minor environmental issues related to geothermal power.

Geothermal power plants can in extreme cases cause earthquakes.

There are heavy upfront costs related to both geothermal power plants and geothermal heating/cooling systems. Very location specific (most resources are simply not cost-competitive).

Geothermal power is merely sustainable (renewable) if the reservoirs are properly managed.



# Chapter 3

## National Database of Renewable Energy

Renewable Energy Installed Capacity: 648.94 MW

Table 3: Renewable Energy Installed Capacity

<b>Techlology</b>	<b>Off-Grid (MW)</b>	<b>On-Grid (MW)</b>	<b>Total (MW)</b>
Solar	327.14	87.87	415.01
Wind	2	0.9	2.9
Hydro	0	230	230
Biogas to Electricity	0.63	0	0.63
Biomass to Electricity	0.4	0	0.4
Total	330.17	318.77	648.94

### 3.1 Solar Home System:

The director-general said the agricultural Electrification Board, the Northern Electricity Supply Company (NESCO) and therefore the refore the West Zone Power Distribution Company are working towards completing universal electric access and the Bangladesh Power Development Board will install 178,000 solar home systems in hilly districts by next year, with the assistance of state-run soft loan provider the Infrastructure Development Company Limited.

The Rural Electrification Board is because of complete its a part of the mandate by installing 5,000 solar home systems in remote villages and NESCO will install similar

systems and expand mini-grids to fill within the gaps in its mandate, which mostly concern island communities.

Table3.1 Solar Home System

<b>SL.</b>	<b>Technology Name</b>	<b>Number</b>	<b>Capacity</b>	<b>Agency</b>
1	Solar Home System	15250	0.83 MW	BREB
2	Solar Home System	4494162	187.12 MW	IDCOL
3	Solar Home System	400	0.2 MW	GIZ
4	Solar Home System	1294410	60.14 MW	MODMR
5	Solar Home System	200	3.15 MW	RDCD

Source: <http://www.sreda.gov.bd/>

### **3.2 Wind Projects System:**

Bangladesh began its first wind generation project in 2005. There are two wind generation projects in Bangladesh, the Muhuri Dam wind generation project and therefore the project in Kutubdia Island. Muhuri Dam Project is that the first grid-connected wind plant in Bangladesh.

Table3.2: Wind Projects System

SL	PROJECT NAME	SID	CAPACITY	LOCATION	RETECHNOLOGY	AGENCY	FINANCE	COMPLETION DATE	PRESENT STATUS
1	1000 kW Capacity Wind Battery Hybrid Power Plant	172	1 MW	Kutubdia Upazila, Cox's Bazar	Wind (Off-Grid)	BPDB	Self	2015-12-31	Completed & Running
2	1000 kW Capacity Wind Battery Hybrid Power Plant	171	1 MW	Kutubdia Upazila, Cox's Bazar	Wind (Off-Grid)	BPDB	Self	2008-12-31	Completed & Running
3	Feni Wind Power Plant	173	900 kW	Sonagazi, Feni	Wind (On-Grid)	BPDB	Self	2006-09-27	Completed & Running
4	Sirajganj 150 MW Power Plant , Sirajganj, Bangladesh	370	2 MW	Sirajganj Sadar Upazila, Sirajgonj	Wind (On-Grid)	BPDB	Self	2019-01-14	Implementation Ongoing
5	10 MW Wind Power Plant	155	10 MW	Kalapara Upazila, Patuakhali	Wind (On-Grid)	RPCL	GoB	2022-12-31	Under Planning
6	Feasibility Study for Installation of Wind Firm in Matarbari Island	280	0 kW	Maheshkhali Upazila, Cox's Bazar	Wind (On-Grid)	CPGCB L	GoB	2019-06-30	Under Planning
7	"60 MW Wind Power Project" at Cox's Bazar by US-DK Green Energy (BD) Ltd	158	60 MW	Chakaria Upazila, Cox's Bazar	Wind (On-Grid)	BPDB	IPP (Unsolicited)	2017-11-30	Under Planning

Source: <http://www.sreda.gov.bd/>

### 3.3 Hydro Projects:

Starting in 1957, the initial phase of the development was completed in 1962. By this point the dam, spillway, penstock and two 40 MW Kaplan turbine generators were inbuilt the facility station. In August 1982 a 50 MW generator was commissioned. In October 1988 the fourth and fifth generating units, both 50 MW Kaplan-type turbines, were installed which raised the entire generation capacity to 230 MW

Table 3.3: Hydro Projects

Sl.	Project Name	Sid	Capacity	Location	Retech nology	Age ncy	Fin an ce	Comple tion Date	Presen t Status
1	Kaptai Hydro Power Plant	162	230 MW	Kaptai Upazila, Rangamati	Large Hydro (On-Grid)	BPD B	Sel f	1988-12-26	Comple ted & Running

Source: <http://www.sreda.gov.bd/>

### 3.4 Biogas Large Projects:

One of the leading NGOs in Bangladesh, has been setting up the biogas plants in the village, under its Eco Village Development Projects

Table3.4: Biogas Large Projects

Sl.	Project Name	Sid	Capacity	Location	Technology	Agency	Finance	Completion Date	Present Status
1	Phenix Agro Ltd. at Gazipur	117	400 kW	Whole Bangladesh, Gazipur	Biogas to Electricity (Off-Grid)	IDCOL	IDCOL	2016-09-30	Completed & Running
2	KKT Bio-Electricity Project	120	100 kW	Whole Bangladesh Panchagarh	Biogas to Electricity (Off-Grid)	IDCOL	IDCOL	2015-12-31	Completed & Running
3	ZPL Bio-Electricity Project	119	30 kW	Whole Bangladesh, Chuadanga	Biogas to Electricity (Off-Grid)	IDCOL	IDCOL	2015-11-30	Completed & Running
4	UKAL Electricity Project	118	30 kW	Whole Bangladesh, Tangail	Biogas to Electricity (Off-Grid)	IDCOL	IDCOL	2014-10-31	Completed & Running
5	Bio-Electricity Project	116	20 kW	Whole Bangladesh, Gazipur	Biogas to Electricity (Off-Grid)	IDCOL	IDCOL	2012-12-31	Completed & Running
6	RKKL Bio-Electricity Project	115	50 kW	Whole Bangladesh, Mymensingh	Biogas to Electricity (Off-Grid)	IDCOL	IDCOL	2010-06-30	Completed & Running
7	UAL Bio-Electricity Project	121	60 kW	Whole Bangladesh, Gazipur	Biogas to Electricity (Off-Grid)	IDCOL	IDCOL	2016-04-30	Implementation Ongoing
8	1 MW Grid Power	160	1 MW	Keraniganj Upazila, Dhaka	Biogas to Electricity (On-Grid)	BPDB	IPP (Unsolicited)	2020-12-31	Under Planning

Source: <http://www.sreda.gov.bd/>

### 3.5 Biomass to Electricity:

Currently, Bangladesh is that the seventh most crowded countries within the world and biomass provides 73% of the entire energy. Biomass resources (such as wood, trash and agricultural wastes) available in rural areas are utilized as cooking fuel. within the rural areas, only 5% people use kerosene as fuel.

Table3.5: Biomass to Electricity

S l.	Project Name	Sid	Capacity	Location	Re Technology	Agency	Finance	Completion Date	Present Status
1	SEAL Biomass based Electricity Project	122	400 kW	Whole Bangladesh, Thakurgaon	Biomass to Electricity (Off-Grid)	IDCOL	IDCOL	2015-12-31	Completed & Running

Source: <http://www.sreda.gov.bd/>

# CHAPTER 4

## Future Planning and Target

### 4.1 Renewable Energy Yearly Target and Planning:

Table 4.1: Target and Planning of Renewable Energy

TECHNOLOGY	2018	2019	2020	2021	TOTAL (MW)
SOLAR	350.74	250	300	250	1150.74
WIND	2.90	180	300	300	782.9
BIOMASS/BIOGAS	1.08	1.5	2.5	3.5	8.58
HYDRO	230	1	2	2	235
TOTAL	584.72	432.5	604.5	555.5	2177.22

Source: <http://www.sreda.gov.bd/>

The government has already initiated several projects to realize the target.

Solar water heating in industry Solar water system for fish farming In Bangladesh

Survey and GIS mapping on biogas and biomass fuels Generating electricity from municipal waste Establishment of solar rooftop systems on commercial basis in government, semi-government and industrial installations Installation of solar rooftop systems on commercial basis in educational institutions Installation of solar charging station Solar Park, Solar Mini Grid, Solar Irrigation Project Feasibility Testing and Piloting

## 4.2 Electricity from municipal waste:

Waste disposal is an emerging problem in most urban areas of Bangladesh. The magnitude of the matter is comparatively small and manageable in rural areas. Improper management and casual dumping of waste may be a noticeable reason behind ruin of the environment in most cities. It appears to be a growing concern in recent times. Low collection coverage, unavailable logistic services, and lack of suitable treatment, recycling and disposal facilities are liable for substandard waste management, resulting in water, land and pollution, and for putting people and therefore the environment in danger. Rapid increment has made waste management a significant problem today. Just outskirts of Dhaka city, isn't an exception regarding poor waste management. The scattered and Waste creates common nuisance, clogs sewers and open drains, encroaches roadways, diminishes aesthetic appearance and causes unpleasant odor. Waste is collected from dustbin or secondary transfer station transported to the dumping sites. Power Division has assigned Bangladesh Power Development Board (BPDB) to implement the Waste to Energy Generation Plant on pilot basis. The capacity of the combined heat and electromagnetic unit are going to be 1 MW (430 kW Electricity + 480 kW Heat).



Fig 4.2: Handover of Feasibility Study Report to Honorable State Minister



### 4.3 Some information on municipal solid waste (MSW) in Bangladesh:

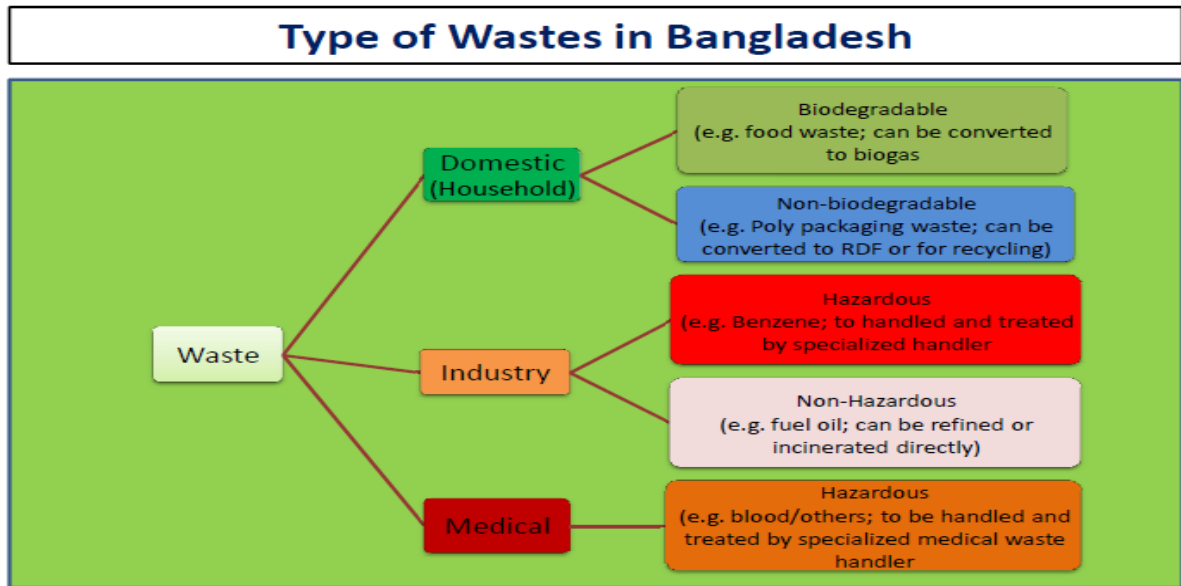


Fig 4.3: Type Of West In Bangladesh

Source: BPDB

Table 4.3: MSW Generation Scenario in urban areas of Bangladesh

Year	Urban Population	% of total population	Waste Generation Rate	Total Waste Generation
1991	20,872,204	20.15	0.49	9,873.5
2001	28,808,477	23.39	0.5	11,695
2004	32,765,152	25.08	0.5	16,382
2015	54,983,919	34.20	0.5	27,492
2025	78,440,000	40.00	0.6	47,064

Source: waste concern-2015 Municipal solid waste recovery potential Bangladesh perspective

#### 4.4 Fuel saving schooling program:

There is no substitute for raising awareness among the overall public about energy efficiency and conservation to create an energy-conscious and prosperous Bangladesh. To the present end, renewable energy and energy saving lessons have already been included within the national school curriculum to form students aware. At an equivalent time, the Sustainable and Renewable Energy Development Authority (SREDA) has launched the "Energy Saving Awareness Schooling Program" to supply practical experience to school-going students on energy saving and energy efficiency. Within the fiscal year 2016-17, this program was organized with the scholars of about 20 schools across the country. Within the schooling program, videos on energy saving are displayed ahead of the scholars of the varsity, comparative images of energy efficiency of varied energy saving equipments are displayed through live test. Immediate lectures are organized among the scholars of the mentioned schools and their neighbors and relatives are encouraged to remember of energy saving and efficiency.



Fig 4.4: Bangladesh Scaling-up Renewable Energy Project

WASHINGTON, March 1, 2019 - the planet Bank's Board of Executive Directors today approved financing for the subsequent project:

### Scaling-up Renewable Energy Project

IDA Credit: US\$156 million

Terms: Maturity = 30 years, Grace period = 5 years

Strategic Climate Funds: US\$29 million

Terms: Maturity = 40 years, Grace period = 10 years

Project ID: P161869

**Project Description:** The project will add up to 310 Megawatt (MW) in renewable energy generation capacity in Bangladesh and can help mobilize up to \$212 million private sector participation to satisfy the growing demand for electricity within the country. The project aims to extend installed capacity of renewables through piloting and expanding investments in key market segments. The project will help provide better access to cleaner electricity also as air by avoiding burning fossil fuels. it'll help cut emissions by 377,000 plenty of carbonic acid gas equivalent a year. The project will support the Infrastructure Development Company Limited (IDCOL) with development of the Renewable Energy Financing Facility and supply resources to create market capacity and develop a pipeline of renewable energy projects.

## **4.5 Fuel efficiency and conservation**

### **4.5.1 Current status:**

Energy may be a mandatory endeavor for economic process and human development that builds the link between both economic development and energy use. Sustainable GDP growth of 20% and above must meet energy requirements the demand for electricity is increasing day by day. so as to realize energy sustainability, not only the availability of fuel but also the employment of energy must be improved. during this regard, it's necessary to cut back the quantity of fuel required to produce various products and services. Energy efficiency and renewable energy are called the 2 pillars of sustainable energy the primary two effects of the event of energy efficiency are (1) development of energy security, (2) effective environmental management. This campaign will yield good leads to the effective energy use movement and can later reduce carbon emissions in Bangladesh. The Energy Efficiency and Conservation plan 2030 aims to save lots of 15% of energy by 2021 by using and conserving primary and secondary energy

### **4.5.2 Future plans and goals:**

1. The government has prepared an action decide to ensure energy efficiency and conservation in terms of supply and demand, which is time bound for implementation.
2. The government has set the subsequent targets for energy saving:
3. Save 15% of total fuel consumption by 2021, and 20% by 2030.
4. Priority-based energy efficiency measures are going to be adopted as follows:
5. 1. ICS replaces 30 million inefficient conventional cookstoves by 2030;
6. 2. Gradually replacing conventional street lights with LEDs
7. 3. Bring electrical appliances under Energy Star Labeling

### 4.5.3 Solar home system

#### Solar home system

The use of electricity by people in rural areas through Solar Home System (SHS) is becoming more and more popular in Bangladesh. Solar home systems generate electricity using PV panels, replacing the utilization of kerosene for lamps and therefore the use of diesel to charge batteries. Solar home systems program has been began to make sure the use of unpolluted energy within the rural areas of Bangladesh where there's no electricity. This program complements the government's vision to get electricity for all by 2021. About 4.5 million solar home systems have already been installed within the off-grid rural areas of Bangladesh under the IDCOL program and about 13 million beneficiaries are becoming solar energy . Under this program, quite 65,000 solar home systems are being installed monthly , which is growing at a mean rate of 56% per annum . The program is replacing 160,000 plenty of kerosene worth 225 million annually. Moreover, about 70,000 people are directly and indirectly involved during this program.

The program has earned a worldwide reputation together of the most important and fastest growing off-grid renewable programs.



Fig4.5.3: Solar home system

#### 4.5.4 Solar rooftop (roof surface) solution

Most rooftops (roof surfaces) of economic and residential buildings are completely or partially unused. The Grid Tide Solar PV system is an independent solar energy plant which will supply additional power to the local distribution system after supplying power to the building. it'll function an efficient solution in grid connected areas through Grid tide AC power generation.

The government sees the installation of solar energy as a possible sector during this model and has made it a prerequisite to urge new power connections by installing solar panels to satisfy a particular portion of customer demand. the govt is encouraging industries to put in solar panels to satisfy a part of their demand for renewable energy. The project is predicted to extend solar energy by 20 MW



Fig 4.5.4.a: Rooftop solar system on the roof of Bangladesh Bank



Fig 4.5.4b: Rooftop solar system on the roof of Wapda building.

#### 4.5.5 Solar pump Drinking water:

Solar powered beverage distribution systems is in a position to use to provide pure water in rural areas especially in saline prone areas to make sure safe water system , solar drinking systems with filtration systems will be popularized to get rid of arsenic salinity and other waste from the water. the govt has already launched 120 solar-based beverage system in coastal areas through the SED project the employment of this renewable energy has the potential to extend day by day within the coastal and northern areas of Bangladesh where there's a severe shortage of safe water.



Fig 4.5.5: Solar powered drinking water distribution system in SATKHIRA

#### 4.5.6 Solar Irrigation:

Agriculture is that the most vital sector of Bangladesh economy. The contribution of agriculture to GDP is eighteen .64% .84% of the manpower of the country engaged in agriculture. Agriculture is one among the driving forces of economic process in Bangladesh. As a result, the growing demand for food and agriculture products is usually a matter of concern for Bangladesh policymakers. As Bangladesh is found within the tropical delta, irrigation plays a crucial role within the agriculture of Bangladesh 43% of agriculture expenditure is spent on irrigation. About 1.34 million diesel irrigation pumps (DTW-3000, STW-1.3m LLP-0.14 m) are getting used for irrigation in 3.4 million hectares of land within the country. the govt aims to exchange diesel-powered pumps with solar pumps, which can reduce the utilization of 150 MW of electricity from the irrigation sector. Installed solar irrigation system remain unused for quite half the year from which it's possible to further expand the solar irrigation system by making the projects more profitable through proper use of productive electricity. the right use of invested solar systems through grid integration of solar systems and therefore the government renewable energy policy will play helpful role in achieving the targets



Figure 4.5.6a: Solar Irrigation project in BARGUNA



Figure4.5.6b: Solar Irrigation project SHIKAPUR, PANCHAGAR



#### **4.5.7 Power from Mymensingh solar plant to national grid:**

The 50-megawatt solar-based power station in Sutiakhali of Mymensingh will start generating electricity by the top of June, targeting the government's initiative to get 10% of the entire electricity by renewable energy by 2021.

The government has targeted generation of 24,000MW of electricity by 2021. Of the electricity, 2,000MW of power would come from renewable sources.

The solar-based power station was established on 144 acres of land with an estimated cost of Tk800 crore in 2017, reports a correspondent from Mymensingh.

Primarily, the assembly cost are going to be Tk10 to 13 per unit, but gradually the value will come down, Indrajit Debnath added.



Figure 4.5.7: The solar-based power plant under construction in Mymensingh

#### 4.5.8 Biogas:

Biogas may be a mixed sort of the varied gases that are obtained as a results of decomposition of organic matter and is usually produced from raw materials like agricultural waste, organic , municipal waste, plant materials, sewage waste, green waste or garbage . Not only is cooking gas available from biogas plants, it also provides organic for grain and fish ponds. the primary biogas plant was inbuilt Bangladesh in 1972 as a non-bank financial organization of Bangladesh Bank, "IDCOL" invests within the biogas sector. additionally , a complete of 76771 biogas plants are constructed across the country till June 2020 at the initiative of Bangladesh Council of Science and Industry Research (BCSIR), GIZ, Ministry of Disaster Management and Relief, Department of government Engineering. Some active programs and projects for construction of biogas plants are being implemented everywhere Bangladesh. Of these, poultry waste based biogas plants are the foremost successful. The gas obtained from these are often wont to generate electricity and a maximum of about half a megawatt of electricity is being generated from the gas thus obtained. consistent with the target of power generation from renewable energy, 31.06 MW of electricity are going to be generated from biogas / biomass by 2021. Sreda's initiative is to get biomass / biogas, dairy and poultry waste at government and personal levels, waste from municipal waste, some waste from power plants.



Figure 4.5.8: Biogas plant

#### 4.5.9 Electricity from waste

One of the sources of renewable energy is electricity from waste. The Sustainable and Renewable Energy Development Authority (SREDA) is functioning under the direction of the facility Department for the event of this sector.

In this context, in line with the target of power generation from renewable energy, by 2021, 31.06 MW of electricity are going to be generated from biogas / biomass at the general public and personal level under the initiative of Sreda is functioning

Waste to Energy survey has already been completed in 8 municipalities of the country. Potential sites are Mymensingh, Cox's Bazar, Sirajganj, Habiganj, Dinajpur and Jessore.

Power generation from municipal waste is Shreda's future plan. Efforts still got wind of 1 MW power station in Dhaka's Keraniganj

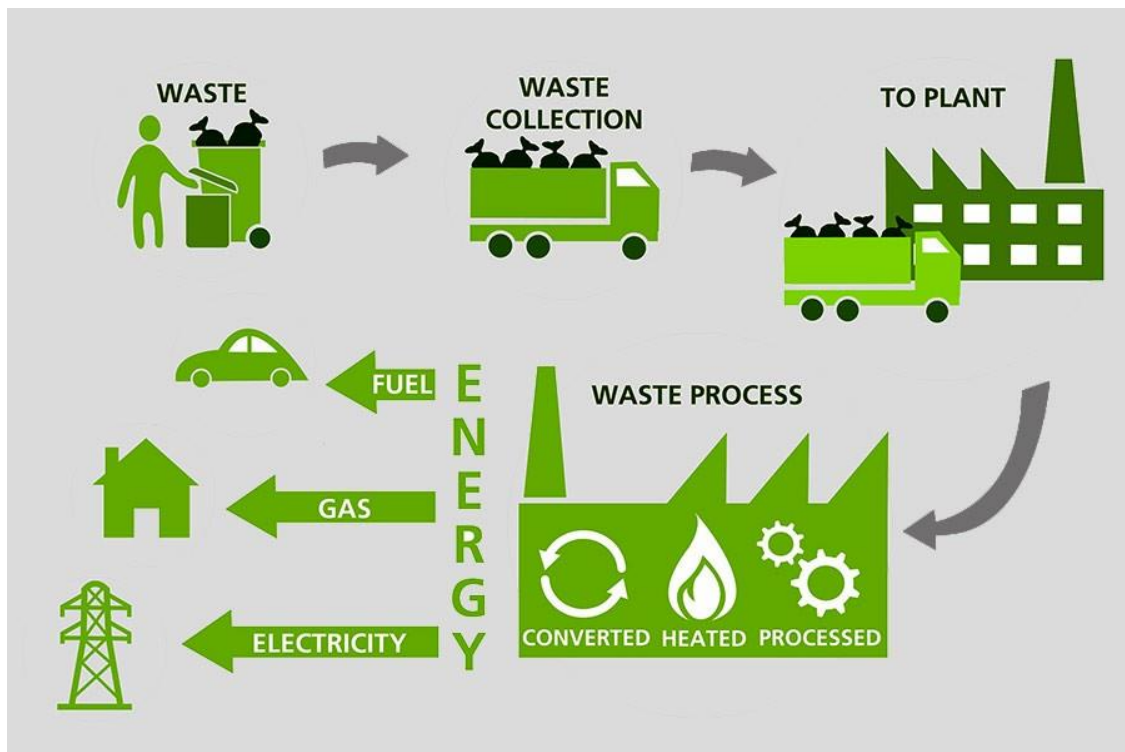


Figure 4.5.9: Electricity from waste

# Chapter 5

## Financing scheme and programs

**Introduction:** Apart from IDCOL's most successful SHS program, this reputed Government financial institutions to this point introduced many re-financing scheme and concerted programs to diversify the RE installations in areas like Biogas and Biomass based power and energy generation, Solar micro and mini-grid, solar irrigation and other forms of commercial scale RE projects. The lending terms of these different schemes are as follows.

### **5.1 RE financing scheme and programs:**

Apart from IDCOL's most successful SHS program, this reputed Government financial institutions thus far introduced many re-financing scheme and concerted programs to diversify the RE installations.

#### **5.1.1 Solar home system (SHS) Program:**

Under IDCOL SHS Program, IDCOL doesn't provide any loan on to the top users. All loans are being through the Participating Organizations (POs) as per the subsequent terms:

Table 5.1.1: Solar Home System Program Particulars

Particulars	Team Details	
Loan Amount	Up to BDT 250 M	80% of POs loans to households
	> BDT 250 M	70% of the POs loans to households
Tenure Including Grace	Up to BDT 250 M	Up to 7 years
	> BDT 250 M & <= BDT 500 M	Up to 6 years
	> BDT 500 M & <= BDT 100 M	Up to 6 years
	> BDT 1000 M	Up to 5 years
Interest Rate	Up to BDT 250 M	6% p.a.
	> BDT 250 M and <= BDT 500 M	7% p.a.
	> BDT 500 M and <= BDT 100 M	8% p.a.
	> BDT 1000 M	9% p.a.

### 5.1.2 Domestic Biogas Program:

Under the Domestic Biogas Program, IDCOL doesn't provide any loan on to the top users. All loans are going to be through the Participating Organizations (POs) as per the subsequent terms:

Table 5.1.2: Domestic Biogas Program

Particulars	Team Details
Loan Amount	80% of the POs loans to the households
Tenure Including Grace	7 years including 1 year grace period
Interest Rate	6% p.a.

### 5.1.3 Solar Irrigation Project

Table 5.1.3: Solar Irrigation Project

Particulars	Team Details
Loan Amount	Up to 50% of the Project Cost
Tenure Including Grace	8 years including up to 1 Year grace period
Interest Rate	6.00% p.a.

### 5.1.4 Solar Mini /Micro Grid Project:

Table 5.1.4: Solar Mini /Micro Grid Project

Particulars	Team Details
Loan Amount	Up to 40% of the Project Cost
Tenure Including Grace	10 years including up to 2 years grace period
Interest Rate	6% p.a.

### 5.1.5 Biogas Based Power Project:

Table 5.1.5: Solar Mini /Micro Grid Project

Particulars	Team Details
Loan Amount	Up to 80% of the Project Cost
Tenure Including Grace	Up to 8 years including up to 1 year grace period
Interest Rate	6% ~ 9% p.a.

### 5.1.6 Biomass Based Power Projects:

Table 5.1.6: Biomass Based Power Projects

Particulars	Team Details
Loan Amount	60% of the Project Cost
Tenure Including Grace	8 years including 1 year grace period
Interest Rate	6% p.a.

### 5.1.7: Other Renewable Energy Projects:

The lending terms for other solar/wind/hydro/other renewable energy projects i.e. solar diesel hybrid solution for telecom BTSs, solar-powered transportation, rooftop system , solar cold storage and dryers, battery charging stations, community biogas projects etc. are going to be as follows

Table 5.1.7: Different Renewable Energy Projects

Particulars	Team Details
Loan Amount	Up to 80% of the Project Cost
Tenure Including Grace	Up to 10 years including up to 2 years grace period
Interest Rate	6%~10%p.a.

However, large grid-tied renewable energy IPP projects will be financed on commercial terms and may also be eligible for a USD loan.



## **5.2 Bangladesh Bank Re-Financing Scheme:**

The financial institution launched the BDT 2bn green banking refinance scheme in August 2009 to line up solar array , bio-gas plants and industrial ETP (effluent treatment plant) under the scheme – to assist reduce industrial pollution and increase power supply. The fund has been named the “solar energy, biogas and effluent treatment plant sector refinance scheme”. The new more sectors are brought under the green banking refinance scheme to create environment-friendly economy,” Under the scheme, Bangladesh Bank is providing loans to commercial banks at interest rates from 5% to 12% for direct refinancing and credit wholesale to the entrepreneurs, who will then have access to banking company loans in those sectors at a maximum rate of an additional 5%. Overall interest rates won't exceed 12%, consistent with the fund’s conditions.

A maximum of 100% refinance facilities are going to be provided to the banks against their finance in fixing those plants in rural and concrete areas and effluent treatment plants for industries. Under the revised scheme, the banks can sanction up to BDT 40m loans for putting in effluent treatment plants. The limit was formerly BDT 10m. The banks are going to be allowed to supply loans in rural areas worth up to BDT 175,000 to put in home solar panels and BDT 150,000 for fixing solar mini grids.

For biogas power plants, loans from BDT 50,000 up to BDT 2.5m are often allocated for coordinated cattle farming under the scheme. For PET bottle reprocessing plants, LED bulb manufacturing plants and environment-friendly brick kilns, banks can provide credit up to Tk50m.

The scheme was undertaken in line with the government’s decide to meet 5% of the entire demand for electricity from green energy by 2015 and 10% by 2020. thus far Bangladesh Bank has included 26 new products under its revolving refinance scheme for solar power , biogas and effluent treatment plants to offer loans at low interest. The banks and FIs have already disbursed BDT 826bn as green financing during the amount from January 2012 to June 2014. The financial institution has brought 47 green products under its refinance scheme where 23 are green energy.

### **5.3 Area of the Scheme:**

Location: The urban and rural areas of Bangladesh.

Focus & Specification: Main focus is on “Households and Business Enterprise” to line solar power Panel, Solar Photovoltaic Plant, Bio-gas Plant and Effluent Treatment Plant

The scheme is allowed for 3 different sectors

- a) solar power
- b) Bio gas
- c) Effluent Treatment Plant.

### **Solar Energy:**

If individual sets solar array in his/her individual/joint apartments, commercial enterprise, cooperative societies or for familial purpose to get electricity by taking the finance from banks in urban/rural areas, he/she are going to be ready to get re-finance from this scheme.

The following sub-sectors also will be granted under this scheme:

Solar Home System

Solar Mini Grid

Solar Irrigation Pumping System

Solar Photovoltaic factory

The Capacity of Solar System:

It ranges from 10Wp to 50KWp.

Loan Range: Loan ranges from 10,000-6, 00, 00,000 taka.

The Eligible Entities:

Single/Joint Family,

Business Enterprise,

Cooperative Societies

**Interest Rate for Loan Holder:**

If Banks/Financial institutions provide loan on to the consumers, rate of interest will range from 8%-9%.

If Banks/Financial institutions provide MFI linkage, rate of interest will range from 11-12%.

**Loan Payment Period & Interest Calculation:**

Loan payment time ranges from 4 years to 10 years highest. Interest must be calculated in reducing balance method.

**Re-financial Loan Payment Period:**

Re-financial loan payment period ranges from 6 months lowest to 10 years highest.

**Debt-Equity Ratio:**

It will be supported the banker-consumer relationship.

## **Bio Gas**

If loan is taken from banks to supply and use bio-gas in rural and concrete areas, then the re-financial scheme are going to be applicable during this regard.

The following sub-sectors are going to be granted under this scheme:

To Set Bio-gas Plant in Existing Cattle/Poultry Firm

Combined Cattle Rearing and to line Bio-gas Plant

To Produce plant food from Slurry

To Set Medium Bio-gas Plant

### **Loan Range:**

Loan ranges from 25,000-25, 00,000 taka.

### **The Eligible entities:**

Single/Joint Family/ Enterprise are eligible to urge loan.

### **Debt-Equality Ratio:**

It will be supported the banker-consumer relationship.

### **Interest Rate for Loan Holder:**

If Banks/Financial institutions provide loan on to the consumers, rate of interest are going to be 9%.

If Banks/Financial institutions provide MFI linkage, rate of interest are going to be 11%.

### **Loan Payment Period & Interest Calculation:**

Loan payment time ranges from 3 months lowest to five years highest. Interest must be Calculated in reducing balance method.

## **5.4 Re-financial loan payment period**

Re-financial loan payment period ranges from 6 months lowest to 5 years highest.

## **5.5 Financing projects for energy efficiency and conservation enhancement activities**

### **5.5.1 Background:**

Sustainable and Renewable Energy Development Authority (SREDA)'s Energy Efficiency & Conservation plan up to 2030 sets a mid-term energy efficiency and conservation (EE&C) national target on reduce the country's energy intensity (energy consumption per production value) by 15% by financial year 2020/21, as compared with year 2013/14. to realize this goal, the program identifies five major interventions which are: (i) energy audit, (ii) EE&C building (iii) EE&C labelling (iv) EE&C finance, and (v) awareness raising. Energy Efficiency & Conservation Promotion Financing (EECPF) Project comprises the fourth pillar among the required interventions. the importance of implementing this EECPF Project is additionally outlined within the 7th Five Year Plan and EE&C Regulations of the govt of Bangladesh.

### **5.5.2 Project Overview:**

EECPF Project utilises a two-step loan (or financial intermediate lending) instrument for the aim of policy financing. SREDA extends low interest loan, using this fund, for people who are introducing energy efficient equipment, which are generally costlier than the traditional type equipment. By offering the advantage of lower financial cost, SREDA is encouraging the investors to pick out energy efficient equipment as compared with conventional equipment.

Once the borrower introduces energy efficient equipment which was acquired utilising this low interest loan, the borrower reports to SREDA energy consumption data through a delegated management system (MIS). SREDA aggregates and analyses the reported data to calculate energy conservation effect through the implementation of EECPF Project. along side other EE&C promotion activities initiated by SREDA, progress towards achievement of the set goal is being monitored and reported on regular basis.

### 5.5.3 Project strategy:

There are three executing agencies who are implementing EECPF Project, which are SREDA, Infrastructure Development Company Limited (IDCOL) and Bangladesh Infrastructure Financing Fund Limited (BIFFL). Among these three executing agencies, SREDA is that the administrative authority of the Project who is managing the general implementation arrangements. SREDA is additionally a technical node for the Project who is liable for identifying the eligibility of the energy efficient equipment and calculating the energy saving effect from the Project activities. to those ends, SREDA issues the business process manuals for Project implementation, and provides the MIS for data collection and calculation. IDCOL and BIFFL are the implementing financial institutions who extend low interest loan in line with the policies and procedures stipulated in SREDA's business process manuals. Both implementing financial institutions are provided the loan fund through the Finance Division of the govt . The currency fluctuation risk (between Japanese Yen and Bangladesh Taka) is borne by the Finance Division. The figure below illustrates the fundamental mechanism of the EECPF Project.

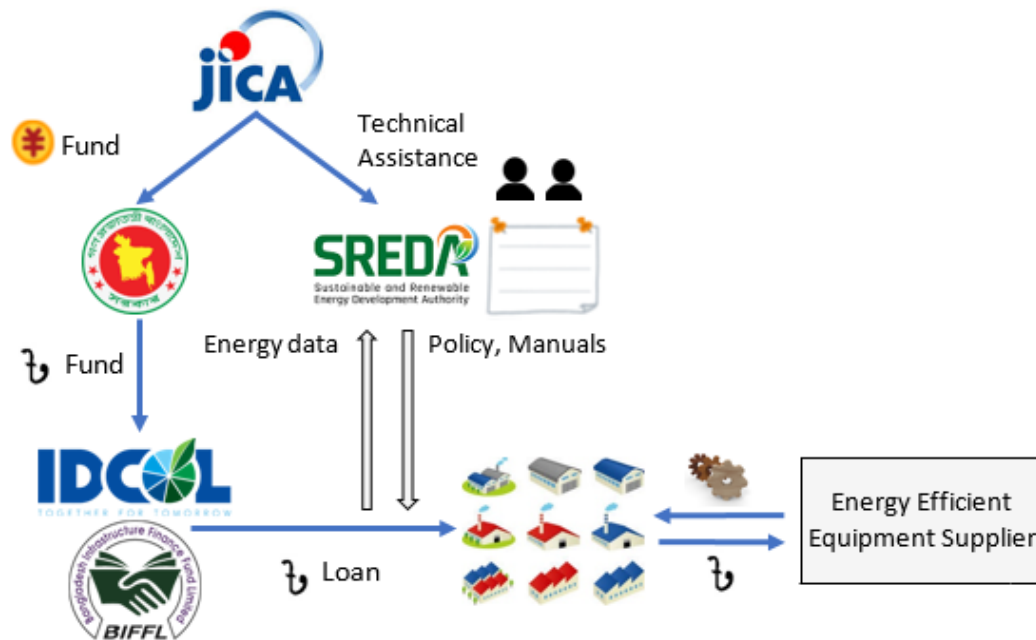


Figure5.5.3: Mechanism of Energy Efficiency and Conservation Promotion Financing Project

#### **5.5.4: Progress:**

As of June 2018, SREDA has given green light to extending low interest loan for seven sub-projects. Table below may be a list of the continued sub-projects which received SREDA's non-objection certificates (NOCs). The sub-project proponents are from various industry sectors including ready-made garment (RMG), spinning, cement manufacturing and residential appliances assembly. Eligible equipment applied for includes household appliance, boiler, cement mill, air conditioning , chiller, textile machine, compressor , among others. Energy saving effect (on process that the energy efficient equipment is being introduced) is calculated to be between 10 to 50%. The energy saving ratio varies because of differences in equipment, process and available baseline data. the amount of approved sub-projects are going to be increasing rapidly because the Project is now in full-swing implementation.

So far, for these seven sub-projects, quite 60% of the available fund money has already been allocated. With many applications being submitted, it's likely that the remaining 40% of the complete fund amount will be earmarked in due course. With considerations for the robustness of demand for this EECPPF Project loan, SREDA is currently seeking for extra resources for topping up the fund.

Table 5.5.4: List of Sub-projects under EECPPF Project

SI	Sector	Implementing Financial Institute (IFI)	Energy efficient equipment (examples)	Energy saving ratio
1	Ready-made garment	IDCOL	Direct drive sewing machine Once-through boiler	25%
2	Cement manufacturing	IDCOL	Vertical roller cement mill	34%
3	Ready-made garment	BIFFL	Direct drive sewing machine VRF air conditioner	50%
4	Spinning	BIFFL	Automatic winder Waste heat recovery & absorption chiller	50%
5	Spinning	BIFFL	PM motor-driven ring spinning frame Pneuma-less roving frame	11%
6	Spinning	BIFFL	Air-jet spinning machine Waste heat recovery & absorption chiller	22%
7	Home appliances assembly	BIFFL	Inverter controlled air compressor	20%

Note: As of June 2018

VRF: Variable Refrigerant Flow

PM: Permanent Magnet



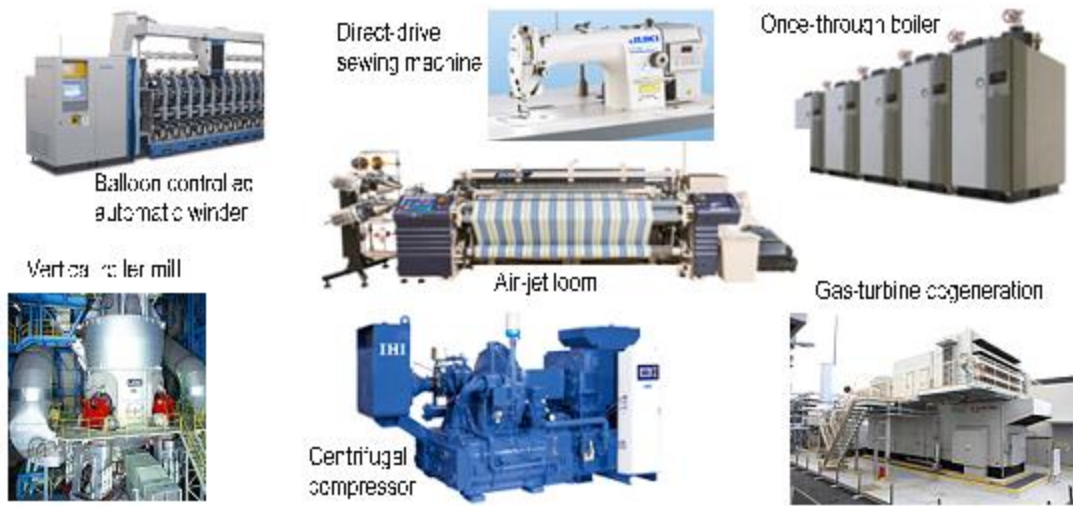


Figure5.5.4 : Examples of Energy Efficient Industry Equipment

Additional applications for the EECPF loan are coming to IDCOL and BIFFL from variety of companies during a sort of sectors. a number of the examples are: glass manufacturing, food processing, weaving, electronics, and so on. Upcoming applications include proposals to put in equipment like gas-turbine cogeneration equipment, heat reflective glass for building EE&C, centrifugal compressor , amorphous-core transformer, air-jet weaving machine, LED lights, etc.

### 5.5.5: Impact of fuel conservation:

Under assumption that every one of those seven sub-projects are fully operation, the expected annual energy saving was calculated to be 11,000 toe or 39,000 MWh. Assuming that the cost of 1 MWh of electricity is BDT 8,000, the entire cost saving from these seven sub-projects will add up to BDT 300 million annually.

Effect from seven approved sub-projects springs from allocating approximately 60% of the entire fund amount. Assuming that entire fund has been allocated, the effect are going to be 1.7 times the maximum amount because the current calculation. Effect from using the complete fund will therefore be calculated as 18,000 toe or 65,000 MWh, which amounts to approximately BDT 520 million per annum

It should be noted that the direct benefit which is calculated here is merely on energy bill cost. Additional benefits, by means of improved production efficiency, higher reliability of kit , factory space saving, emissions reduction, also are expected. Including these indirect benefits, the EECPE Project effect is probably going to be more that what's being exhibited within the next table.

Table 5.5.5: Expected Energy Conservation Effect of EECPE Project.

Name	Effect Form 7 Approved sub-Project	Effect from the entire fund amount
Energy	11,000 toe	18,000 toe
Conservation	=39,000 MWH	=65,000 MWH
Monetary team	BDT 300 million	BDT 520 million

### **5.5.6: Future prospects:**

Once the Government's Energy Audit Regulation comes into force, SREDA intends to integrate the EECPF Project implementation with the energy audit practice. By doing so, the EECPF Project may function as an incentive to market the conduct of energy audit. Likewise, the EECPF will take pleasure in the enforcement of the Energy Audit Regulation therein data submission will become a statutory mandate for the industry.

Further, SREDA also will encourage the implementation of Component III of this EECPF Project, which could be a mechanism to increase low interest loan for energy efficient home appliances purchase. to possess this realised, SREDA is promoting the introduction of energy efficiency star labelling programme.

Through the implementation of this EECPF Project, it absolutely was found that energy efficient equipment contributes not only to saving energy but also to improving production efficiency in broad terms. There also are cases where the energy efficiency equipment also brings forth better safety (notably with the case of once-through boiler). Such being the case, SREDA will enhance the EECPF Project scope in order that it'll cause benefits to a good range of industry.

## 5.6:100% Renewable Energy in Bangladesh

### 5.6.1 100% Renewable Energy Review

Bangladesh is among the five fastest growing economies within the world. Yet, the country's sustained economic expansion increased the energy demand and strains existing energy infrastructure. Keeping energy access reliable and on an occasional enough price to be affordable for everybody, has been a nonstop struggle over the past decades.



Figure5.6.1:Renewable energy process in house

In order to unleash the complete potential of Renewable Energy in and for Bangladesh, the planet Future Council, along side the Bangladeshi Organization Coastal Development Partnership and also the German development Organization Bread for the globe started the project “100% Renewable Energy for Bangladesh – Access to renewable energy for all within one generation” in 2018.

## 5.6.2 Activities of Renewable Energy

A series of multi stakeholder workshops happened in Dhaka in 2018, gathering participants from government, development Organization financing institutes, think tanks and civil society Organization. The participants discussed the feasibility of a transition to 100% RE, given necessary technology has a reasonable price. Given the densely populated territory of the Asian country , the choice of becoming a pacesetter in deploying floating RE technologies to harness Bangladesh's huge solar and off-shore wind potential was particularly discussed.

A study tour to the coastal region of Chittagong was conducted in early 2019 to experience the impact of global climate change on erosion of coastal land and riverbanks. People living in those areas got to frequently relocate, thanks to loss of their land. Leveraging the potential of portable energy systems and portable, electric cook stoves through enabling policy measures can play an important role in adapting to such extremes and within the technical study by ISF and subsequent policy recommendations.



Figure5.6.2.a: Activities Meeting Of Renewable Energy

Finally, unlocking the complete potential of RE for sustainable development and implementation of the Paris Agreement in Bangladesh requires donors to hitch efforts. Hence, a gathering of 25 German Parliamentarians and experts was held within the German Bundestag in June 2019 to share first-hand THE 100% Renewable Energy for Bangladesh – energy access for all within one generation” was launched in Dhaka, Bangladesh. The Minister of designing welcomed the study as a very important step in following abreast of the pledge made in 2016 in Marrakech by the 48 member states of the Climate Vulnerable Forum of which Bangladesh is a crucial member. Bangladesh Economy, but also to address the rising energy demand of citizens. Representatives from various ministries gave further insights into their deduct from the study.



Figure5.6.2.b: Activities Meeting Of Renewable Energy

### **5.6.3100% Renewable Energy for Bangladesh**

Access to renewable energy for all within one generation: This scientific feasibility study unveils that deploying 100% renewable energy in Bangladesh is possible and can provide access to reliable energy for all its citizens, while Increase to the level of industrialized countries by 2050. It proves that a renewable energy based system can create 1 million more jobs than the fossil fuel industry in the same timeframe

# CHAPTER 6

## CONCULATIONS AND REFERENCES

### CONCULATIONS:

On the basis of the findings of this review paper, the following conclusions are drawn.

1. Power sector in Bangladesh has seen a great improvement in the recent years. Power generation in this country is mainly dependent on non-renewable energy sources like gas, petroleum, coal etc. To meet the increasing energy demand, burning of fossil fuel has increased tremendously. This burning and release of CO<sub>2</sub> is a huge contributor to the greenhouse effect and climate change. Besides country's natural gas reserve is on the way of declination. Govt. of Bangladesh has already made some investments in the renewable energy. Of them solar and hydro energy are contributing most in our power sector. But their contribution in the national grid is not considerable.
2. Significance should be given on solar energy because it is the emerging renewable energy sector in Bangladesh which has vast potential to fulfill the majority of the country's energy demand. The government has already made an attempt to utilize more energy in near future from other renewable energy sources like wind, biogas, biodiesel etc. High initial cost, complexity, unpredictability are some challenges to implement renewable energy projects. The government and the private sector should work together to overcome those challenges. As the stock of fossil fuel is decreasing day by day, there is no alternative of put more emphasis on renewable energy sources to meet power demand locally

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