SRI RAAJA RAAJAN COLLEGE OF ENGINEERING AND TECHNOLOGY
AMARAVATHIPUTHUR, KARAIKUDI – 630 301

Department of Electrical and Electronics Engineering

FUNDED PROJECT REPORT

Start date	End date	Duration	Number of students involved
04.01.2021	4.05.2021	4 months	4

HYBRID POWER GENERATION

Submitted by
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Client Detail:
CG Power Systems, Devakottai.

Introduction

Energy is the most essential part of modern life. We use many technologies for the production of power. The common non- renewable sources we use for the production of power are coal, natural gas and oil. Since many decays we have been using these for our several needs. Fossil fuels are formed by anaerobic decomposition of buried dead organisms over 650 million years ago. Among these fuels oil has high density of energy. World needs 8, 40, 00,000 barrels of oil per day. We use 16, 76,120 metric tonnes of coal every day. We utilize 2,963 Cubic meters of Natural gas every day. By the above data we can estimate how much amount of fuel we are utilizing each day to meet our requirements. Using of fossil fuels is not a modern thing, for the period of our an sisters we are using fuels for the purpose of cocking, lighting and other purposes. In today's environment we are using fuels for the working of machineries in industries, transportation and to produce electric power. After Word War-2 the demand for fossil fuels had increased rapidly due to industrial revolution. The energy consumption is increasing at a rate of 2.3% every year. The below graph represents the production of fuels from the past 200b years to future prediction for 200 years.

According to many renewable energy experts, a small "hybrid" electric system that combines home wind electric and home solar electric (photovoltaic or PV) technologies offers several advantages over either single system.

Many hybrid systems are stand-alone systems, which operate "off-grid" -- that is, not connected to an electricity distribution system. For the times when neither the wind nor the solar system are producing, most hybrid systems provide power through batteries and/or an engine generator powered by

conventional fuels, such as diesel. If the batteries run low, the engine generator can provide power and recharge the batteries.

However this technology is already existed in two different forms, but we are giving the two technologies in one place. Most probably concentrating on the wind turbine blade design by using readily available PVC (Poly Vinyl Chloride) pipes. It is easy to get them into required size and shape by following design considerations. It is household usage purpose project which is available at low cost compared to individuals available. The reason behind combining both of them is to improve the pole efficiency for the same using in conventional methods.

Apparatus

- Solar panel
- Wind turbine model
- Battery indicator
- Battery
- Electric motor
- Power control unit
- The regenerative braking system

Functional Requirements

1. The system consists of Arms in which PV cells are placed.
2. The head part consists of the wind mill or wind turbine generator which converts wind energy into electricity by the rotation of shaft of generator.
3. The bottom part consists a housing in which electricity produced is converted and stored.
4. The head part consists vane which orients the windmill blade to the direction of wind for better performance.

Electrical Design

The project team designed the wind blades uniquely with the readily available material like PVC (Poly Vinyl Chloride) pipe of diameter 11.5 cm and we cut the same in to the required shape of three feet size choose for our requirement by following the principles of aerodynamics. Theoretical maximum efficiency of the wind turbine is given as follow

$$P=1/2\rho A\ V^3$$

Where, ρ=Air density

A=Swept area

V=Air velocity

But whereas actual results are slightly differ from the practical results. By using the above given theoretical formula we can able to find out the theoretical efficiency of any designed wind turbine.

HAWT BLADE DESIGN

A focus in made on design of wind turbine with the horizontal axis. It is very complicated to design its profile anyway we tried our best to give the best out of it . Tip speed ratio: It is defined as the relationship between rotor blade velocity and relative wind velocity.

$$\lambda = \Omega r/Vw$$

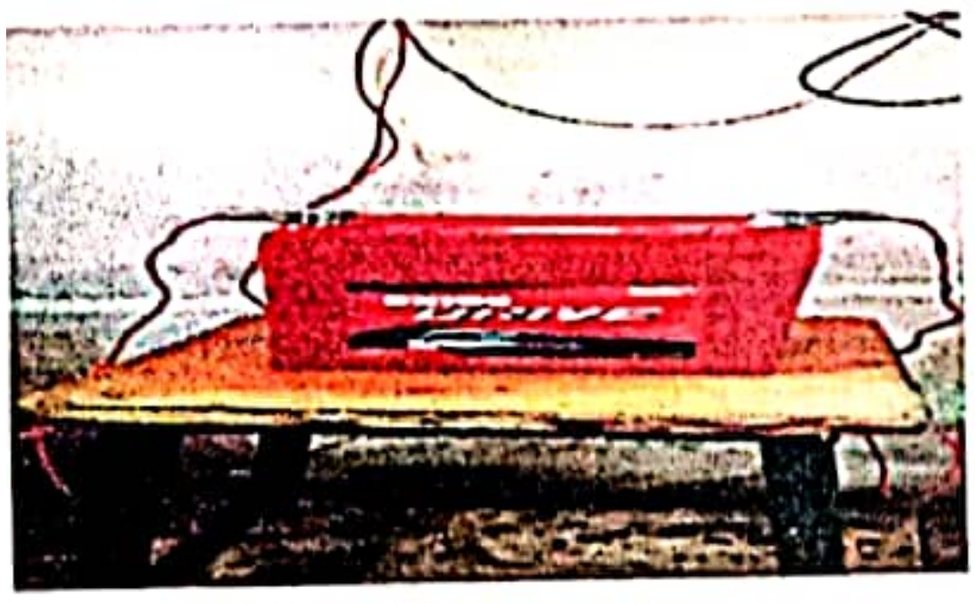
Where,

λ = Tip speed ratio

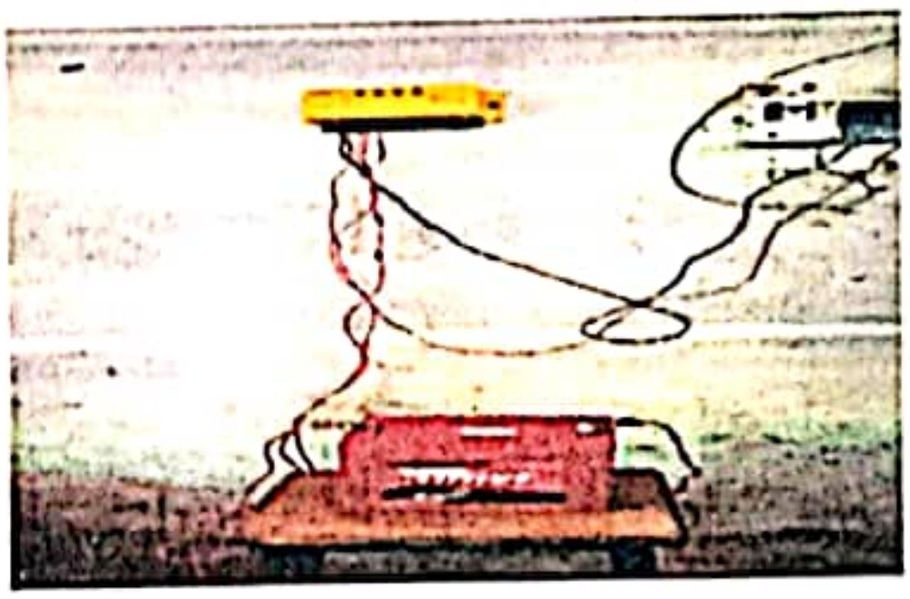
Ω = Rotational velocity (rad/s)

r= radius

Vw=wind speed



BATTERY TESTING



BATTERY CONNECTION

SOLAR PANEL CONNECTION

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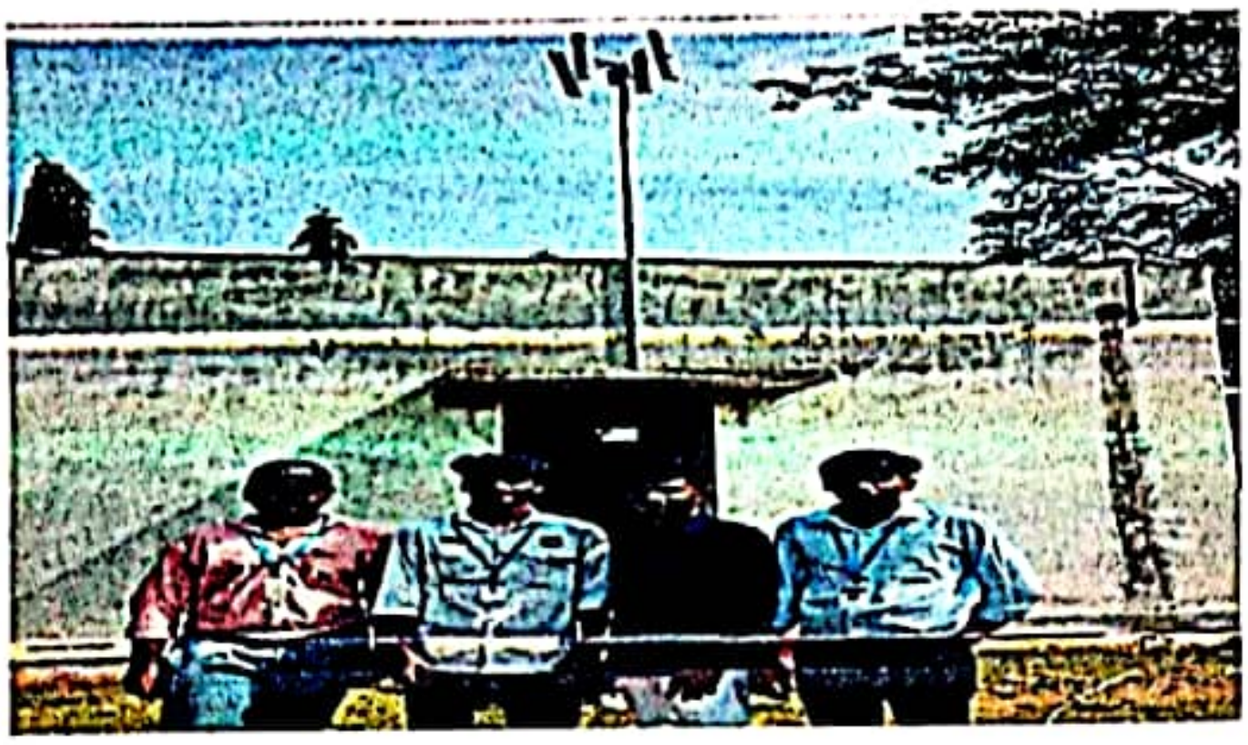

FINAL PROJECT OUTCOME

QUOTATION:

S.NO	ITEMS	QTY	UNIT PRICE	AMOUNT
1.	EXIDE DRIVER 32R-32AH	1	3200	3200
2.	SOLAR MTEK 50-12V	1	2300	2300
3.	EASTMAN CHARGE CONTROLLER LCD DISPLAY.20AMP/24V	1	1400	1400
4.	MOTOR	1	2000	2000
5.	SOLAR PANEL	1	4000	4000
6.	WIND MODEL FABRICATION	1	2800	2800
			TOTAL	15,700

This project was funded by CG Power Systems with whom the institution have signed Memorandum of Understanding (MoU) for the academic year 2019-2020.

Prof.P.Manisankar, Vice-chancellor, Bharathidasan University appreciated the students for their innovative approach in bringing this project, Hybrid power generation in our campus while implementation.

SRI RAAJA RAJAN COLLEGE OF ENGINEERING AND TECHNOLOGY ★ KARAIKUDI

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ABSTRACT

Renewable Energy is the energy that comes from natural resources such as sunlight, wind, rain, tides, waves and geothermal heat which are continually replenished. Hybrid power generation model mainly focuses on the renewable energy resources. These sources of energy can meet the world's demand without dismantling the stability of Earth. Renewable power system model is mainly to meet the increasing energy demand through nonconventional energy sources. In our project a hybrid model Solar and Wind has been planned to use to generate electricity. This configuration allows the three sources to supply the load separately or simultaneously depending on the availability of energy resources. The objectives of the present study are to convert the solar and wind into electricity and to optimize the energy requirement using these nonconventional energy resources. It reduces the environmental pollution using clean or environmental friendly technology and creates awareness among people regarding renewable energy resources.

CHAPTER-1

INTRODUCTION

Wind energy is a source of renewable power which comes from air current flowing across the earth's surface. Wind turbines harvest this kinetic energy and convert it into usable power which can provide electricity for home, farm, school or business applications on small (residential), medium (community), or large (utility) scales. Wind energy is one of the fastest growing sources of new electricity generation in the world today. These growth trends can be linked to the multi-dimensional benefits associated with wind energy.

- **Green Power:** The electricity produced from wind power is said to be "clean" because its generation produces no pollution or greenhouse gases. As both health and environmental concerns are on the rise, clean energy sources are a growing demand.
- **Sustainable:** Wind is a renewable energy resource, it is inexhaustible and requires no "fuel" besides the wind that blows across the earth. This infinite energy supply is a security that many users view as a stable investment in our energy economy as well as in our children's' future.
- **Affordable:** Wind power is a cost-competitive source of electricity, largely due to technological advancements, as well as economies of scale as more of these machines are manufactured and put online around the world.
- **Economic Development:** As well as being affordable, wind power is a locally-produced source of electricity that enables communities to keep energy dollars in their economy. Job creation (manufacturing, service,

construction, and operation) and tax base increase are other economic development benefits for communities utilizing wind energy.

1.1 Overview

In recent years, wind energy has become one of the most economical renewable energy technology. Today, electricity generating wind turbines employ proven and tested technology, and provide a secure and sustainable energy supply. At good, windy sites, wind energy can already successfully compete with conventional energy production. Many countries have considerable wind resources, which are still untapped.

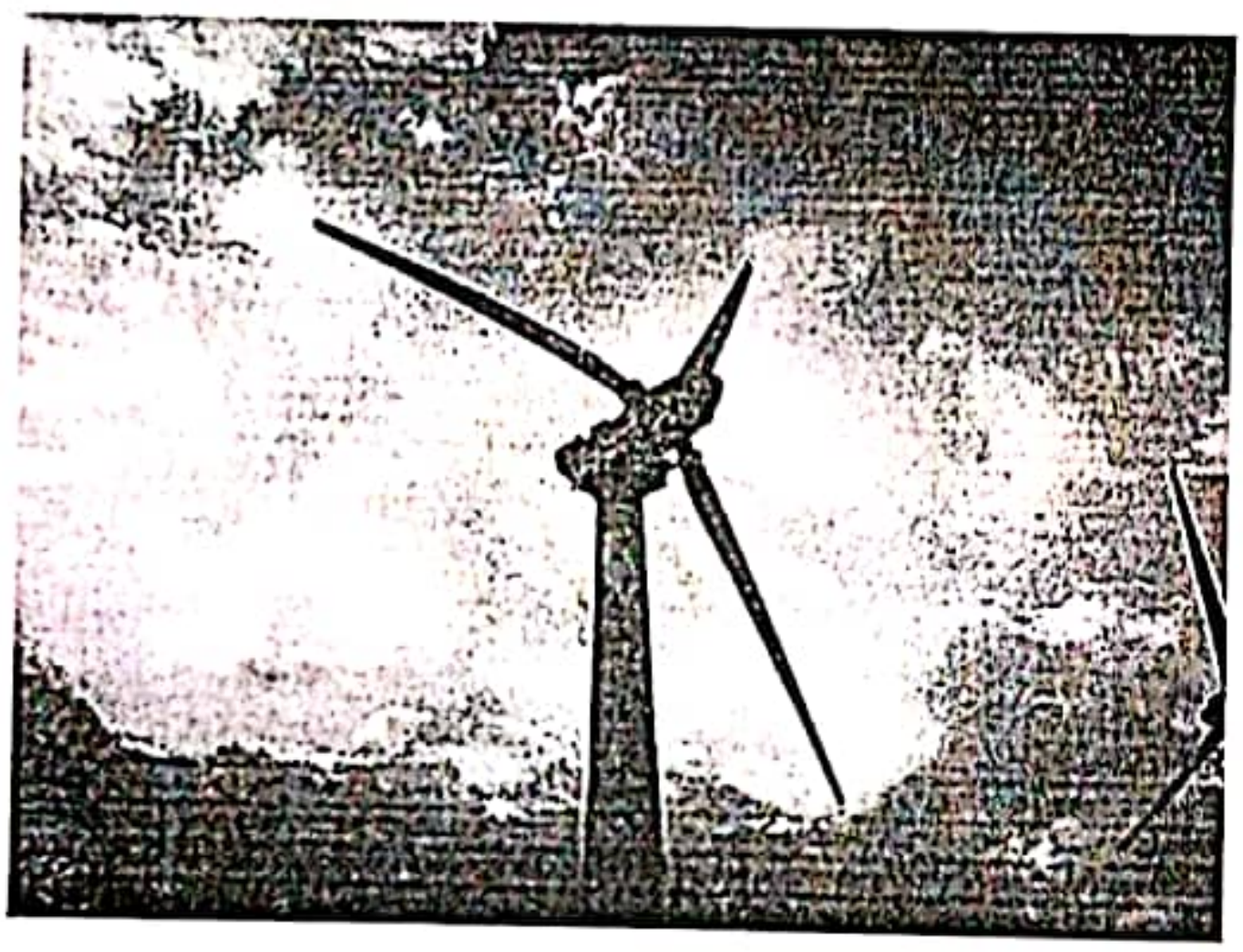

Fig 1.1 wind

- Wind energy produces no greenhouse gases.
- Wind power plants can make a significant contribution to the regional electricity supply and to power supply diversification.
- Very short lead time for planning and construction is required as compared to conventional power projects.

1.4 Solar energy

Solar energy is the energy obtained by capturing heat and light from the Sun. Energy from the Sun is referred to as solar energy. Technology has provided a number of ways to utilize this abundant resource. It is considered a green technology because it does not emit greenhouse gases. Solar energy is abundantly available and has been utilized since long both as electricity and as a source of heat.

Solar technology can be broadly classified as –

- **Active Solar** – Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. Active solar is directly consumed in activities such as drying clothes and warming of air.
- **Passive Solar** – Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light-dispersing properties, and designing spaces that naturally circulate air.

1.4.1 Conversion of Solar Energy

The solar energy is the energy obtained by capturing heat and light from the Sun. The method of obtaining electricity from sunlight is referred to as the Photovoltaic method. This is achieved using a semiconductor material.

The other form of obtaining solar energy is through thermal technologies. which give two forms of energy tapping methods.

- The first is solar concentration, which focuses solar energy to drive thermal turbines.

- The second method is heating and cooling systems used in solar water heating and air conditioning respectively.

The process of converting solar energy into electricity so as to utilize its energy in day-to-day activities is given below –

- Absorption of energy carrying particles in Sun's rays called photons.
- Photovoltaic conversion, inside the solar cells.
- Combination of current from several cells. This step is necessary since a single cell has a voltage of less than 0.5 V.
- Conversion of the resultant DC to AC.

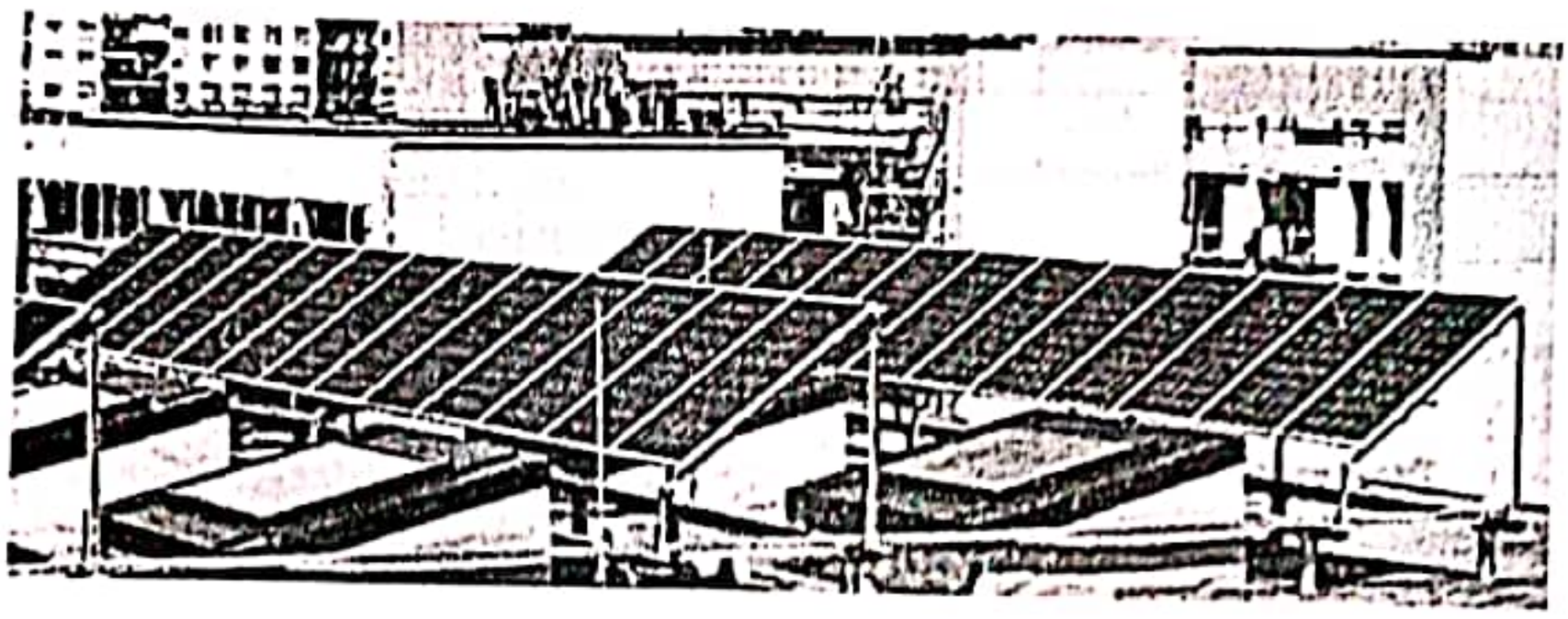

Fig 1.2 Solar energy

Solar energy in one form or another is the source of nearly all energy on the earth. Humans, like all other animals and plants, rely on the sun for warmth and food. However, people also harness the sun's energy in many other different ways. For example, fossil fuels, plant matter from a past geological age, is used for transportation and electricity generation and is essentially just stored solar energy from millions of years ago. Similarly, biomass converts the sun's energy into a fuel which can then be used for heat, transport or electricity. Wind energy, used

hundred of years to provide mechanical energy or for transportation, uses air ...rents that are created by solar heated air and the rotation of the earth. Today ...d turbines convert wind power into electricity as well as its traditional uses. ...n hydroelectricity is derived from the sun. Hydropower depends on the ...poration of water by the sun, and its subsequent return to the Earth as rain to ...ide water in dams. Photovoltaics (often abbreviated as PV) is a simple and ...zant method of harnessing the sun's energy. PV devices (solar cells) are unique ...hat they directly convert the incident solar radiation into electricity, with no ...se. pollution or moving parts, making them robust, reliable and long lasting. ...ar cells are based on the same principles and materials behind the ...mmunications and computer revolutions, and this CDROM covers the operation, ... and applications of photovoltaic devices and systems.

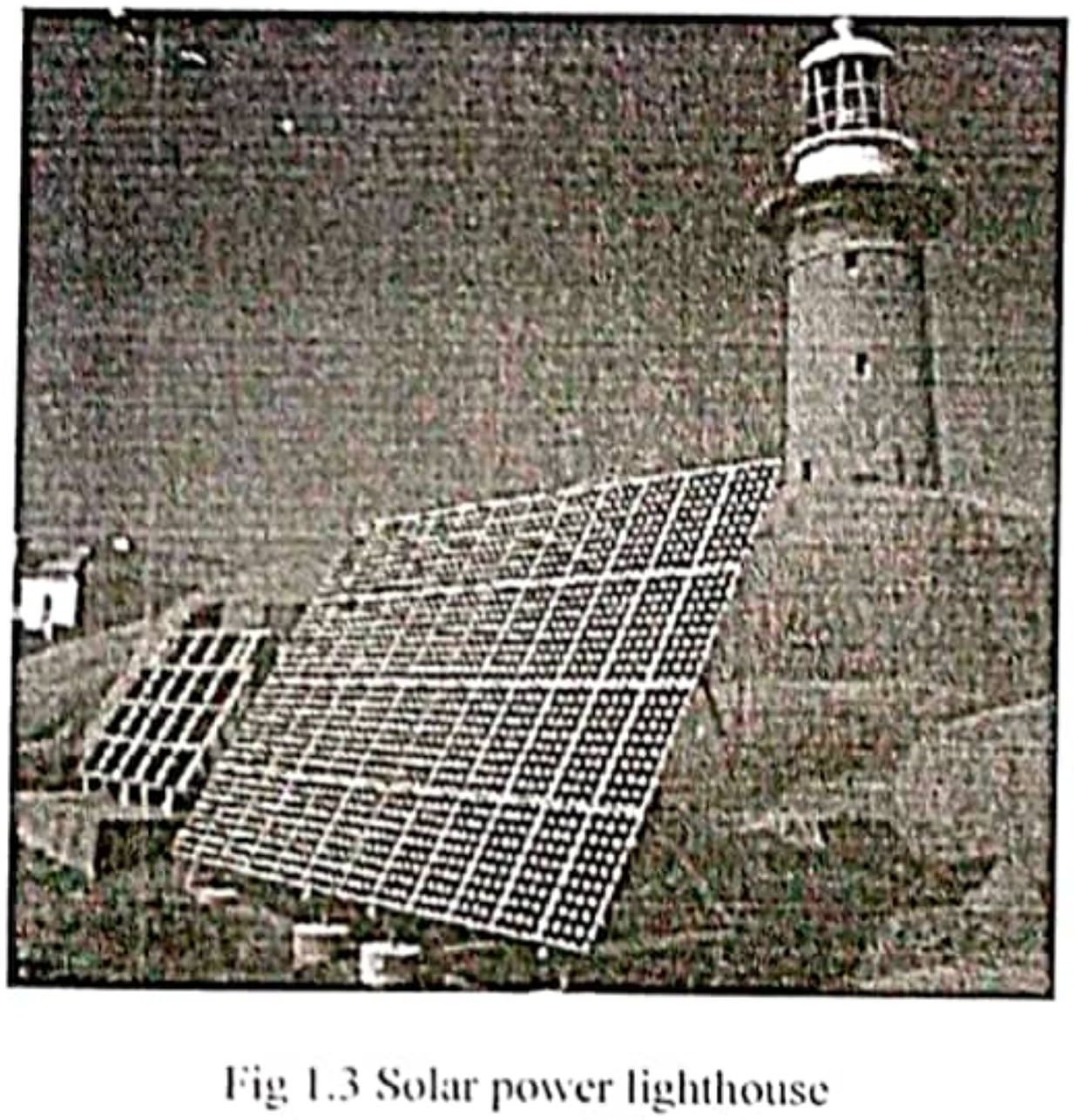

Fig 1.3 Solar power lighthouse

CHAPTER-3

EXISTING SYSTEM

To use individual power generation model consists of Rain water power, Solar PV and Wind energy.

3.1 Rain Water Power generation

Rainwater harvesting is the accumulation and deposition of rainwater for reuse before it reaches the aquifer. In this technique, we channel the water falling on roof tops of buildings and homes, and open spaces to a storage tank through a filter. Excess water is directed to a well or pit through which water seeps in earth to increase water table.

3.2 Solar power generation

Solar power is converted into the electric power by a common principle called photo electric effect. The solar cell array or panel consists of an appropriate number of solar cell modules connected in series or parallel based on the required current and voltage. PV (Photo-voltaic) cells are made up from semiconductor structures as in the computer technologies.

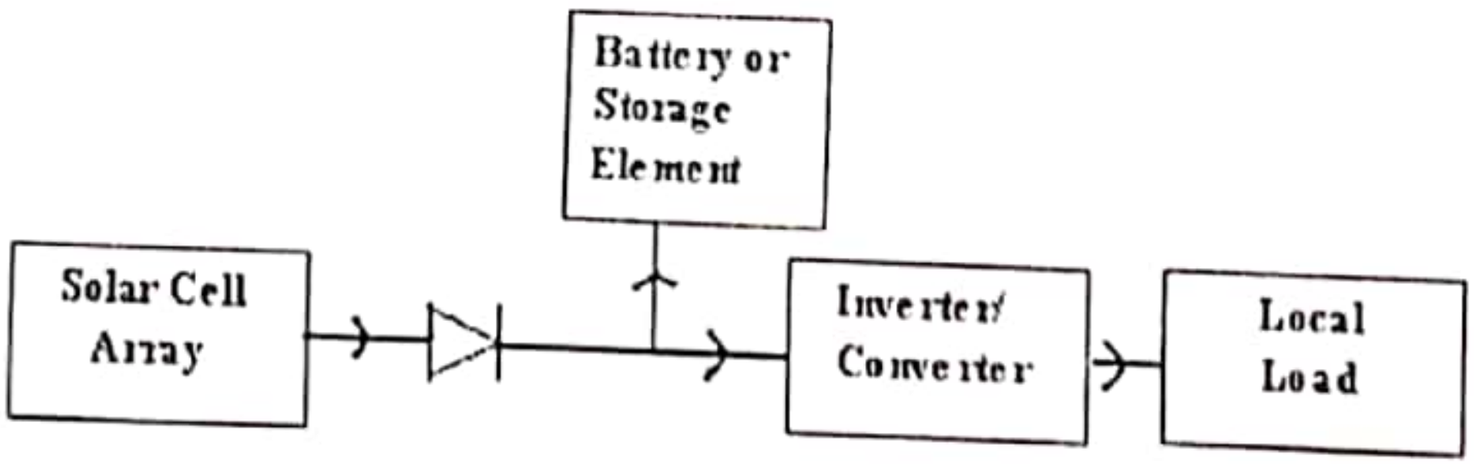

Fig 3.1 Solar power generation

3.3 Wind Energy power generation

The wind passes through the propeller and producing the circumferential force and axial thrust. This circumferential force is also known as torque, which drives the generator to produce the electrical power.

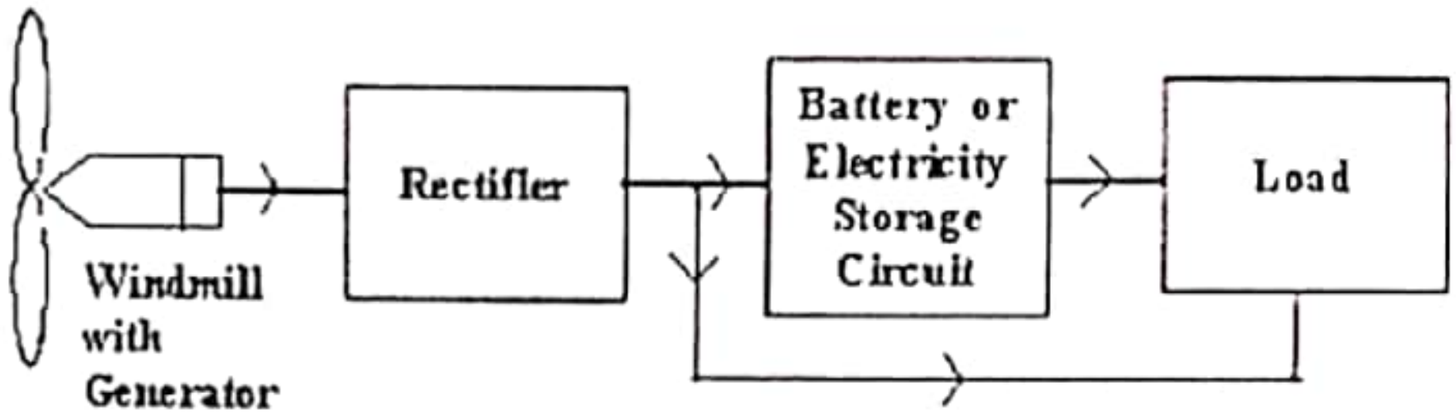

Fig 3.2 Wind Power generation

CHAPTER-4

PROPOSED SYSTEM

In our present project planning to develop a hybrid power generation model consists of Solar PV, Wind energy, turbine and battery which is mentioned in the process of working and installation as given below:

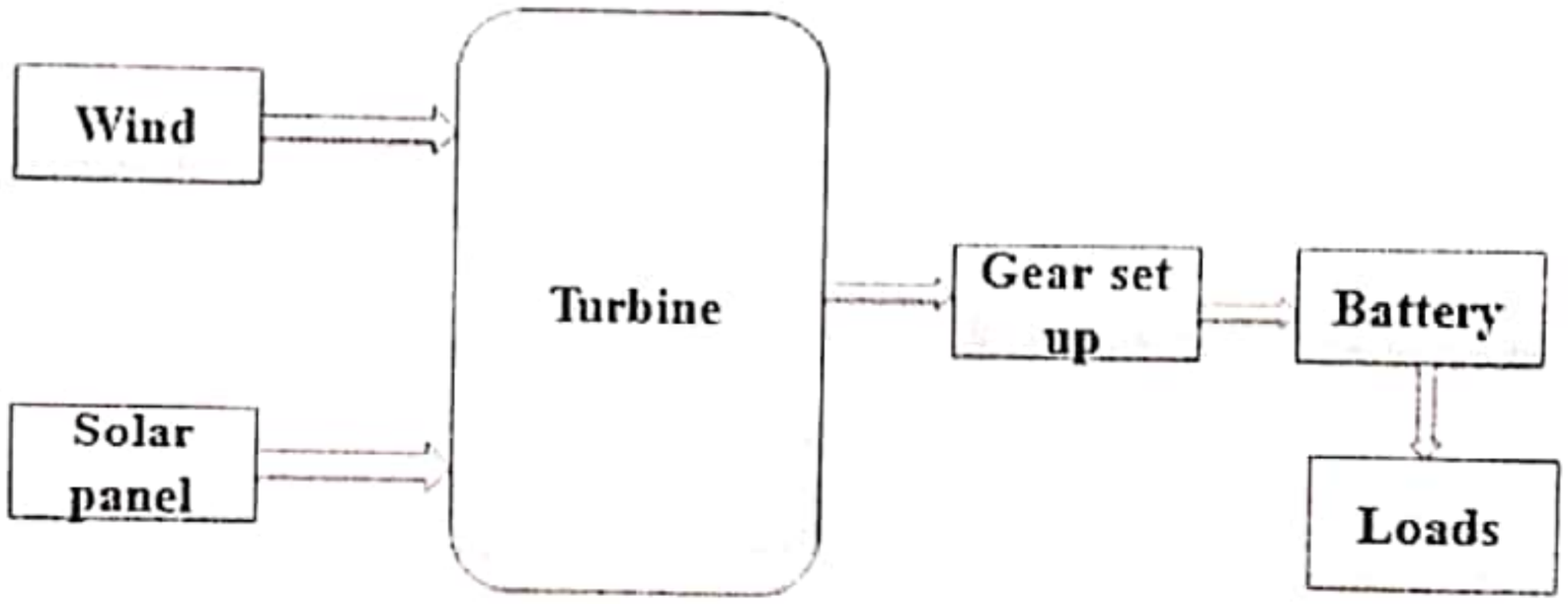

Fig 4.1 Block Diagram

4.1 Solar PV Energy

Solar panels are the medium to convert solar energy into the electrical energy. Solar panels can convert the energy directly or heat the water with the induced energy. Photovoltaic is known as the process between radiation absorbed and the electricity induced. Solar power is converted into the electric power by a common principle called photo electric effect. The solar cell array or panel consists

CHAPTER-6

EXPERIMENTAL SET UP

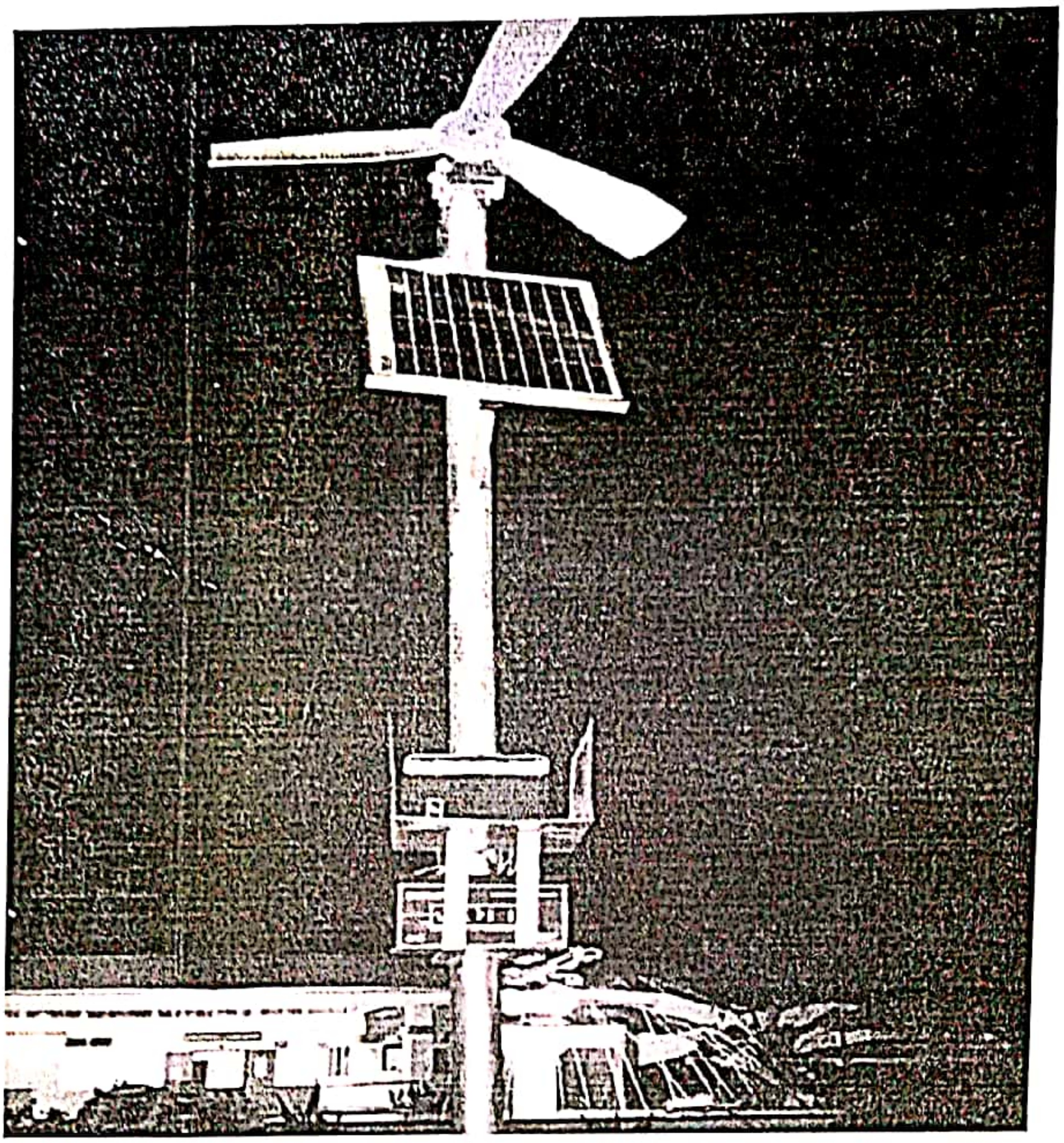

Figure 6.1 project model

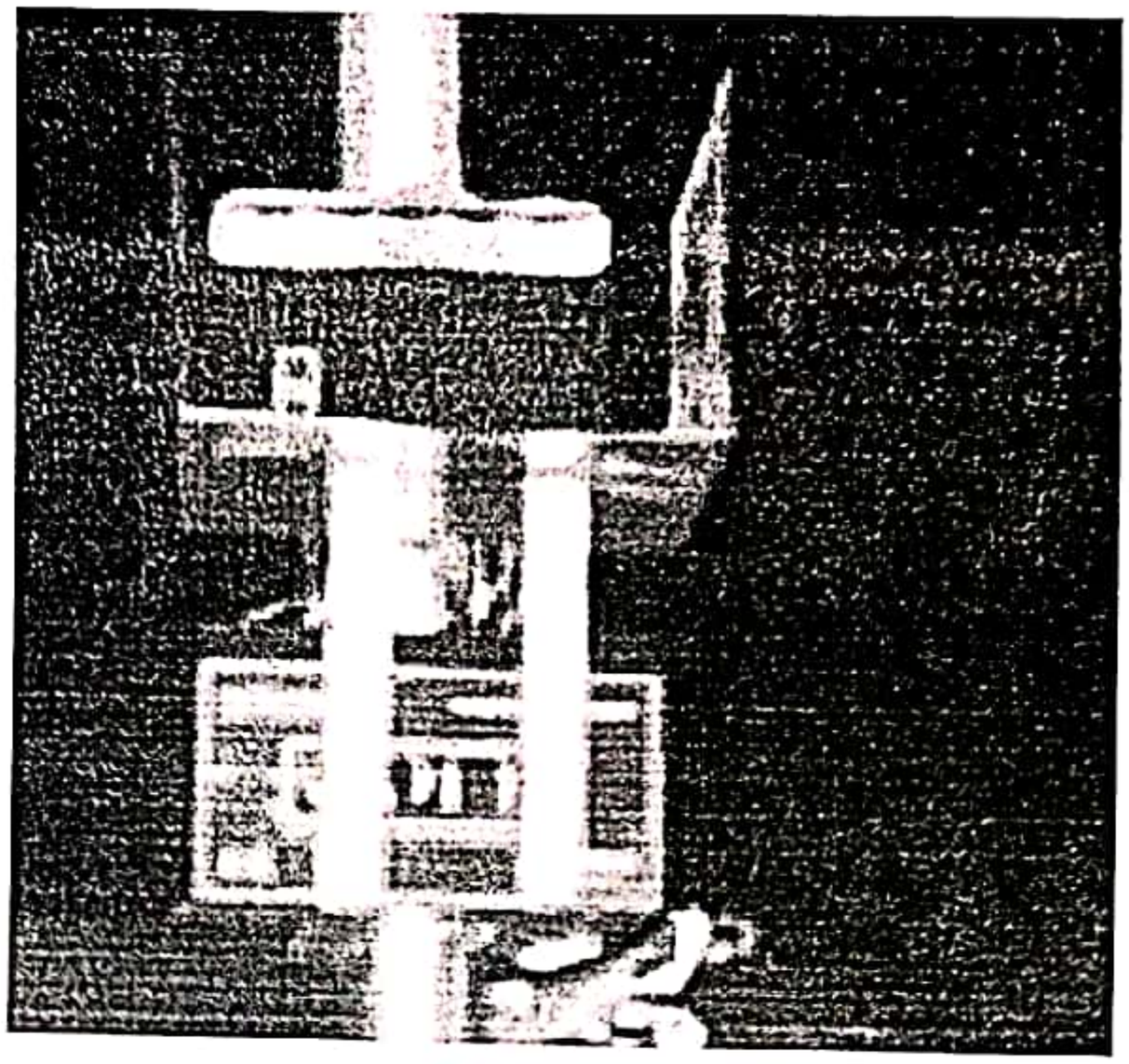

Figure 6.2 power detector

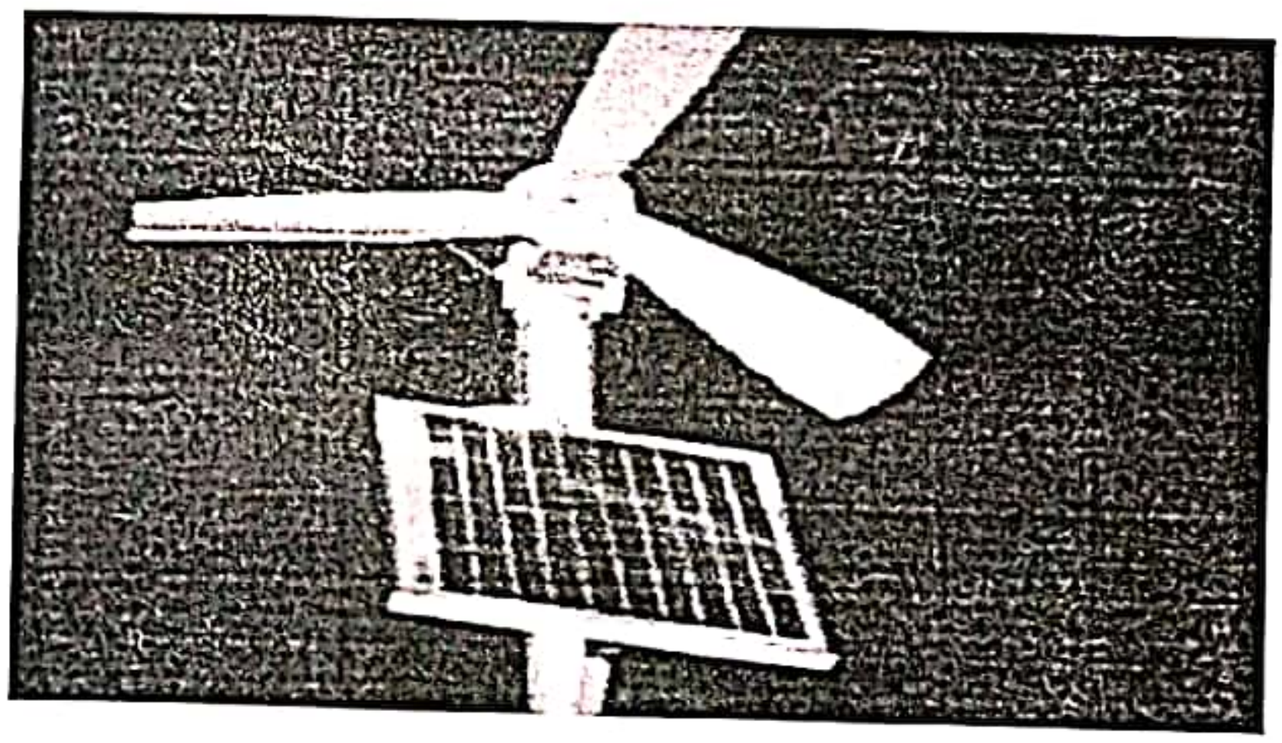

Figure 6.3 wind blade and solar PV

Memorandum of understanding

This is to certify that the memorandum of understanding (MoU) is made on 21st of January 2021.

BETWEEN

CG Power Systems located at Devakottai.

AND

Sri Raaja Raajan College of Engineering and Technology , Karaikudi hereinafter referred as "SRRCET", located at Karaikudi, Sivaganga District, Tamilnadu", recognized by AICTE and Anna university, offering quality education and philanthropy, represented by principal on the date 21-January-2021 has been signed off and both the parties agree to adhere to the MoU.

The details of the above said MoU are as follows:

Objective : To set up a development centre at SRRCET

Purpose : (a) To impart technical knowledge and skill for the students and faculty of CG Power Systems through internships, industrial project etc.,

(b) To create a bridge to reduce the gap between industries and institutions.

(c) To develop products and projects for CG Power Systems for 6 months from the date of MoU.

1.Scope of works:

1.1 CG Power Systems

a . Setting up a development centre at SRRCET.

b . Creating awareness about the latest technologies, trends and employability/entrepreneurship skills needed to the students of SRRCET.

c . Hiring and deploying students of SRRCET for internships.

d . Offering live industrial design project to the willing students, as per CG Power Systems norms.

e . Providing students and faculty development programs, whenever possible.

f. Carrying out drafting that result in mutual growth for both CG Power Systems and SRRCET.

g . Mentoring the students and faculty for converting their creative ideas into the projects.

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1.2 **Sri Raajan Raajan College of Engineering and Technology, Karaikudi(SRRCET)**

a. Provide infrastructure support to CG Power Systems based on the listed down requirements.

b. Appoint SPOC for continuous coordination, implementation and execution of this MoU.

c. Provide minimum 10 interns and also permit and other CG Power Systems interns to utilize the centre, when required.

d. Promote the need of having hands on experience in live project industrial advancements for the students in order to get the technical skill and entrepreneurial skills upgraded.

e. Promote faculty to get latest insides about the industrial sector and give preference to industrial projects.

f. Utilize the development centre for designing activities of SRRCET, its faculty and students.

g. Ensure discipline, ethical behaviour of the personnel utilizing the development centre growth.

2. Infrastructure requirements to be provided by SRRCET

a.Work space of minimum 300sq.ft / 30sq.m with provision for displaying CG Power Systems name board and centre details and required stationery.

b.Minimum of 5 desktops/ laptops with a configuration of minimum 4GB RAM/ 500GB HDD , 2 GHZ clock speed with USB/optical drivers, uninterrupted power supply and internet connectivity(existing system from labs can be used on sharing basis.

d.Matlab , Homer pro, ETab, any desk / team viewer, antivirus and other basic software used for the major course related subject

d.support to install any additional software tools required for the development centre.

e.Provide necessary support of CG Power Systems

3.Activities to be carried out by CG Power Systems as part of MoU

- Internships and training for interns
- Industrial awareness for students and faculty
- Insights about latest technology and industrial trends to create awareness
- Support in creative ideas, designing activities of SRRCET and patent/IPR support.
- Live industrial projects/ case studies and working experience.
- Carry out products/ solution development at the centre.

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4.Financials

This MoU does not cover any financial liabilities on both the parties.

In case of any additional services needed by SRRCET , apart from the above indicated ones, the charges will be mutually discussed and agreed on a case –to- case basis. The charges, if, any, are subject to the applicable taxes and necessary supporting bills should be accompanied.

5. Non disclosure and confidentiality

By signing on this MoU, both the parties agree that confidential information about both the parties will never be disclosed by any one of the parties, to any third party without the concerned the other party. Also, the document confidential and both the parties can utilize it only for the purpose of accreditation/ recognition / incorporation from any professional government bodies only. Any other usage apart from the above has to be done with the written consent of the other party.

6. Termination

Both parties can mutually terminate this MoU , with a prior written notice 3 months. Upon termination both the parties shall return the infrastructure/ confidential information/ any other tools/ programs to each other.

7. Renewal of MoU

The MoU can be renewed upon its expiry for an additional period 1 to 6 months, based on mutual agreement between both the parties.

8. Annexures of MoU

Through annexure to this MoU, both the parties can perform below activities.

- Add any additional services based on mutual agreement between both parties.
- List down the details of the development activities.
- Indicate any activities that are being carried (commercial or non commercial) with specific details

For and on behalf of
Sri Raaja Raajan College of Engineering and Technolgy

PRINCIPAL

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Amaravathipudur, Karaikudi - 630 302
Sivagangai Dist. Tamil Nadu

For and on behalf of
CG Power Systems

K. Pradheep

Mr.K.PRADHEEPAN,
PROPRIETOR

SRI RAAJA RAAJAN COLLEGE OF ENGG & TECH. KARAIKUDI