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FEASIBILITY ANALYSIS OF GRID CONNECTED PHOTOVOLTAIC SYSTEM FOR RUPPUR, BANGLADESH

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ABSTRACT
The smart grid is a suite of information-based applications made possible by increased automation of the electricity grid, as well as the underlying automation itself; this suite of technologies integrates the behavior and actions of all connected supplies and loads through dispersed communication capabilities to deliver sustainable, economic and secure power supplies. The focus of this paper is to familiarize with Smart Grid perspective to Bangladesh where the power system is very detailed, complex and quite aged. The agenda of this paper is to discuss about the significance and a detailed feasibility study of practical implementation of Smart Grid in Bangladesh. For the smart management system, we explore various management objectives, such as improving energy efficiency, profiling demand, maximizing utility, reducing cost, and controlling emission. We also explore various management methods to achieve these objectives. For the smart protection system, we explore various failure protection mechanisms which improve the reliability of the Smart Grid, and explore the security and privacy issues in the Smart Grid,

INTRODUCTION
In Bangladesh the increasing demands for energy has already exceeded the capacity from existing plants from conventional sources of energy. Thus access to electricity is very limited. Now solar photovoltaic PV) systems are being widely deployed in rural areas and large scale coverage in rural areas with renewable energy sources is being actively considered with mini-grid structure. As a way of addressing energyindependence, global warming and emergency resilience issues Smart grids are being promoted by many governments. The function of an Electrical grid is not a single entity but a combination of multiple networks and power generation companies with multiple operators employing varying levels of communication and coordination, which is manually controlled. An aim to bring a greater mass under electrification, major integrated power distribution programs have been undertaken in order to increase and improve power generation and customer service. Presently the following five organizations are responsible for the distribution of power--

- Bangladesh Power Development Board (BPDB)
- Rural Electrification Board (REB)
- Dhaka Power Distribution Company (DPDC)
- Dhaka Electric Supply Company (DESCO)
- West Zone Power Distribution Company (WZPDC)

SMART GRID PLATFORM IN BANGLADESH
The power system in Bangladesh is very complicated and quite mixed with lots of lacking. But, there are many scopes to convert the power grid of Bangladesh to the smart grid. It is the high time to initiate the plans to form grids which are more smart, receptive and flexible than present power grids as there is presence of power crisis and other problems. In Bangladesh, by increasing the usage of renewable resources the implementation of smart grid technology can be achieved. In prospective to the socio-economic condition of Bangladesh; smart grid will enable consumer empowerment to manage their energy usage and financial savings. In recent days, an interest is increasing rapidly about the small-scaled grid system based on Photovoltaic power generation. Such a grid system, which is called as micro grid, has advantages to increase an operational efficiency and economics when it is connected to grid or supply a secured electric power at islands, mountains and remote areas

PROPOSED SMART GRID
Our proposed smart grid model consists of a smart model of the Rooppurregion power system. The model includes different power stations there. It also included the simulated the output of this virtual designed smart power system. In our proposed system we tried to apply the local power system in our design and then simulated

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and also debugged the design that we find a case. We tried to find good efficiency and reduce the power loss and cut down the cost. We also given the practical data (from nearest substations) as input

A. Demand Response Applications

One of the major beneficiary of the smart grid systems can be Demand-side management. The key goal of demand-side management is to allow the utility company to manage the user-side electrical loads. A very popular component of demand-side management is developing incentives for the smart grid customer, such as residential home users, to modify their temporal use of electricity, for reducing the peak-to-average load on the grid. Incentives can come in the form of lower pricing or coupons, among others. Note that demand-side management is strongly connected to demand-response models, as the two concepts can generally be grouped under programs that seek to shape the demand and supply for a more efficient energy consumption in the smart grid.

B. Security In Smart Grid

A smart grid is a large-scale system that extends from power generation facility to each and every power consuming device such as home appliance, computer, and phone. This large-scale nature has increased the possibilities of remote operation of power management and distribution system. With energy being a premium resource, ensuring security against theft, abuse, and malicious activities in a smart grid is of prime concern. The challenges of ensuring cyber security in a smart grid are diverse in nature due to the diversity of the components and the contexts where smart grids are deployed. Deploying a smart grid without strong and diligent security measures can allow advanced cyber-attacks to remain undetected, which can eventually compromise the entire system.

SITE SELECTION & FEASIBILITY ANALYSIS

Ruppur is suitable for this Smart Grid because the temperature, wind speed, solar radiation, humidity, atmospheric pressure is better than other places of Bangladesh.

According to NASA latitude of this place is 24.4 and longitude is 88.6. This place is selected because it is very hot and humid which is very important for photovoltaic power system. The heating design temperature is 13.9 degree Celsius, cooling design temperature is 32.0 degree Celsius and earth temperature amplitude is 16.1 degree Celsius. The temperature of this area is high and sun light stays for long. So it is an advantage for photovoltaic system.

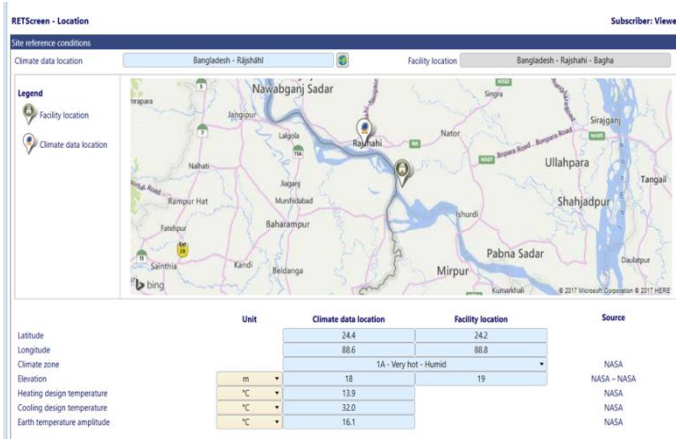

Fig-1:Site selection

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Month	Air temperature	Relative humidity	Precipitation	Daily solar radiation - horizontal	Atmospheric pressure	Wind speed	Earth temperature	Heating degree-days 18 °C	Cooling degree-days 10 °C
	°C	%	mm	kWh/m²/d	kPa	m/s	°C	°C-d	°C-d
January	18.9	52.1%	15.05	4.32	100.9	1.8	20.6	0	275
February	22.3	46.6%	19.41	5.25	100.7	2.1	25.2	0	345
March	26.6	44.4%	45.88	5.95	100.3	2.2	30.1	0	516
April	27.7	62.8%	75.03	6.33	100.0	2.6	30.6	0	532
May	27.7	77.6%	205.81	5.74	99.7	2.7	29.7	0	547
June	28.1	84.4%	328.63	5.04	99.4	2.6	29.2	0	544
July	28.0	86.2%	387.57	4.41	99.4	2.3	28.7	0	557
August	27.9	85.5%	344.98	4.36	99.5	2.0	28.6	0	555
September	27.1	84.8%	336.02	4.03	99.9	1.9	27.7	0	512
October	25.1	79.4%	151.47	4.42	100.4	1.6	25.7	0	468
November	22.0	67.5%	15.28	4.46	100.7	1.6	22.4	0	359
December	19.6	56.4%	3.61	4.21	100.9	1.7	20.6	0	299
Annual	**25.1**	**69.1%**	**1,928.74**	**4.87**	**100.1**	**2.1**	**26.6**	**0**	**5,509**
Source	NASA	NASA	NASA	NASA	NASA	NASA	NASA	NASA	NASA
Measured at					m	10	0		

Fig-2: Feasibility rate

According to NASA feasibility rates are better in Rooppur than other places in Bangladesh. Nuclear power plants (proposed) also placed in Rooppur. The annual average airtemperature of this place is 25.1, Relative humidity 69.1%, Solar radiation 4.87%, Atmospheric pressure 100.1, wind speed 2.1, Earth temperature 26.5 degree Celsius. The daily

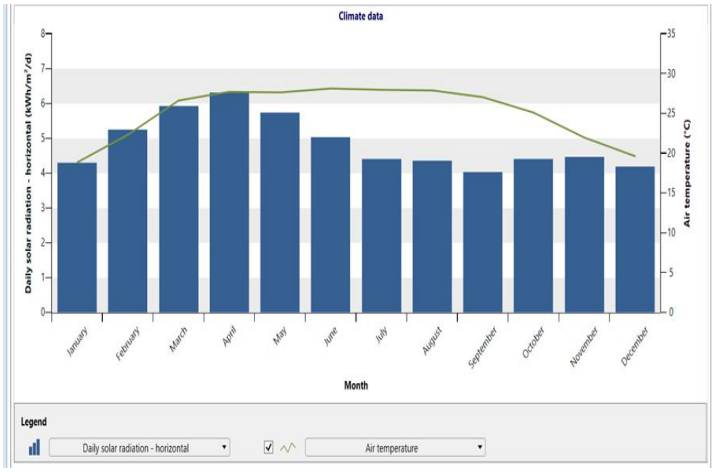

Fig-3:Solar radiation for a year.

Better Solar radiation and well temperature is the great opportunity for Smart Power Grid. Better Solar radiation and well temperature is the great opportunity for Smart Power Grid.

COST ANALYSIS

They are might be 5 acres for 1 Megawatt power plant, according to the cost of Rooppur area it is nearly 25000$. Workers and engineers will cost nearly 25000$ and 625000$. Solar panels will cost 5$ per kw. [10].so for 1 megawatt it will cost 5000$. The transformer and cable cost nearly 75000$ (www.commodities-new.com). The building cost, transport cost, equipment cost etc. must be 610000$. So for 1 Megawatt power plants it will cost nearly 1590000$.In photovoltaic system for 1 megawatt power plant capacity factor is 20%, (capacity factor= actual energy produced/maximum load*time) Number of units 164 (load), initial cost per kilo watt 1,590$, annual savings 420$ per kilo watt. The initial cost of photovoltaic system is high but It willdecrease day by day. So this system is cheaper than other The main purpose of photovoltaic system is to save the annual cost and increase power. In Bangladesh there are hydro, gas, coal power plants. As an example coal power plant produced power by burning coal and the cost of this is five dollars for one kilo watt power. So for one megawatt we need fifty thousand dollars per year. On the other hand, we also need large coal burner, large amount of man power and other safety facilities. In photovoltaic system we don't need to burn coal and n need burners to produced power and it totally safe.

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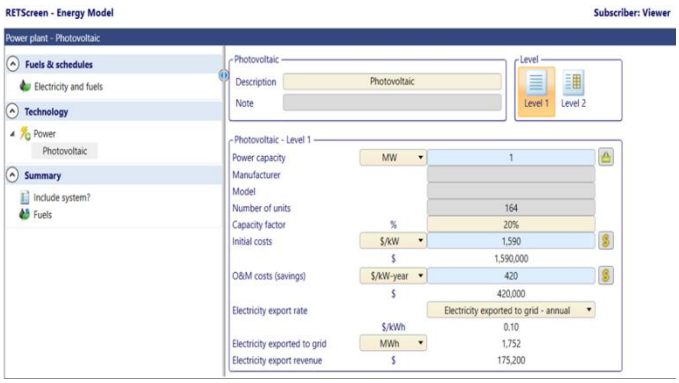

Fig-5:Cost Analysis

There is less losses than other system. So annually safe fifty thousand dollars is huge for a power plant with better power generation.

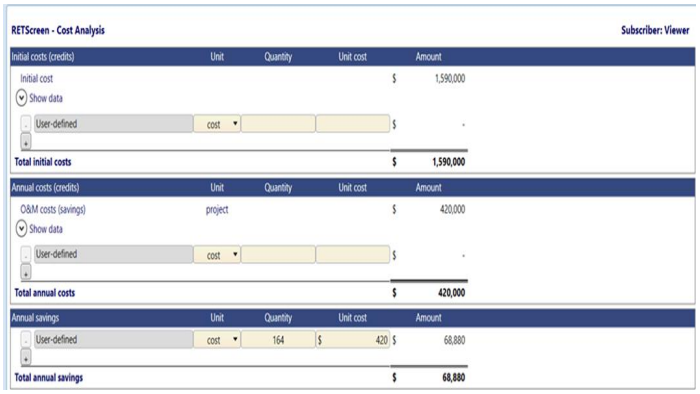

Fig-6:Savings

RESULTS

In photovoltaic system although the initial cost is high but the cost of running the system is low therefore the risk of the system is low as well. Payback period of the system is as low

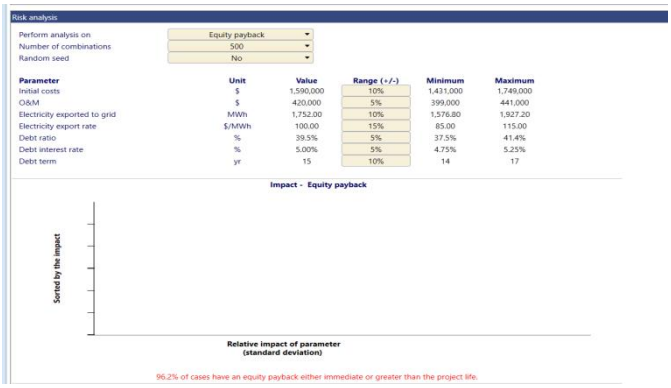

Fig-7:Risk analysis

as just 4 years so the profits can be earned very quickly. If the system is made using coil, then a burner is required and the costs also increases. Maintaining costs increase, feasibility of the system decreases and more manpower is required.

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CONCLUSION

The power sector of Bangladesh is mainly dependent on natural gas. But the gas supply is decreasing day by day as no new reserve could be discovered and hence the country is suffering a severe power crisis. To minimize the power shortage Government has taken short term plan, on an emergency basis. Under this plan, rental and quick rental power plants are installed using diesel and high Sulphur fuel oil (HSFO). The average cost of un-served energy from quick rental power plants is $0.344/kWh. The cost of energy for our proposed system is $0.200/kWh and it will be feasible to install our proposed system in Bangladesh. So our government should increase power generation from renewable sources instead of other conventional sources. If we can generate significant amount of power from photovoltaic sources, then it will not be necessary to hike the price of electricity so frequently and in this process emission of significant amount of CO2 and other greenhouse gases can be reduced.

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