A COMMUNITY SERVICE PROJECT REPORT

ON

"EFFECTIVE UTILISATION OF SOLAR ENERGY FOR DOMESTIC AND COMMERICAL PURPOSES"

Submitted in partial fulfillment of the requirements for the award ofthe degree

BACHELOR OF TECHNOLOGY

In

ELECTRONICS AND COMMUNICATION ENGINEERING

by

BONDILLI SANDEEP SINGH (20021A0405)
BOKA JO SAI ARUN (20021A0406)
PENUMAKA VANDANA (20021A0407)
REGULLA AKHILESH KIRAN (20021A0408)

UNDER THE GUIDANCE
OF
DR.K.RAMA DEVI M.E, Ph.D.

Assistant Professor of
Electronics and Communication Engineering

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMUS)
Jawaharlal Nehru Technological University, Kakinada
Kakinada-533003, Andhra Pradesh, INDIA

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS), JNTU KAKINADA

CERTIFICATE

This is to certify that the Community Service Project Report entitled **"EFFECTIVE UTILISATION OF SOLAR ENERGR IN DOMESTIC AND COMMERCAL PURPOSES"** is being submitted by B.Sandeep Singh (20021A0405), B.Jo Sai Arun(20021A0406), P.Vandana (20021A0407), R.AkhileshKiran (20021A008), in partial fulfillment for the award of the Degree of Bachelor of Technology in Electronics And Communication Engineering of University College of Engineering Kakinada (Autonomous), JNTU Kakinada, for the record of bonafide work carried out by them.

SIGNATURE OF THE SUPERVISOR ***SIGNATURE OF THE H OD***

DR.K.RAMA DEVI M.E,Ph.d Dr.N.Balaji

Community Service Project Report

Submitted in accordance with the requirement for the degree ofBachelor of Technology

Name of the College	University College of Engineering Kakinada
Department	Electronics and Communication Engineering
Name of the Faculty Guide	DR.K. RAMA DEVI
Duration of the CSP	From 07.09.2022 To 21.01.2023
Name of the Student's	B.Sandeep Singh (20021A0405) B.Jo Sai Arun (20021A0406) P.Vandana (20021A0407) R.Akhilesh Kiran (20021A0408)
Programme of Study	B.Tech
Year of Study	III Year
Date of Submission	27.02.23

STUDENT'S DECLARATION

We, student of B.Tech Program, B.Sandeep Singh (20021A0405), B.Jo Sai Arun(20021A0406), P.Vandana (20021A0407), R.AkhileshKiran (20021A008) of the Department of **Electronics and communication Engineering**, University College of Engineering Kakinada, do hereby declare that, We have completed the mandatory community service project from 07/09/2022 to 21/01/2023 in Kakinada under the Faculty Guidance of Dr.K. Rama Devi, Assistant professor ,Department of Electronics and communication Engineering in University College of Engineering Kakinada.

(Student Signature and Date)

B.Sandeep Singh (20021A0405)

B.Jo Sai Arun (20021A0406)

P.Vandana (20021A0407)

R.Akhilesh Kiran (20021A0408)

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We would like to express our heartfelt thanks to AICTE for giving us the beautifulopportunity to do a community service project.

We would like to acknowledge that this project was successfully completed entirely by us.

BONDILI SANDEEP SINGH (20021A0405)
BOKKA JO SAI ARUN (20021A0406)
PENUMAKA VANDANA (20021A0407)
REGULLA AKHILESH KIRAN (20021A0408)

ABSTRACT

- The main purpose of this project is to research and explore about the solar energy which has more advantages now a days.
- Energy comes in different forms. Light is a form of energy. So is heat. So is Electricity. Often, one form of energy can be turned into another. This fact is very important because it explains how we get electricity, which we use in so many ways. Electricity is used to light streets and buildings, to run computers and TVs, and to run many other machines and appliances at home, at school, and at work. One way to get electricity is from coal. This method for making electricity is popular. But it has some problems. Our planet has only a limited supply of oil and coal. In this method details about Endless Energy, Solar energy is taken into consideration.

- This research explored and compared energy consumption from various houses in a particular village. The various electricity problems of the community can get a solution from solar energy.
- Solar energy can play a important role in a community. It help the community reducing greenhouse gas emissions and mitigating climate change, which is critical to protecting humans, wildlife, and ecosystems. Solar energy can also improve air quality and reduce water use from energy production.

- The main purpose of solar energy is , Solar energy can help to reduce the cost of electricity, contribute to a resilient electrical grid, create jobs and spur economic growth, generate back-up power for nighttime and outages when paired with storage, and operate at similar efficiency on both small and large scales.

- Solar energy is environmentally friendly technology, a great energy supply and one of the most significant renewable and green energy sources. It plays a substantial role in achieving sustainable development energy solutions. Therefore, the massive amount of solar energy attainable daily makes it a very attractive resource for generating electricity. Both technologies, applications of concentrated solar power or solar photovoltaic, are always under continuous development to fulfill our energy needs. Hence, a large installed capacity of solar energy applications worldwide, in the same context, supports the energy sector and meets the employment market to gain sufficient development.

- This project highlights solar energy applications and their role in sustainable development and considers renewable energy's overall employment potential. Thus, it provides insights and analysis on solar energy sustainability, including environmental and economic development. Furthermore, it has identified the contributions of solar energy applications in sustainable development by providing energy needs, creating jobs opportunities and enhancing environmental protection. Finally, the perspective of solar energy technology is drawn up in the application of the energy sector and affords a vision of future development in this domain.

Contents

CHAPTER 1: EXECUTIVE SUMMARY

1.1Description of Community:

Kakinada is a city in the Indian state of Andhra Pradesh. It is the administrative headquarters of Kakinada district. The city is a home to some of the best educational institutions in the country. It is one of the three smart cities of Andhra Pradesh under Smart Cities Mission.

1.2 Summary of activities done:

- Studied about solar energy and its applications.
- We conducted a survey near Yanam to analyze the places where the solar energy is used.
- We approached many people and houses which are dependent on solar energy and analyzed the pros and cons of usage of solar energy.
- We created awareness on the usage of solar energy and its advantages.
- We analyzed the problems of solar energy and referred different solutions that will be helpful to the community.
- We created a prototype model that increases the solar energy efficiency.

1.3 Learning Objectives:

- Generating energy that produces no greenhouse gas emissions from fossil fuels and reduce some types of air pollution
- Creating local power projects that increase regional grid resiliency saving money on energy bills each month, with no up-front investment.
- It is important to know much knowledge about the solar energy and its installation and how it's going to affect lives of the people in the future

1.4 Outcomes:

- We got to know much renewable energy and its future scope
- We got to more about the Solar energy and its different applications for different purposes by conducting a survey
- We tried know much about misinformation that is spreading and the We cleared much of the misinformation that was in many people's minds by doing a survey and awareness in our locality
- When we got to know how much important is efficiency of a solar panel ,It is really important that many engineers must focus on improving the efficiency of the solar panel
- So we built a prototype which is similar to the solar tracking system.

CHAPTER 2: OVERVIEW OF THE COMMUNITY

Kakinada Mandal of East Godavari district has **total population of 312,538** as per the Census 2011. Out of which 152,571 are males while 159,967 are females. In 2011 there were total 82,333 families residing in Kakinada Mandal. The **Average Sex Ratio of Kakinada Mandal is 1,048.**

As per Census 2011, all of the population of Kakinada Mandal lives in rural areas. The average literacy rate in rural area is 80.6% and the sex ratio of Kakinada Mandal is 1,048.

The population of Children of age 0-6 years in Kakinada Mandal is 29698 which is 10% of the total population. There are 15041 male children and 14657 female children between the age 0-6 years. Thus as per the Census 2011 the **Child Sex Ratio of Kakinada Mandal is 974** which is less than Average Sex Ratio (1,048) of Kakinada Mandal.

The total literacy rate of Kakinada Mandal is 80.62%. The male literacy rate is 76% and the female literacy rate is 70.07% in Kakinada Mandal.

Table 2.1 population of Kakinada MAndal

Population
312,538
Families
82,333
Literacy
80.62%
Sex Ratio
1,048

Child Population - Kakinada Mandal

According to Census 2011, there were 29,698 children between age 0 to 6 years in Kakinada Mandal. Out of which 29,698 were male while 29,698 were female.

2.1 Kakinada Mandal Data

As per the Population Census 2011 data, following are some quick facts about the Kakinada Mandal.

Table 2.2 Literacy rate of Kakinada mandal

	Total	Male	Female
Children (Age 0-6)	29,698	15,041	14,657
Literacy	80.62%	76%	70.07%
Scheduled Caste	27,197	12,650	14,547
Scheduled Tribe	1,693	895	798
Illiterate	84,504	36,622	47,882

Average literacy rate of Kakinada Mandal in 2011 were 80.62% in which, male and female literacy were 84.31% and 77.14% respectively. Total literate in Kakinada Mandal were 228,034 of which male and female were 115,949 and 112,085 respectively.

We have also looked at different electricity consumption of the Kakinada city for different purposes in the year 2022.

Table 2.3 electricity consumption of Kakinada mandal

purposes	Consumption of electricity(in Lakh units)
Domestic purpose	2114.8
Commercial purpose	512.6
Industry purpose	474
Public Water Work & Street Light	32.3
Others	18.6

CHAPTER 3: COMMUNITY SERVICE PART

Description of the Activities undertaken in the Communityduring the Community Service Project:

Conducting the survey: By conducting the survey, we gathered the information about the various problems faced by the community in the field of energy resources

Analyzing the problems and finding out the solutions: After conducting the survey, we identified all the major problems that the community is facing for their livelihood. We have given some solutions to their problems and guided them.

Summary of the community Project:

We conducted the survey, in the search of the houses and communities using solar energy as their power supply. Then we interacted with the household people and asked some questions about their motivation for using the solar energy as their power source and what are the pros and cons of using the solar energy.

Then we visited the other places, where the people are not having the solar panels on the houses and we tried to interact with them about why there are not using the solar energy as their power source. And then we motivated them about the uses and advantages of using the solar energy as their power source.

We created awareness about the advantages of solar energy and the uses of it.

And we have successfully erased the misconceptions about solar energy in the minds of the community people. And further we explained the communities people how to install the solar panels on their houses

We further studied the various ways to improve the solar energy efficiency

And analyzing various method‘s like effective PV solar energy concentrating system based on mirror refection, solar tracking, we made a conclusion that solar tracking is best for improving the solar energy efficiency.

Then we created a prototype model of the solar tracking that it is automated solar panels which actually follows the path of the sun to get maximum power.

Activity Log

Day & Date	Brief description of the weekly activity	Learning Outcome
Week – 1	We discussed about various issues regarding the energy	We have noticed
	Requirements of the community.	Various types of energy sources in Kakinada. We have noticed many people in the community lack awareness about different renewable energy options
	We tried to get the overall overview of the community and the various energy resource options that are available in the community	
Week - 2	We tried figure out different renewable energy options that would be suitable for the community. We decided to do a survey regarding how this renewable energy is used for various domestic purposes. We decided that the solar energy would be as a main area of interest for this community service project.	We learned about the community's shift towards solar energy as alternative for the different domestic and commercial energy usage and decided to do a survey upon how this energy is being used.
Week – 3	We looked for different locations where solar energy is as source of many domestic purposes and gathered the locations that are to be surveyed. We surveyed one of the houses in that is completely dependent on solar energy	We gathered all the information regarding cost to setup and maintain the solar module and the battery capacity. We also some of the problems they are facing.
Week – 4	We analyzed different problems that arise because usage of solar energy and we looked at different references where we could solve these problems	Solar energy to still go deep into people's energy requirements requires a lot of awareness within people and We need to spread awareness regarding its effective solutions too
Week – 5	We explored different locations where we could use to survey and spread awareness regarding various solar energy alternatives to use as energy source. We also made a list of those misconceptions we needed to clear	It is important to spread awareness regarding various solar energy alternative that are there for different requirements
Week – 6	After we went to people for survey and awareness, We noticed a problem, about solar panel i.e. It's efficiency. So we looked at different solutions from our side. We referred to different solutions online	We made list of solutions we could improve efficiency. We decided to build a prototype of a solar tracker

Day & Date	Brief description of the weekly activity	Learning Outcome
Week – 7	We built a prototype similar to a solar tracking system which has a possibility to increase the efficiency of this solar PV module.	Solar tracking system is one of the ways we could improve the efficiency of the solar PV module.
Week – 8	Final report has been presented, based surveys and the Awareness campaigns that are conducted	The final report contains all the references that are considered for preparing this report and we successful in spreading awareness.

WEEK-1

India has about 6 lakh villages supporting more than 75% of its total population, An integrated approach for effective implementation of solar energy program would go a long way in serving the rural community.

Our focus mainly depended on electricity consumption of the community. The energy consumption of the community its requirement is mainly utility electricity.so the obvious alternative we could think was the renewable energy .We decided that for this week we would mainly focus on the renewable energy distribution

`The scope of the study involves

- Study of renewable energy and different sources.
- Identification of actionable efforts for renewable sources.

Renewable energy

Consumption of energy is a huge part of our day to day living. We eat with energy, we travel with energy, and we work with energy and many more. This makes the availability of energy very necessary for humans. The main sources of energy we observed in the community are Windmills, Solar panels, Dams. The main sources of energy for these are renewable sources.

- Renewable energy sources refer to all those limitless energy sources present in nature. These energy sources are present in nature and are naturally replenished in nature. Because of this reason they never get exhausted or never run out. The main types of renewable energies are-

- **Wind Energy**: Wind energy is obtained from the force of the wind. A large number of windmills are set up to harness the power of wind and then generate electricity.

- **Disadvantage of wind energy**: In the case of windmills, the amount of electricity obtained from one windmill is very less hence this makes the entire setup costs of windmills very high.

- **Geothermal Energy**: This energy is generated from the heat stored in the earth. This type of energy is used for heating a house or generating electricity.

- **Disadvantage of geothermal energy**: The regions that consist of geothermal plants often experience minor seismic activity
- **Solar Energy**: Solar energy is that energy is derived from the sun. The solar energy is stored in devices known as solar cells. Solar energy is harnessed in the form of light and heat.

- **Different energy sources**

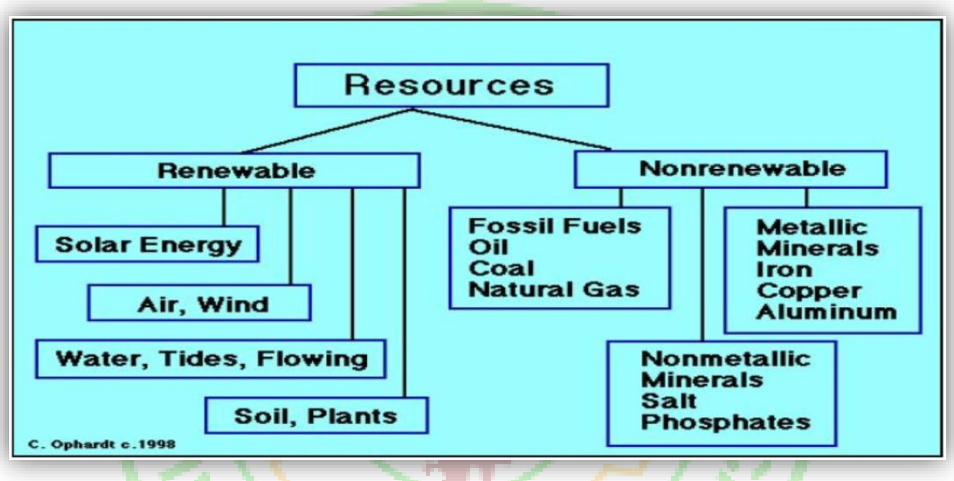

Fig 3.1.1 Installed renewable energy capacity in India as of a 2020

After studying about all these renewable resources, we observed that solar energy has more advantages when compared with other resources. So, we decided that the solar energy would be as a main area of interest for this community service project.

Table 3.1 Installed Renewable Capacity In India

• **RENEWABLE ENERGIES**	• **CAPACITY INSTALLED**
• **Solar**	• 48.55 GW
• **Wind**	• 40.03 GW
• **Small hydro**	• 4.83 GW
• **Large hydro**	• 46.51 GW
• **Biopower**	• 10.62 GW
• **Nuclear**	• 6.78 GW

WEEK-2

INTRODUCTION TO SOLAR ENERGY

Energy produced and radiated by sun is known as solar energy. This solar energy can be converted directly or indirectly into other forms of energy such as heat and electricity.

Most of the energy is received from the Sun in the form of short-wave radiations of light. When this radiation strikes a solid or liquid, it gets absorbed and transformed into heat energy. This heat energy is either stored (warming the material) or is conducted to the surrounding materials (air, water etc.) or is re-radiated (in the form of a long wave radiation) to the other material having relatively lower temperature.

ADVANTAGES OF SOLAR ENERGY

- It is a renewable source of energy.
- It is available at all parts of the world.
- It is free source of energy.
- It is non-polluting source of energy.

DISADVANTAGES OF SOLAR ENERGY

I. It is intermittent in nature

ii. Variable in nature.

iii. It requires large area for collection and storage.

APPLICATIONS OF SOLAR ENERGY

1. Solar Water Heating :A solar water heating unit comprises a blackened flat plate metal collector with an associated metal tubing facing the general direction of the sun. The plate collector has a transparent glass cover above and a layer of thermal insulation beneath it.This system of water heating is commonly used in hotels, guest houses, tourist bungalows, hospitals, canteens as well as domestic and industrial units.

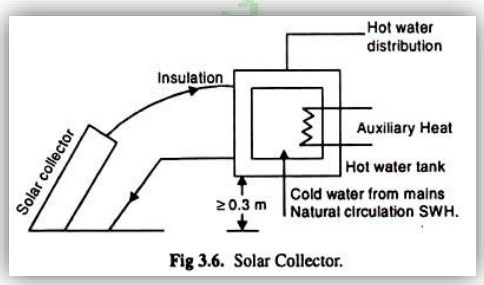

Fig 3.6. Solar Collector.

Fig 3.2.1 Solar Collector

2. SOLAR COOKING

A variety of fuel like coal, kerosene, cooking gas, firewood dung cakes and agricultural wastes are used for cooking purposes. Due to the energy crisis, supply to these fuels are either deteriorating (wood, coal, kerosene, cooking gas) or are too precious to be wasted for cooking purposes (cow dung can be better used as manure for improving soil fertility).

This associated the used of solar energy for cooking purposes and the development of solar cookers.

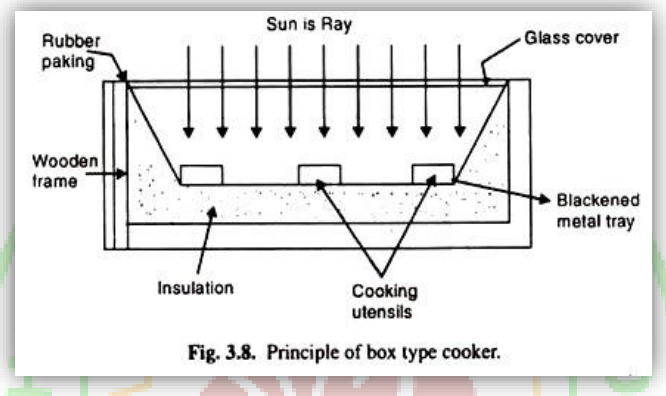

Fig. 3.8. Principle of box type cooker.

Fig 3.2.2 Solar Cooker

3. SOLAR DISTILLATION

In arid, semi-arid or coastal areas there is scarcity of potable water. The abundant sunlight in these areas can be used for converting saline water into potable distilled water by the method of solar distillation.

In this method, solar radiation is admitted through a transparent air tight glass cover into a shallow blackened basin containing saline water. Solar radiation passes through the covers and is absorbed and converted into heat in the blackened surface causing the water to evaporate from the brine (impure saline water). The vapours produced get condensed to from purified water in the cool interior of the roof.

The condensed water flows down the sloping roof and is collected in the troughs placed at the bottom and from there into a water storage tank to supply potable distilled water in areas of scarcity, in colleges, school science laboratories, defence labs, petrol pumps, hospitals and pharmaceutical industries

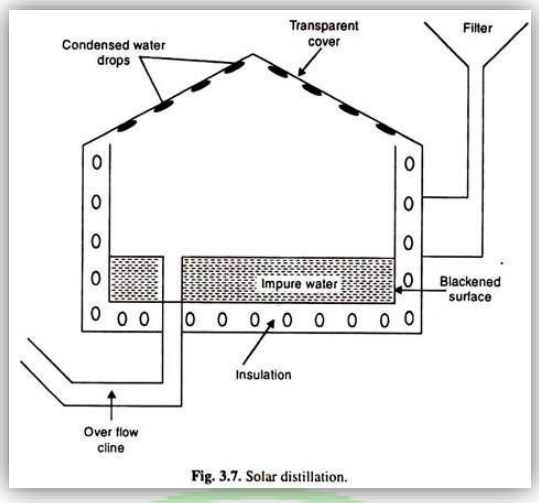

Fig. 3.7. Solar distillation.

Fig 3.2.3 Solar Distillation

- **HOW SOLAR PANELS WORK?**

It is a universal truth that sunlight brightens the world, but no one ever knew it would illuminate the residences and businesses with an environment-friendly and a low-cost electricity. While sun is the major source of energy, solar panels serve as the medium to convert sunlight into clean electricity. Considered as a promising alternative energy source, the solar panels are powering thousands of homes and businesses throughout the world.

- **COMPOSITION OF SOLAR POWER SYSTEM**

A typical solar energy system consists of solar panels, batteries, inverters and a charge controller. Every solar panel is comprised of several photovoltaic cells each of which is coated with a negative and positive layer to create an electric field. While these cells are significant and essential part of solar panels, batteries, inverters and charge controllers also have a supporting role in generation of clean electricity.
Let us know more about their function of components present in this solar panel.

- **ROLE OF A SOLAR POWER INVERTER**

As electrons are produced, they enter into an inverter, which converts the direct current (DC) electricity from the photovoltaic cells into altering current or AC power. Our home appliances and electronic items, such as computers, toasters, and televisions, use AC power when plugged.

- **SOLAR POWER BATTERY - ENERGY BACKUP**

The electricity produced by solar panels is in excess, sometimes, and it should not be wasted. A solar power battery, thus, stores this energy for later use. Later implies at night or when it is cloudy and sunlight is not available. Lead-acid batteries are commonly used in solar power systems as they are affordable as well as efficient. A battery bank, which is a collection of batteries in a solar energy system, should be able to store power for 5 days of operation without needing more sunlight.

- **SOLAR POWER CHARGE CONTROLLER**

  A charge controller extends the life of the battery bank by preventing it from overcharging. The controller, actually, monitors the battery voltage, and reduces and increases the current with varying voltage.

- **HOW TO SOLAR PANEL WORK?**

Step1:
Sunlight activates the panel. The solar cells, which are also referred to as photo voltaic cells, absorb sunlight during daylight hours.
Step 2:
The cells produce electrical current. The motion of electrical field surrounding a wafer creates the electrical current.
Step 3:
The electrical energy is converted. That is direct current is converted to alternating current using an inverter.
Step 4:
The converted electricity powers your home.
Step 5:
A net meter measures the usage of current in a house.

- **ADVANTAGES OF INSTALLING SOLAR PANELS**

- Installing solar panels is not just a trend but a contribution toward protecting the environment by reducing the carbon emissions.
- While you may be a next solar candidate, knowing how solar panels work will further assist you during their installation and help you reap benefits of it.
- Solar panel installation increases the saving chances of your monthly budget and on the other hand it makes you a contributor of the green and friendly environment

  After gaining knowledge on this solar energy topic, we decided to go for a survey to a house in a village to know more about the solar energy.

WEEK-03

GOING TO FIELD WORK:

- We thought in order to do a proper survey we need to have prior knowledge and proper Exposure to survey and make them Aware.
- So we decided to do a survey i.e. to go to a house which is fully equipped and installed with solar energy.
- We started to look for a household which is dependent on solar energy
- We found a house in village Tallerevu, which is fully equipped with solar energy
- These were the following questions we enquired about

1. Is the house completely dependent on solar energy?
2. What is the capacity of the solar energy installed?
3. What is the Cost to setup whole of the solar panel?
4. How many large energy appliances connected to this solar energy?
5. What is cost of maintenance of the battery of the solar energy?
6. What is capacity of the solar invertor?

We initially thought of directly going into the survey but we thought it is really important we go to house which is fully equipped with solar energy i.e to have right knowledge to make people aware about the solar energy.

Their responses

RESPONSES:

1. Most of the electricity in our house is running using solar energy. But simple solar installs do not provide power to specific devices. Instead it simply a percentage of electricity that our entire house uses. The amount of our usage depends on size and angle of roof as well as our budgets. Many of our village people do offset their electric bills with solar.

2. Generally 3 kilowatts of solar power system is enough for an average family of three to four people. But we have AC at home. So we have 7 kilowatts capacity of solar energy installed.

3. As our capacity installed is 7 kilo watts, on average monocrystalline solar panels cost Rs 43 to Rs 63 per watt, meaning that outfitting a 3kw solar panel system cost between Rs 2,25,000 to Rs 3,00,000.

4. In our house, we can run 4 fans, 5 lights, 1 air conditioner, 1 fridge, 1 oven, 1 washing machine. As 7kilowatts solar power is installed.

5. The price of our solar battery is between Rs 10,500 to Rs 12,000. It is not sure, But I think it should be changed for every 2 years or it should be checked

6. Generally, solar inverter capacity depends on size of our invertor should be similar to the Dc rating of our solar panel system. So as we are installing 7 kilo watts system, we can expect the proposed inverter to be 7000W, plus or minus a small percentage.

Photos:

Fig 3.3.1 Solar Panel

Fig3.3.2 solar Main Box

WEEK-4

We analyzed a different problem that arises during usage of solar energy.

- Size: to power an entire building a large solar array is required it's unfortunate that photo volatile technology is still in its infancy but, for now, we must build large arrays to compensate for the inefficacies of single panels. some roofs are not big enough to fit solar panels we would like to have.

  An alternative is to install some of the panels, I your yard but they need to have access to sunlight. If you don't have the space for all the panels that you wanted, you can opt for installing fewer to still satisfy some of your energy needs.

- Weather –dependent: although solar energy can still be collected during cloudy and rainy days, the efficiency of the solar system drops. Solar panels are dependent on sunlight to effectively gather solar energy.

- Clouds diminish the power of solar panels, especially in habitually foggy or overcast regions. This might make it a poor choice for solar power generation.

- Night: the earth itself a rather large obstruction and it acts nightly to disturb the flow of photons to helplessly immobile solar arrays.so solar energy cannot be collected during the night.

- Solar energy storage is expensive: solar energy has to be used right way, or it can be stored in large batteries. These batteries, used in off grid solar systems can be charged during the day so that the energy is used at night. This is a good solution for using solar energy all day long but it is also quite expensive.

- Panel Deterioration: solar panels gradually become damaged by ultra violet radiation. Rain, snow, dirt, temperature fluctuations hail and wind also pose serious hazards.

- Cost: the initial cost of purchasing a solar system is fairly high. this includes paying for solar panels, inverter, batteries, wring, and the installation

- In summary, residential solar power has some economic and technical drawbacks but many of them can be overcome by planning and responsible maintenance.

LITERATURE REVIEW:

PARKUNAM N(2020):studied that the photovoltaic(PV) solar cell generates electricity by receiving solar irradiance in the forms of photons .when the heat induced in the panel exceeds the operating temperature ,there is a drop in electricity efficiency . to increase the electrical efficiency of solar cell by cooling the cell with the help of various heat sinks and wick structure with copper and aluminum fins .the heat removed from the back surface of the panel with the help of fins that absorb heat generated by the cells during the day. Therefore, the decreased temperature of PV panel increases the electrical efficiency of solar cell. When the solar cell receives more solar radiations, it generates more electricity.

K. P. Amber et al. (2020) studied that at higher ambient temperatures during summer months, the cell temperature of a photovoltaic (PV) module increases to 50-60 °C and sometimes could go as high as 80 °C due to which the PV module heats up and fails to deliver its optimum output. He carried out an experimental study that focused on enhancing the efficiency of mono-crystalline photovoltaic (PV) modules by reducing their back- surface temperature. For this purpose, the heat transfer area has been increased by introducing fins at the back surface of the PV modules with two different configurations, i.e. rectangular and circular. Thermal analysis included measuring hourly module temperature, calculation of hourly Nussle number, coefficient of convection heat transfer, and convection heat loss from the back surface of each module, whereas in terms of analyzing the module's electrical performance, hourly readings were taken for the module's maximum power and efficiencies. The results showed that there was a significant effect of fins on the back surface of the PV modules. PV modules, particularly with rectangular fins having larger cross-sectional and surface area dissipated 155% more heat and generated 10.8% and 4% more power than the reference module and the circular fins-based module, respectively, and resulted in a 10.6% decrement in module temperature and an increase in module efficiency by 14.5%. The circular fins-based module dissipated only 27% more heat than the reference module. Therefore, the PV module with rectangular fins is recommended for the enhanced performance of PV installations.

WEEK-05

Knowing the problems that are faced because of solar energy we decided to spread awareness regarding misconceptions and do another survey.

DAY 1: We made a list of misconceptions that are required to spread awareness

- The list of misconceptions we made are from different resources online and some of the knowledge we obtained from different sources

Myth #1 • All solar systems keep working even when the power goes out

A building powered with a grid-connected solar power system will lose power in case of an outage. Buildings that are entirely independent of the grid (off-the-grid) and/or run on a hybrid system will continue to use solar power during daytime power outages.

- Backup batteries can be integrated with a grid-tied system for 100% uptime. By installing backup batteries, you will have a power supply even during an outage. In the case of off-grid, off-the-grid, and hybrid systems, batteries store solar power produced by the solar panels.

Myth #2 • Warmer climates are better for solar power generation

Solar panels harness the sun's light and not its heat. High temperatures lower the efficiency of solar panels. Also, solar panels do not completely shut off during the cloudy or rainy season. They continue to operate at 50% efficiency. Additionally, the excess energy produced during the summer months is available in the form of energy credits/money to be used during times when not much solar energy is produced.

Therefore, cities with moderate annual temperatures such as Bangalore are better suited for solar than warmer cities like Chennai.

Myth #3 • Most Indians cannot afford to own a solar power system

Many of us are under the assumption that switching to solar is a luxury, and an option only for wealthy folks. This isn't true. Falling costs of solar and the accessibility of financing options like loans and government subsidies have made solar a feasible option for all property owners. Property owners are eligible to avail incentives based on **solar energy generation**.

If your solar installation covers 100 percent of your electricity needs and your monthly solar lease fee/loan instalment is lower than your typical electricity bill, you'll see savings right from the start.

Myth #4 • you can't run heavy loads like heating appliances (air conditioner or heater) on solar power

You definitely can. Companies like **Solarify** can help you calculate your daily energy needs and help you decide how many solar panels you would need to support that need. 1 kW (3 solar panels) provides approximately 4 units of energy per day. Hence, a typical 3-4 BHK house in Kakinada would need about 12-15 solar panels to support their daily energy needs.

- 1 kW solar panel is sufficient for a 3 BHK house. It is capable of generating 5000 watts of electricity during the day. It can give a power supply of 8-10 hours to 3 BHK homes in India. With this much energy, you can power 3 fans, 1 refrigerator, 1 tv, 1 laptop, and 4-5 lights.
- A 1 kW solar power system can cost you approximately Rs. 98,000 in India. The pricing could vary.

DAY 2:

- We chose a location near Jntuk localities. We decided to go to houses in that locality and find some houses which use solar energy
- We went different houses in that locality and We did spread awareness regarding various misconceptions
- We also explained them different advantages of using solar energy as different alternate source of energy
- We explained them different step by step processes to install solar panel
- We suggested them different rooftop plants and no of panels space required to setup the plant on your roof top
- We explained them about different schemes available in Andhra Pradesh that provide subsidy for this rooftop installation.
- We explained them different methods how they could install solar panel in their house by asking the right questions
- The right question you should ask is how much are you currently paying to your electricity supplier.
  Check your Electricity bill & find Average UNITS are you're consuming in each billing Cycle

For example:

Month	Season	No of Units (Consumption)	Avg Units / year
Jan-00	Winter	320	375 units / Month
Feb-00		380	
Mar-00	Summer	420	
Apr-00		550	
May-00		650	
Jun-00	Rainy	320	
Jul- 00		300	
Aug-00		280	
Sep-00	Rainy / winter	290	
Oct-00	Winter	310	
Nov-00	Autumn	360	
Dec-00		320	

Your Average Consumption would be: 194 Units / Month

1 Kw system generates Approximate 120 Units / Month so you should install 2kw system for your residence. But there is a Catch. Your sanctioned load should be 4kw in order to install 2kw system. (Grid Connected solar rooftop system's maximum capacity must be less than 50% of your sanctioned load)

Also check if you have sufficient Shadow Free Rooftop Area.

Generally, 1 kw system requires 8 sq. mtr area.

Hope this helps.

We explained them different subsidiaries in Andhra Pradesh

- Andhra Pradesh Eastern Power Distribution Corporation Limited (APEPDCL) announced that residential customers interested in installing grid-connected rooftop solar (RTS) plants will now be eligible for central financial assistance. The Ministry of New and Renewable Energy (MNRE) has sanctioned 8 MW capacity in the residential sector under Phase II of the RTS program for APEPDCL with timelines for completion of allocation capacity in 15 months.

- That opens a window for potentially 2600 plus residents of the state who own a proper terrace to avail of the scheme, assuming a typical size of 3 KW of the solar rooftop. With this new scheme in Andhra Pradesh which promotes solar power, a solar rooftop system of 1 KW will cost Rs. 50,000. The government, in its move, is set to encourage house owners to install such systems by giving a 30% subsidy by the centre and 20% by the state government for the same. The state government unveiled its renewable energy export policy, which applies to solar projects. The state was given the ability to use potential land for setting up projects to export power to other states, attracting investments and generating revenue in the process.

Photos:

Fig 3.5.1 & 3.5.2 Local Survey

WEEK 6

We looked at different ways at which we could improve the efficiency of a solar PV module.

DAY 1: We referred to many Articles online so we could put it in this report.

- Solar photovoltaic (PV) panel conversion efficiency is an important factor in determining how much power a PV plant will be able to produce — and, in turn, indicate whether it will be a profitable investment.

- PV cell conversion efficiency refers to the percentage of solar energy that a cell can convert into usable electricity. Solar module developers are focused on improving their efficiency rates to make PV technologies more attractive by competing with fossil fuel energy sources on cost.

- One method to improve the solar efficiency is by using mirror reflection concentrating on to the solar panel.

- The mechanical setup consists of two mirrors which are used as a concentrating mirror which reflects the sunlight onto the solar panel. Solar panel is vertically mounted between two mirrors. Panels are tilted at some specified angle. Also, to give mechanical strength the surface of the system is made up of wooden. To achieve more efficient output power we put a vertical panel

-

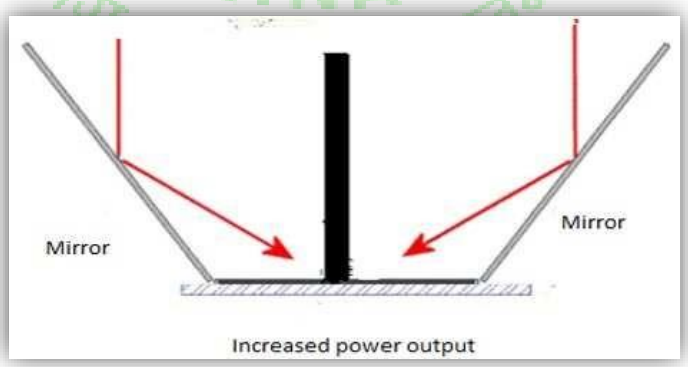

Fig 3.6.1 Increased Power Output

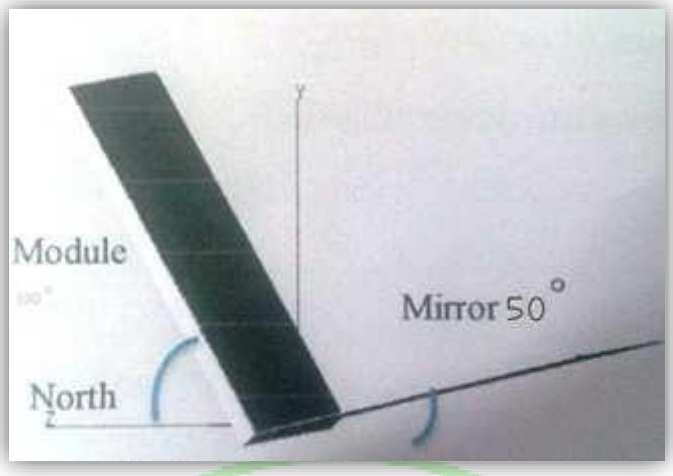

Fig 3.6.2 Mirror Angle

- Different other ways we can improve efficiency and maintenance solar PV are
- Buy one of the more efficient solar panel models
- Buy panels with High Concentrated Photovoltaic (CPV) Cells
- Avoid installing solar panels in shaded areas
- Get an expert to install your solar panels
- Clean your solar panels
- Monitor your solar panel output using energy management software.
- Solar tracker's installation also improves the efficiency of the solar panel
- Trackers direct solar panels or move toward the sun. These devices change their orientation throughout the day to follow the sun's path to maximize energy capture. In photovoltaic systems, trackers help minimize the angle of incidence between the incoming light and the panel, which increases the amount of energy the installation produces
- We decided to build a prototype similar to a solar tracking system that improves the efficiency of the Solar PV module.

Week-7

We decided to build a prototype similar to a solar tracking system which increases the efficiency of the solar PV module

Scope

- It can be used for small and medium scale power generations.
- It can be used for power generation at remote places where power lines are not accessible.
- It can be used for domestic and industrial power backup system.
- Solar radiation Tracker has played a vital role in increasing the efficiency of solar panels in recent years, thus proving to be a better technological achievement. The tracking system is designed such that it can trap the solar energy in all possible directions

Definition:

A Solar tracker is an automated solar panel which actually follows the sun to get maximum power. The primary benefit of a tracking system is to collect solar energy for the longest period of the day, and with the most accurate alignment as the Sun's position shifts with the seasons.

Fig 3.7.1 Solar Tracker

Solar Panel:-

Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. Photovoltaic modules use light energy (photons) from the Sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells. The structural (load carrying) member of a module can either be the top layer or the back layer. Cells must also be protected from mechanical damage and moisture. Most modules are rigid, but semi-flexible ones are available, based on thin-film cells.

Fig 3.7.2 Solar Panel

Arduino UNO Microcontroller:-

Arduino is an open source, computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL) permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form

.

Fig 3.7.3 Ardunio UNO Controller

It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC to DC adapter or battery to get started.

Light Dependent Resistor: - A LDR or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance. A photo resistor is made of a high resistance semiconductor. In the dark, a photo resistor can have a resistance as high as several mega ohms (MΩ), while in the light, a photo resistor can have a resistance as low as a few hundred ohms. If incident light on a photo resistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance.

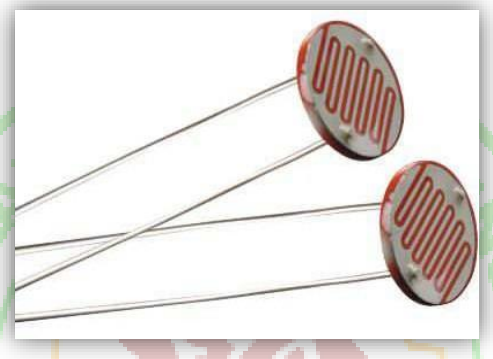

Fig 3.7.4 LDR Sensors

Servo Motors:-

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system.

Fig3.7.5 Servo Motor

Software Interface Arduino IDE:-

The Arduino IDE supports the languages C and C++ using special rules of code structuring.

The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution.

Operation

- LDRs are used as the main light sensors. One servo motors are fixed to the structure that holds the solar panel. The program for Arduino is uploaded to the microcontroller. The working of the project is as follows.
- LDRs sense the amount of sunlight falling on them. Two LDRs are divided into to left and right.
- If the bottom LDRS receive more light, the servo moves in that Direction.
- For east – west tracking, the analog values from two top LDRs and two bottom LDRs are compared and if the top set of LDRs receive more light, the vertical servo will move in that direction.
- For angular deflection of the solar panel, the analog values from two left LDRs and two right LDRs are compared. If the left sets of LDRs receive more light than the right set, the horizontal servo will move in that direction.
- If the right sets of LDRs receive more light, the servo moves in that direction

Assumption & Dependencies

- All the soldering and wiring are done correctly.
- There must be a sunny day for the full efficiency of the system.

1.<u>Specific Requirement</u>

(i) External Interface Requirement:

(a) Hardware Interface Requirement

Solar Panel:-**Solar panel** refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating.

Arduino UNO Microcontroller: -

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC- to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

LDRs:-A **Light Dependent Resistor** (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance.

Servo Motors:-A **servomotor** is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

(b) Software Interface **RequirementArduino IDE(Refer Appendix code):-**

The Arduino IDE is a cross-platform Java application that serves as a code editor and compiler and is also capable of transferring firmware serially to the board.

The development environment is based on Processing, an IDE designed to introduce programming to artists unfamiliar with software development. The programming language is derived from Wiring, a C-like language that provides similar functionality for a more tightly restricted board design, whose IDE is also based on Processing.

(ii) Product Feature

The unique feature of this system is that instead of taking the earth as its reference, it takes the sun as a guiding source. Its active sensors constantly monitor the sunlight and rotate the panel towards the direction where the intensity of sunlight is maximum.

(iii) Performance Requirement

There must be a sunny day for the full efficiency of the system

- **circuit Diagram**

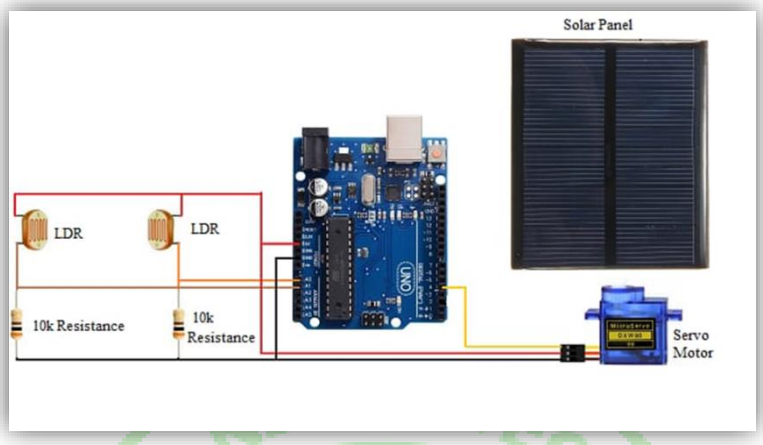

Fig 3.7.6 Prototype circuit Diagram

Implementation:

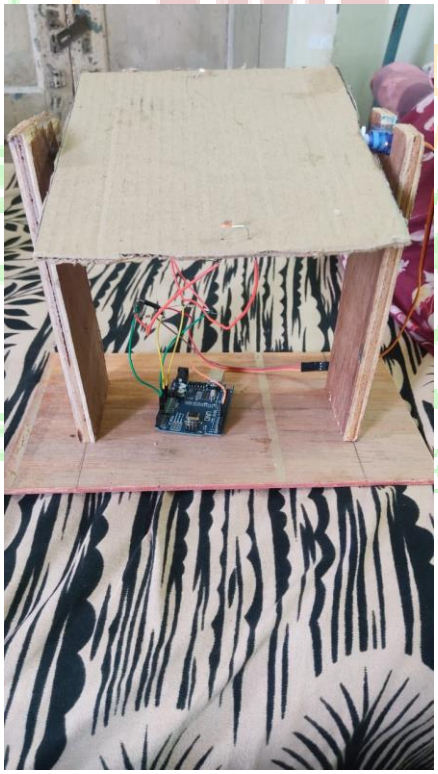

Fig 3.7.7 Solar Tracking Prototype

Conclusion:-

Solar radiation Tracker has played a vital role in increasing the efficiency of solar panels in recent years, thus proving to be a better technological achievement. The vital importance of a dual axis solar tracker lies in its better efficiency and sustainability to give a better output compared to a fived solar panel or a single axis solar tracker. The tracking system is designed such that it can trap the solar energy in all possible directions. Generally, in a single axis tracker that moves only along a single axis it is not possible to track the maximum solar energy

Hence, maximum possible energy is trapped throughout the day as well as throughout the year. Thus, the output increases indicating that the efficiency more than a fixed solar panel (about 6-7% more).

WEEK 8

PREPARING THE FINAL REPORT BASED ON THE OBSERVATIONS ON USAGE OF SOLAR ENERGY IN COMMERCIAL AND DOMESTIC APPLIANCES:

- India has about 6 lakh villages supporting more than 75% of its total population.
- An integrated approach for effective implementation of solar energy programme would go a long way in serving the rural community.
- We chosen solar energy as our topic because it is something where we as public can take part in it. So we went to a village named tallarevu for a survey.
- They asked us many questions about solar energy, its cost, its installation and many more.
- They asked whether all solar systems keep working even when the power goes out.
- They asked that how the solar energy works during night times.
- They asked whether all the appliances of entire house can run under this solar energy.
- They asked whether solar panel damages the roof.
- They said that reselling the house will be difficult with solar panels.
- We made a list of misconceptions and decided that it is required to give awareness to the people.
- We started our awareness by saying how solar panel works.
- We explained about how to install a solar energy and capacity available.
- We had explained about how to measure the capacity to install solar panels.
- We discussed about different uses of solar energy in both commercial and domestic purposes.
- We helped to stop the misconceptions on renewable energy by spreading awareness.
- Finally, we decided to build a prototype similar to a solar tracking system which increases the efficiency of the solar PV module.

CHAPTER 4: OUTCOMES DESCRIPTION

Conclusion:

After studying this project, we are able to:

- Explain the principles that underlie the ability of various natural phenomena to deliver solar energy.
- Outline the technologies that are used to harness the power of solar energy.
- Discuss the positive and negative aspects of solar energy in relation to natural and human aspects of the environment.
- Save energy cost in a long run.
- Gain knowledge on how to improve solar panel efficiency or energy storage.
- Give awareness for reducing dependency on fossil fuel for energy production.

Out of all these outcomes, we got an idea of doing a project on generating more energy using solar energy throughout the day.

That is "AUTOMATIC SOLAR TRACKING SYSTEM ".

FUTURE SCOPE :

- There is misinformation and wrong representation of renewable energy in the world because of this people can't see the potential and need for renewable energy
- We helping to stop this misinformation on renewable energy spreading by spreading awareness
- It is really important to build a future that relies on renewable energy
- By helping spread this knowledge that you have acquired on the topic and helped others gain awareness on this knowledge
- By doing this we could be part of steps for building a future that relies on renewable and solar energy

REFERENCES USED:

- Adham Makki et al. / Renewable and Sustainable Energy Reviews 41 (2015) 658- 684. "Advancements in hybrid photovoltaic systems for enhanced solar cells performance".[1]
- Book Alternative Energy Sources: By Efstathios E. (Stathis) Michaelides.: Springer-Verlag Berlin Heidelberg 2012.[2]
- Rok Stropnik, Uroš Stritih / Renewable Energy 97 (2016) 671-679, "Increasing the efficiency of PV panel with the use of PCM".[3]

Appendix CODE:

```
#include <Servo.h>
Servo myservo;
#define LDR_1 A0
#define LDR_2 A1
int pos = 90;
int Resistance = 20;
void setup(){
myservo.attach(4);
pinMode(LDR_1, INPUT);
pinMode(LDR_2, INPUT);
myservo.write(pos);
delay(1000);
}
void loop(){
int value_1 = analogRead(LDR_1);
int value_2 = analogRead(LDR_2);
if((abs(value_1 - value_2) <= Resistance) || (abs(value_2 - value_1) <= Resistance)) {
}else {
if(value_1 > value_2)
{
pos = pos+1;
}
if(value_1 < value_2)
{
pos = pos-1;
}
}
if(pos > 180) {pos = 180;}
if(pos < 0) {pos = 0;}
myservo.write(pos);
delay(50);
}
```