SYNDICATE – 06

WILL SOLAR ENERGY BE A PROPER SOLUTION FOR ENERGY CRICIS IN SRI LANKA

FACULTY OF DEFENCE AND STRATEGIC STUDIES

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DS COMMENT

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ABSTRACT

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LIST OF ABBREVIATIONS

CHAPTER ONE

INTRODUCTION

1. Solar Energy is controlled directly from the sun, though' slightly throughout cloudy weather. Alternative energy is employed worldwide and is more and more common for generating electricity or heating and desalinating water.

SOLAR POWER IS GENERATED IN 2 MAIN WAYS

2. Photovoltaics (PV), also known as solar cells, square measure electronic devices that convert daylight directly into electricity. the trendy electric cell is probably going a picture the majority would recognize - they are within the panels put in on homes and in calculators. Today, PV is one amongst the fastest-growing renewable energy technologies and is prepared to play a serious role within the future international electricity generation combine.

3. Solar PV installations is combined to produce electricity on an advertisement scale or organized in smaller configurations for mini-grids or personal use. exploitation solar PV to power mini grids is a superb thanks to bring electricity access to those that do not live close to power transmission lines.

4. The cost of producing star panels has plummeted dramatically within the last decades, creating them a reasonable style of electricity. star panels have a lifetime of roughly twenty-five years and are available in kind of shades counting on the sort of fabric employed in producing.

NET-METERED COMES OR SMALL POWER PRODUCERS

5. The net-metering theme, that was introduced in 2010 continued to serve the star PV upside business with massive scale implementation across the country.

6. On September 6, 2016, the govt. launched Associate in Nursing increased version of the upside star PV Program below the theme “Sooryabala Sangramaya” that converts to “Battle for solar Power”. below this programmed, excess energy exported to the grid will either be carried forward (as originally exhausted the net-metering theme) or sheathed (this scheme is known as net-accounting), at a tariff of LKR twenty-two per kWh throughout the primary seven years and LKR fifteen per kWh throughout the remaining 13 years.

7. The programmed makes an attempt to encourage institutional users through a 3rd theme, called the small power producers’ theme, wherever all generation is exported through a separate export meter while not creating any modification to the electricity users metering methodology. With the numerous reductions of value of solar PV elements, the service suppliers have quickly touched to faucet massive industrial

customers WHO own massive buildings with sensible roofs for star PV systems. The following could be a list of merchandise power-driven by daylight, either directly or through electricity generated by Solar Panels.

CHAPTER TWO

SOLAR ENERGY PROCESS

8. Solar energy captures energy from the sun and converts it into electricity for your home or business. Our sun is a natural nuclear reactor. It releases tiny packets of energy called photons that travel 93 million kilometers from the sun to earth in about 8.5 minutes.

WHAT IS SOLAR PROCESS?

9. SHIP stands for Solar Heat for Industrial Processes and describes systems that provide solar heat in a factory. A collector field heats a process liquid by means of solar radiation and a heat exchanger transfers this heat in the form of hot water, heat flows, to a power grid or a production process in the plant by means of air or steam.

HOW SOLAR ENERGY WORKS (STEP BY STEP)

STEP 1: Sunlight activates the panels.

Figure 2.1: A rack-and-panel solar system

10. Each individual panel/plate consists of a layer of silicon cells, a metal frame, a glass showcase that is surrounded by a special foil and wiring. For maximum impact,

the panels are grouped in "paintings" and placed on roofs or in large outdoor areas. Solar cells, also called photovoltaic cells, absorb sunlight during the day.

STEP 2: The cells produce electrical current.

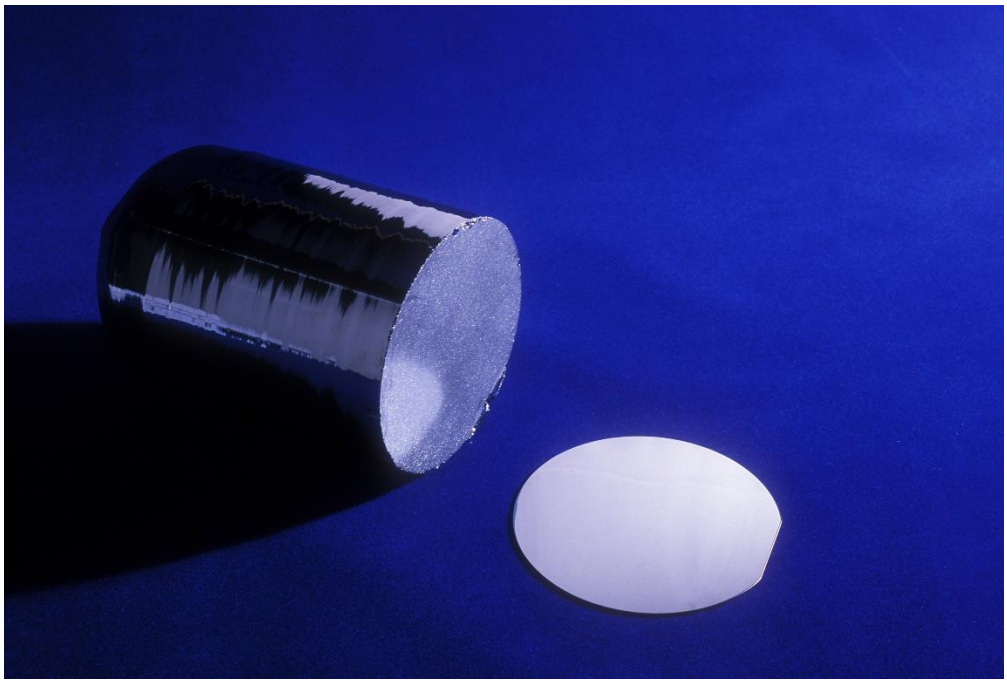


Figure 2.2: A silicon ingot and wafer

11. In each solar cell there is a thin semiconductor wafer made of two silicon layers. One layer is positively charged and the other negatively charged and forms an electric field. When light energy from the sun hits a photovoltaic solar cell, it powers the cell and causes electrons to "detach" from atoms in the semiconductor wafer. These free electrons are set in motion by the electric field surrounding the wafer, and this motion creates an electric current.

STEP 3: The electrical energy is converted

Figure 2.3: A solar inverter. Image provided by SMA Solar Technology AG

12. you now have solar panels that work efficiently to convert sunlight into electricity. however, the electricity produced is called direct current this is not the type of electricity that powers most homes. fortunately, dc power can easily be converted to ac power by a device called an inverter. in modern solar systems, these inverters can be configured as one inverter for the entire system or as individual microinverters installed behind the panels.

STEP 4: The converted electricity powers your home.

Figure 2.4: A solar microinverter

13. Once solar energy has been converted from direct current to alternating current, it flows through your electrical panel and is distributed throughout the house to power your devices. It works the same as the electricity your utility company generates from the grid, so nothing in the house has to change. Since you are still connected to your traditional utility company, you can automatically draw additional electricity to supplement solar grid shortages.

STEP 5: A net meter measures usage.

Figure 2.5: A smart electric meter

14. On a cloudy day and at night, your shingles or solar panels may not catch enough sunlight to generate power. Conversely, in the middle of the day when no one is home, excess energy can be collected - more than what you need to run your home. This is why a meter is used to measure the amount of electricity flowing back and forth - to and from your home. Your utility company often provides credits for excess electricity that you send back to the distribution grid. This is called the net measure.

CHAPTER THREE

IMPORTANCE OF SOLAR ENERGY

14. One of the foremost distressing problems with nowadays is that the rising price of energy. Energy prices on the increase as Earth's resources being depleted very little by little. Luckily, technology has provided new resources from natural entities, like solar power. If you're searching for ways that to include the benefits of solar energy into your home, confer with your renewable energy company and use these concerns to assist you take a point.

ENVIRONMENTAL

a. **Helps the environment**. Solar energy is one amongst those renewable resources that's nice for the setting. once you work with a renewable energy company, you're obtaining your power from renewable resources, solar power being one amongst them. this sort of energy doesn't manufacture greenhouses gas and it doesn't foul water or air. it's self-sufficing and an honest thanks to give energy to your home or business.

ECONOMICAL

a. **Electricity price independence.** When you work with a regular utility company, your costs probably on the increase in the least times. however, once you on the grid with a renewable energy company, you have got a lot of steadier rates. They use renewable energy like solar power, which helps level the rates. Plus, they solely charge you for what you employ and not variable rates that in impact with different electricity suppliers.

b. **Solar energy creates jobs.** When you support renewable energy corporations, you're making jobs that cause the installment of systems that make a lot of energy from renewable resources. It's a positive cycle that you simply will extremely stand behind. The lot of human that use renewable resources, the lot of human the businesses can have to be compelled to sustain the clean energy systems.

c. **Domestic choices.** When it involves renewable energy resources, you'll be able to be assured that your house is being power-driven through domestic energy production. solar power and different renewable resources that make your power once you're with a renewable supplier all come back from right here. You don't have to be compelled to take energy from

another a part of the globe so as to urge what you wish. That conjointly helps keep the costs down and at steadier levels.

d. **More causes for underutilized land.** Using renewable resources like alternative energy can cause there to be a lot of reason to use land that has been underutilized yet. Most areas still have plenty of land if you look from the massive cities which land is being employed for nothing. With renewable resources live, that land will produce nice worth.

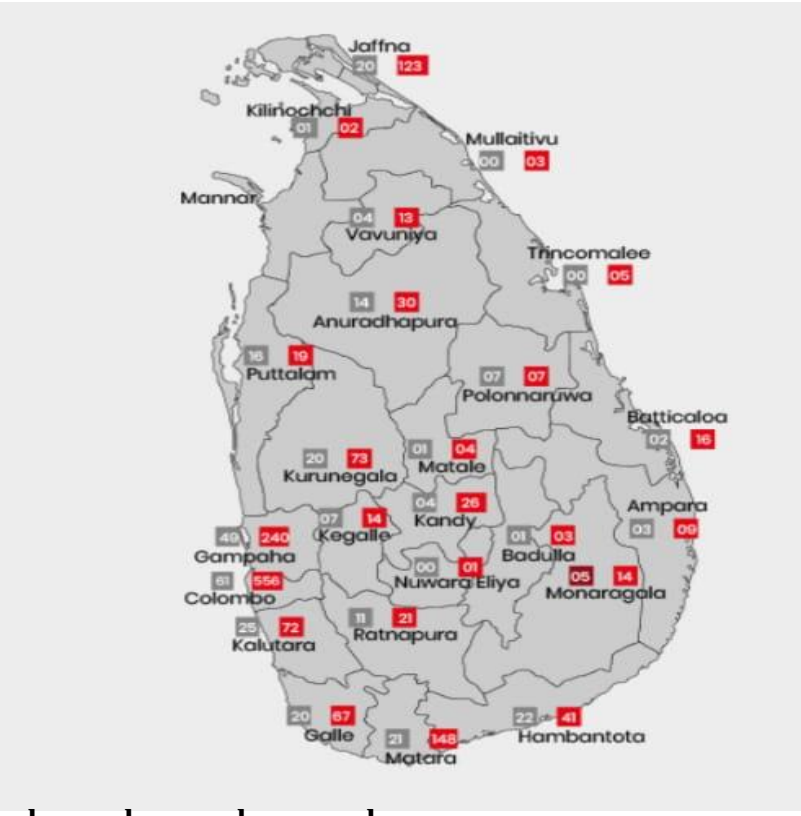
CHAPTER FOUR

CURRENT SITUATIONS

LARGE PROJECT

15. Solar energy is the energy derived from the sun through the form of solar radiation. A partial list of other solar applications includes space heating and cooling through solar architecture, daylighting, solar hot water, solar cooking, and high-temperature process heat for industrial purposes.

16. Most hydroelectric and thermal/fossil fuel-based power stations in the country are owned and/or operated by the government via the state-run Ceylon Electricity Board , while the renewable energy sector consists mostly of privately run plants operating on a power purchase agreement with the CEB.



Places where solar panels proceed

a. **<u>Hambanthota Solar Power Station.</u>** The Hambantota Solar Power Station is the first commercial-scale solar power station in Sri Lanka. The photovoltaic solar facility was constructed in Buruthakanda, in the Hambantota District.

i. Site area
ii. 40,000 m2 (430,000sq ft)
iii. Power generation
iv. Nameplate capacity
v. 1,237 kW
vi. Annual net output
vii. 1,700 MW h

1. The facility will be built in two phases, the first phase will have a capacity of 737 kW (kW), the second phase will have a capacity of 500 kW, and the construction cost of the first phase of 737 kW is expected to reach Rs 10.224 billion. Funding is provided by the Government of Japan. The second stage exceeds the price of Rs. 627 million rupees. The South Korean government and the rupee will provide 513 million rupees. 114 million people will be taken over by the local government. The second phase subcontractor is SunPower Systems (Pvt) Ltd. The entire 1237 kW facility was completed at the end of 2012 and will have an annual capacity of up to 1.7 gigawatt-hours (GW), with 1 GWh in the first phase and 0.7 GWh in the second phase. The generated electricity will be sold to the state energy company Ceylon Electric Power, and the proceeds will be used to develop local electrification projects.

b. **<u>Welikanda Solar Power station.</u>** The Solar One Ceylon Power Station is a megawatt solar photovoltaic farm built in January 2017 at Welikanda, in the Polonnaruwa District of Sri Lanka. The solar farm utilizes 315W and 320W polycrystalline modules manufactured by JA Solar Holdings, which are installed over 624 single-axis solar trackers supplied by the Spanish firm Grupo Clavijo. The solar farm is expected to produce approximately 20,000 MWh annually.

Technical Specifications

Plant Capacity	10MW
Annual Energy	23GWh
Project Location	Welikanda,Sri Lanka
PV Modules	315Wp & 320Wp Polycrystalline
Inverter Stations	10Nos, Central 1000kW
Tracker System	Single-Axis Tracking

Figure 4.2: Welikanda Solar Power station.

c . <u>Vavuniya Solar Power Station</u>. According to the competitive bidding procedure of "Soorya Bala Sangramaya Phase II", the 1MW solar power plant plans to build 60 solar power plants (1MWp x60) based on construction, ownership and operation. Developed with Vavuniya. The single-axis tracker system will install a total of 2,760nos, 360W double-sided solar modules. The factory is located on 5 acres of land. The plant will provide 1.729 GWh of electricity to the State Grid.

Technical Specifications

Plant Capacity	1MW
Annual Energy	1.7GWh
Project Location	Vavunia, Sri Lanka
PV Modules	360Wp Bi-Facial
Inverter Stations	7Nos, String 125kW
Tracker System	Single-Axis Tracking

Figure 4.3: Vavuniya Solar Power Station

DOMESTIC PROJECTS IN SRI LANKA

17. Nowadays people are tempted to use solar panels. A large percentage of the urban population is in favor of it. Due to the high initial cost, the government will provide a loan at a concessionary interest rate

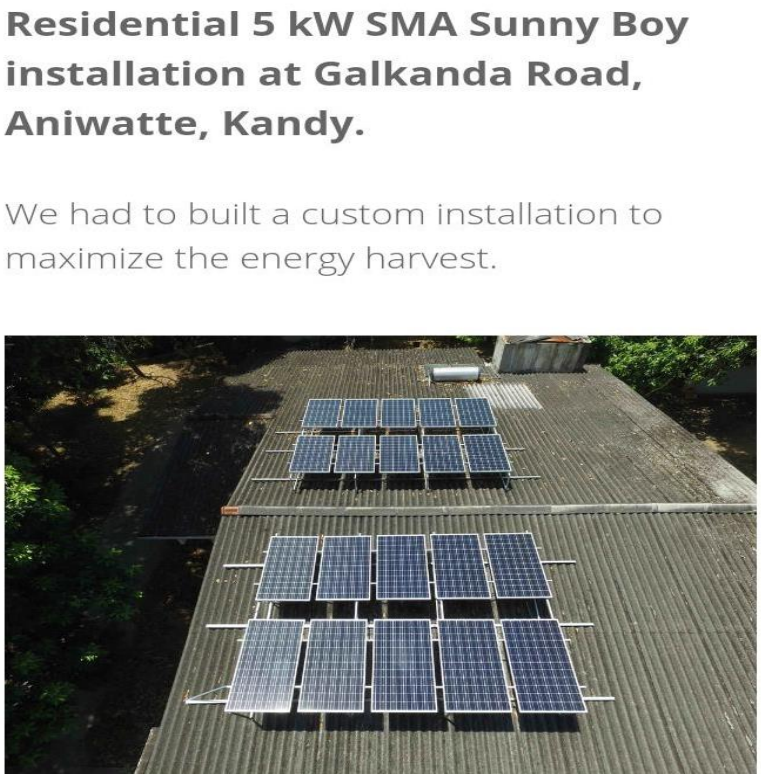


Figure 4.4: Aniwatte solar power station

Residential 1.5 kW SMA Sunny Boy installation at Gampola.

Figure 4.5: Gampola solar power station

Sinhaputhra Finance PLC 50KW Phase 1

50 KW Grid Tie inverter system installed at Sinhaputhra Finance PLC with 200 panels of 250Watt each and three SMA STP 17000TL inverters

Figure 4.5: Sinhaputhra finance solar power station

Residential 10KW SMA Sunny Boy Installation in Aruppola, Kandy.

Inverter Installation with
2 SMA Sunny Boy 5000-TL21 Inverters

Figure 4.6: Aruppola solar power station

CURRENT PRICES OF SOLAR PANELS IN SRI LANKA

Approx. CEB Bill/month Rs.	Capacity	Price Rs
3,000 - 6,000	2.0 kW	435,000
3,000 - 6,000	2.0 kW	480,000
6,000 - 11,000	3.0 kW	632,000
6,000 - 11,000	3.0 kW	685,000

CHAPTER FIVE

ADVANTAGES & DISADVANTAGES

ADVANTAGES

a. Renewable energy source. Renewable energy supply among all the advantages of solar panels, the important is that alternative energy could be a renewable energy supply. It is controlled all told areas of the Sri Lanka and is accessible a day. we tend to cannot run out of alternative energy, in contrast to several the opposite sources of energy. Solar energy is going to be accessible as long as we've got the sun, so daylight are going to be obtainable to United States of America for a minimum of five billion years once consistent with scientists the sun goes to die.

b. Reduces Electricity bill. Since you may be meeting several energy desires with the electricity your scheme has generated, your energy bills can drop. What proportion you save on your bill are going to be obsessed with the dimensions of the scheme and your electricity or heat usage. Moreover, not solely can you be saving on the electricity bill, however there's conjointly a break to receive payments for the excess energy that you just export back to the grid through the Smart Export Guarantee (SEG). If you generate a lot of electricity than you utilize (considering that your solar array system is connected to the grid)

c. Numerous Applications. Solar energy is used for numerous functions. you will be able to generate electricity (photovoltaics) or heat (solar thermal). Alternative energy is wont to turn out electricity in areas while not access to the energy grid, to distil water in regions with restricted clean water provides and to power satellites in house. Solar energy also can be integrated into the materials used for buildings. Shortly past Sharp introduced clear alternative energy windows.

d. Low Maintenance prices. Solar energy systems typically do not need loads of maintenance. You simply ought to keep them comparatively clean, therefore improvement them a few of times p.a. can do the task. If unsure, you will be able to perpetually believe specialized improvement firms, which provide this service.
Most reliable solar array makers provide 20-25 years pledge.

1. Also, as there are not any moving elements, there is no wear and tear. The electrical converter is typically the sole half that must be modified once 5-10 years because of its endlessly operating to convert alternative energy into electricity and warmth (solar PV vs. star thermal). except the electrical converter, the cables conjointly would like maintenance to confirm your alternative energy system runs at most potency. So, once covering the initial value of the scheme, you will be able to expect little defrayment on maintenance and repair work.

e. **Technology Development.** Technology within the alternative energy trade is consistently advancing and enhancements can intensify within the future. Innovations in physics and applied science will doubtless increase the effectiveness of star panels and double, or perhaps triple, the electrical input of the alternative energy systems.

Disadvantages

a. **Cost.** The initial cost of purchasing a solar system is very high. This includes solar panels, inverters, batteries, wiring and installation costs. Therefore, the Sri Lankan economy cannot invest so much money.

b. **Weather-Dependent.** Although solar energy can't collect during cloudy and rainy days, So the efficiency of the solar system reduces. Solar panels are dependent on sunlight to effectively gather solar energy.

c. **Solar Energy Storage Is Expensive**. To storage the solar energy required lot of batteries. So, these batteries are very high cost in economy market. and companies which product solar batteries are very limited. So, they increase their product prizes always.

d. **Uses a Lot of Space**. Solar PV panels require a lot of space and some roofs are not big enough to fit the number of solar panels that you would like to have. When we want more solar energy, we have to use lot of solar panels. Therefore, we want large horizontal lands to do it. As well as, these areas haven't any kind of blocks which reduce the sunlight.

e. **Inefficiency.** According to the second law of thermodynamics, solar cells will never reach 100% efficiency. The maximum efficiency is 85%, when mirrors and motors are following the sun. Most solar panels on people's houses convert only 14% of their available energy into power. So, it is insufficient to heavy works in home.

f. **Panel Deterioration**. With the time, solar panels gradually become damaged by ultraviolet radiation. Rain, snow, dirt, temperature fluctuations, hail and wind. Therefore, we have to fix and replace solar panels. So, the cost of reinstall process is very high.

g. **Environmental Pollution.** A few of the more elements contained in panels and associated equipment include

i. cadmium. - When sealed inside solar panels, cadmium is harmless. Panels must be disposed with very care when leeching into environment.

ii. lead. Batteries, - specifically deep-cycle, lead-acid batteries, are required by solar arrays to ensure a constant supply of electricity. But these batteries very harmful to the environment. As an example, Lead has been found to cause a number of impairments in children, including developmental disabilities.

CHAPTER SIX

CONCLUSION

18. A solar panel works by allowing photons, or particles of light, to knock electrons free from atoms, generating a flow of electricity. Solar panels actually comprise many, smaller units called photovoltaic cells. (Photovoltaic simply means they convert sunlight into electricity.) Many cells linked together make up a solar panel. The most broadly utilized types of energy originate from non-inexhaustible and limited sources, for example, petroleum derivatives that give us coal, flammable gas and oil. Aside from being non-sustainable, these wellsprings of energy additionally pollute the environment and cause boundless annihilation of regular living spaces. In such a situation, it is turning into a major issue to discover alternative energy sources that won't harm the environment yet give enough capacity to meet the world's energy requirements. Sun based energy is a modular innovation, which implies that you can introduce quite a few boards relying upon your necessities and requirements. Utilizing sun-based force significantly reduce your power bill, even totally disposing of it if your sunlight-based establishments are sufficiently large.

19. Though this seems like a profitable and cost reducing project, these systems are hard to implement in a country like Sri Lanka. Because the initial cost that comes under this project is kind of hard to bear if we introduce this system household. As we can observe the houses which are having solar systems are having some kind of wealth. So that shows us the installation cost is too much. But this system can be implemented for bigger buildings which uses for business purpose as they can redeem the cost for the installation through their profit. But they have to keep the line connected to CEB alive in cause of failure of this system.

20. Since Sri Lanka is a tropical country, we can’t be certain about we get quite enough amount of sunlight through the year, weather is unpredictable and this kind of system hard to implement in the hill country area which they get high rainfall throughout the year. It seems this system should work well in the dry zone. But the energy obtain from that area won’t be enough. Well to add enough amount of national grid we can take some land and build a large scale of solar panel plantation. There will e some issue arises when obtaining land for this project as they have to obtain land from public to this project. They won’t donate their land even they receive a better deal. Because they have been own those lands from generations. So that solution is not suitable for a country like Sri Lanka.

REFERENCES