"HYBRID ELECTRICAL VEHICLE"

A Project

Submitted in partial fulfillment for the

Award of the degree of

BACHELOR OF TECHONOLOGY

IN

MECHANICAL ENGINEERING

Submitted by

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(2016-2017)

DECLARATION

We hereby declare that this submission is our own work to the best of our knowledge and belief, it contains no material previously or written by any other person nor material which to a substantial extent has been accepted for the award of any degree or diploma of the university or other institute of higher learning, except where due acknowledgment and references has been made in the text.

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CERTIFICATE

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I finally pray that Almighty fulfils the aspirations of all the people who have been a part of this journey and those who will be a part of future journeys.

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ABSTRACT

In an era where energy conservation has become the latest topic of discussion not only among the erudite but also among the ordinary responsible denizens, fuel efficiency along with minimum pollution has become the benchmark for any new automobile and in the same context "Hybrid Cars" come as the latest addition.

By the name itself it can be inferred that a hybrid car is an improvisation to the traditional gasoline engine run car combined with the power of an electric motor.

The project on the above topic intends to bring to notice the concepts associated with the hybrid technology through the following topics components and constituents, need, efficiency, performance etc.

NOMENCLATURE

Symbol	Description
D	Dia. Of Blade
A	Cross-section area of Blade
D	Dia. Of Shaft
K.E.	Kinetic Energy of Air
M	Mass of Air
V	Velocity of Air
P	Pressure of Air
B	Thickness of Blades
kW	Kilo watt
km/hr	Kilometer per Hour
G	Spring Action to Provide Motion
I	Electrical Energy Out
F	Force exerted on the pillar piston
A	Permanent Magnets to provide Induced EMF
B	Rod to connect wheel
C	Rubber Spring
E	Shocker Rod
m/s	Meter per second

V

c	Speed of light
Rpm	Revolution per minute
PV Cells	Photovolatic cells
P	Density of Air
WECS	Wind Energy Conversion System
HEV	Hybrid electrical vehicle

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INTRODUCTION

CHAPTER 1: INTRODUCTION

Energy is a requirement that is endlessly and exhaustingly utilized the world over. With the increase in the rate of various developmental activities around the world the energy being consumed is also increasing with the result that conventional energy resources are fast getting depleted and even reserves are proving less than sufficient to satisfy the growing energy demand. As a result consumers around the world have to bear the brunt of increasing power cuts and power costs. Hence for the future power independence is fast becoming a vital requirement. The concept design therefore formulates a system which provides internally generated energy for homes and also integrates a sub system into the household such that the dependence on the electricity

Figure 1

1.1 What makes it a "Hybrid"?

Any vehicle is hybrid when it combines two or more sources of power. In fact, Many people have probably owned a hybrid vehicle at some point. For example, a mo-ped (a motorized pedal bike) is a type of hybrid because it combines the power of a gasoline engine with the pedal power of its rider.

Hybrid vehicles are all around us. Most of the locomotives we see pulling trains are diesel-electric hybrids. Cities like Seattle have diesel-electric buses -- these can draw electric power from overhead wires or run on diesel when they are away from the wires. Giant mining trucks are often diesel-electric hybrids. Submarines are also hybrid vehicles -- some are nuclear-electric and some are diesel-electric. Any vehicle that combines two or more sources of power that can directly or indirectly provide propulsion power is a hybrid. .

Figure 2 below shows an electric car, which has a set of batteries that provides electricity to an electric motor. The motor turns a transmission, and the transmission turns the wheels.

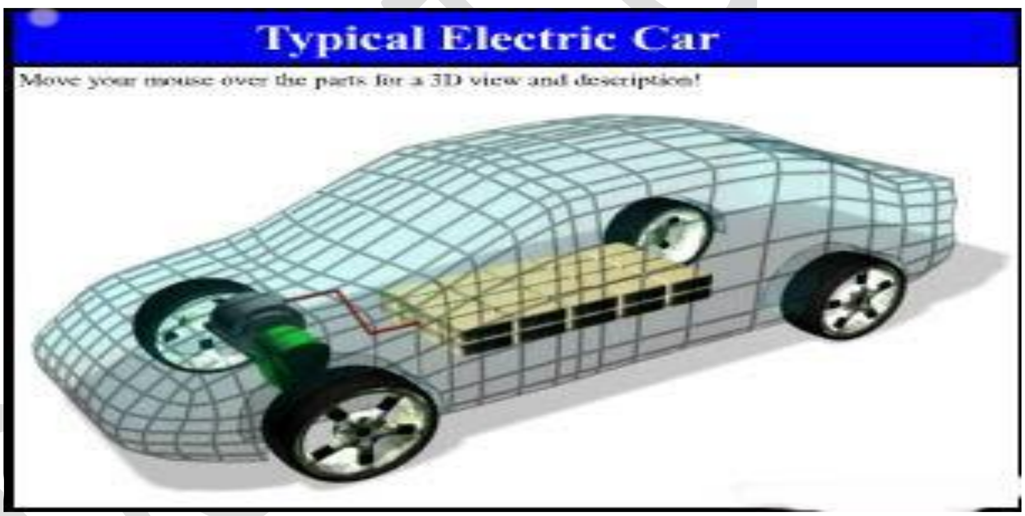

Figure 2

1.2 HYBRID COMPONENT

Hybrid cars contain the following parts:

- **Electric motor** - The electric motor on a hybrid car is very sophisticated. Advanced electronics allow it to act as a motor as well as a generator. For example, when it needs to, it can draw energy from the batteries to accelerate the car. But acting as a generator, it can slow the car down and return energy to the batteries.
- **Generator** - The generator is similar to an electric motor, but it acts only to produce electrical power. It is used mostly on series hybrids.
- **Batteries** - The batteries in a hybrid car are the energy storage device for the electric motor. Unlike the gasoline in the fuel tank, which can only power the gasoline engine, the electric motor on a hybrid car can put energy into the batteries as well as draw energy from them.
- **Transmission** - The transmission on a hybrid car performs the same basic function as the transmission on a conventional car. Some hybrids, like the Honda Insight, have conventional transmissions. Others, like the Toyota Prius, have radically different ones, which well talk about later.

1.3 PARTS OF AN ELECTRIC MOTOR

Let's start by looking at the overall plan of a simple two-pole DC electric motor. A simple motor has six parts, as shown in the diagram below:

- Armature or rotor
- Commutator
- Brushes
- Axle
- Field magnet
- DC power supply of some sort

Parts of an electric motor	2

An electric motor is all about magnets and magnetism: A motor uses magnets to create motion. If you have ever played with magnets you know about the fundamental law of all magnets: Opposites attract and likes repel. So if you have two bar magnets with their ends marked "north" and "south," then the north end of one magnet will attract the south end of the other. On the other hand, the north end of one magnet will repel the north end of the other (and similarly, south will repel south). Inside an electric motor, these attracting and repelling forces create rotational motion.

In the diagram we can see two magnets in the motor: The armature (or rotor) is an electromagnet, while the field magnet is a permanent magnet (the field magnet could be an electromagnet as well, but in most small motors it isn't in order to save power).

1.4 HYBRID GENERATING UNIT

The generating unit for the proposed design utilizes a hybrid power source as a means of powering the household loads. The hybrid power source combines wind and solar energy to service the household requirements.

Hybrid system for home is a combined system of wind and solar power generation system. Aero turbines convert wind energy into rotary mechanical energy. A mechanical interface, consisting of a step-up gear and a suitable coupling transmits the energy to an electrical generator. The output of this generator is connected to the Battery or system grid. The battery is connected to the inverter. The inverter is used to convert DC voltages to AC voltages. The load draws current from the inverter.

The apparatus involved for the windmill section are:

- Generator
- Main shaft with Leafs
- Gear Wheel Arrangement

Wind power ratings can be divided into three convenient grouping, small to 1kW, medium to 50 kW and large 200 kW to megawatt frame size.

Solar energy implies the energy that reaches the earth from the sun. It provides daylight makes the earth hot and is the source of energy for plants to grow. Solar energy is also put to two types of use to help our lives directly solar heating and solar electricity. Solar electricity is the technology of converting sunlight directly in to electricity. It is based on photo-voltaic or solar modules, which are very reliable and do not require any fuel or servicing. Solar electric systems are suitable for plenty of sun and are ideal when there is no main electricity.

1.5 HYBRID SYSTEM BLOCK DIAGRAM

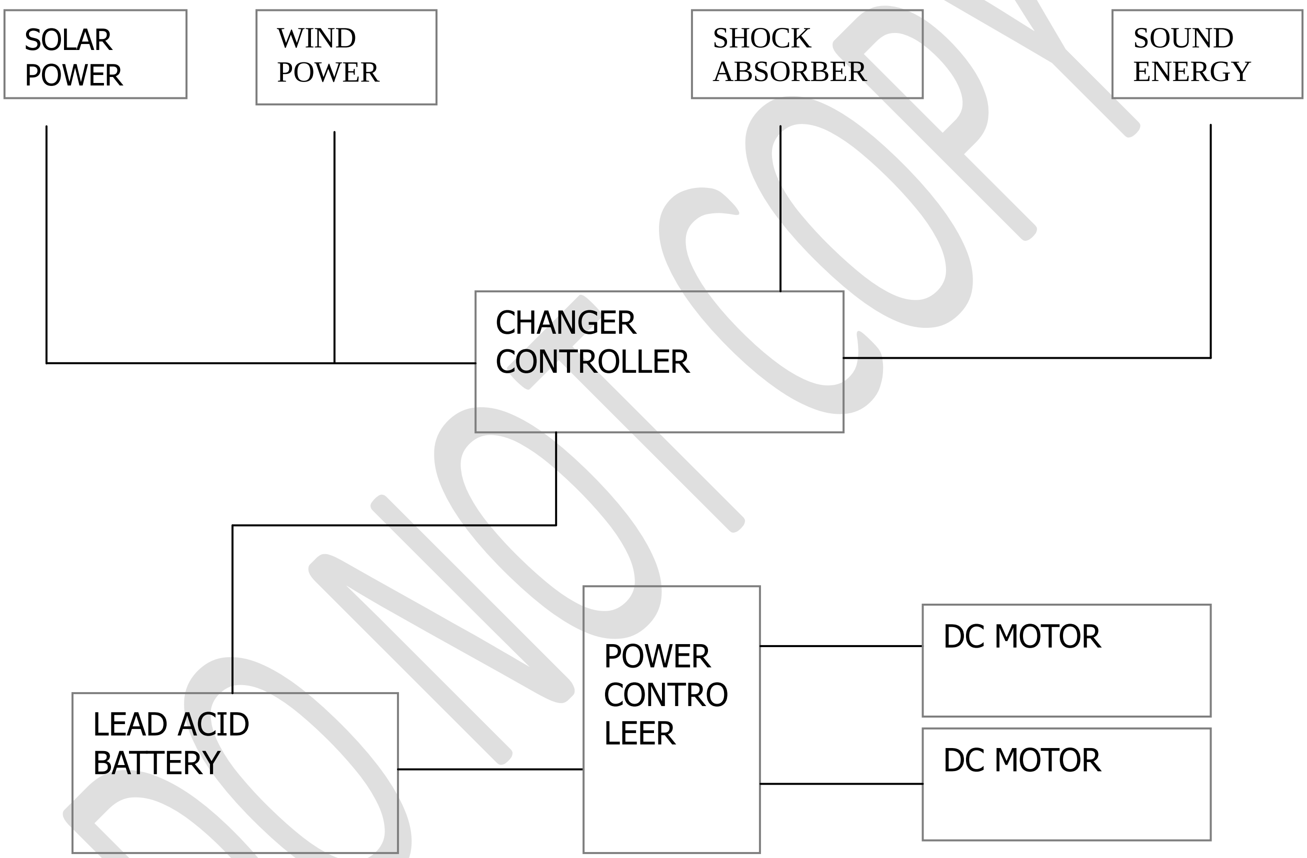

Figure.3

1.6 HYBRID GENERATING STATION

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CHAPTER - 2

LITERATURE SURVEY

CHAPTER 2: LITERATURE SURVEY

2.1 Literature review of Hybrid Electric Vehicle

1. Rushikesh Trushar Soni (2015) [1] investigated on hybrid electric vehicle and he has been fond that the transmission of power using freewheels and chain wheels are very cheap and reliable. One disadvantage is that driving on electric power is not a good option for a long distance travel. Though this combined power train system can become much useful in more stop and go traffic situations. With the use of this power train system, the overall fuel consumption and fuel economy is improved. Such vehicle would run on fuel but would use its electric motor to boost the power when needed. The cost of HEVs is a little more than the conventional cars but they more efficient and the exhaust emissions are less.

2. Parag Kulkarni (2015) [2] demonstrates the growing need for sustainable transportation in the World and the role of HEVs as a possible solution. Through technology review and comparative analysis it shows that HEVs can significantly reduce harmful emissions of gases. This paper summarizes the key initiatives and features of Hybrid Electric Car adapted by the world to encourage the purchase of fuel-efficient vehicles, particularly hybrid electric vehicles.It also gives brief information about hybrid electric vehicles ,their categories and types according to different parameters.

3. T. Vignesh et al.(2017) [3] investigated Energy and environmental issues are among the most important problems of public concern. Wind and solar energy may be one of the alternative solutions to overcome energy shortage and to reduce greenhouse gaseous emission. Using electric cars in cities can significantly improve the air quality there. The basic principle of solar based electric vehicle is to use energy that is stored in a battery to drive the motor and it moves the vehicle in forward or reverse direction. The DC voltage from the PV panel is then boosted up using a boost DC-DC converter, and then an inverter, where DC power is converted to AC power as well as AC power is generated by using wind turbines, ultimately runs the Brushless DC motor which is used as the drive motor for the vehicle application. This paper focuses on the design and implementation of the various components, namely: solar panel, wind turbine, charge controller, battery, DC-DC boost converter, DC-AC power converter (inverter circuit), arduino processor and BLDC motor for the vehicle application. This idea, in future, may help protect our

fuels from getting extinguished. This study proposed an improvement of the energy management system of a hybrid electric vehicle using using Renewable Energy Sources. Hybrid power generation system is good and effective solution for power generation than conventional energy resources. It has greater efficiency. It can provide to remote places where government is unable to reach. So that the power can be utilize where it generated so that it will reduce the transmission losses and cost. Cost reduction can be done by increasing the production of the equipment. People should motivate to use the non-conventional energy resources. It is highly safe for the environment as it doesn't produce any emission and harmful waste product like conventional energy resources.

In Germany, being able to use a car is one element of individual freedom and is a cornerstone of individual mobility. 82 % (2008) of all German households possess a car and in just over a third of these households two or more cars are available. Despite the already high degree of car availability in the past, the motorization has even further increased in recent years (Follmer et al. 2010). In the new millennium the high dependence of individual mobility on private cars led to a discussion of alternatives to the internal combustion engine, initiated particular by significantly increasing oil prices. Worldwide, many governments and interest groups moved the issue of sustainable mobility in the foreground (Greenpeace 2010, Kendall 2008). Hybrid and electric vehicles (EV) are seen as an important part of a technology portfolio targeted at reducing greenhouse gas emissions as well as the dependence on oil by funding the expansion of renewable energies, developing new mobility concept, e.g. for public transport, or supporting technological developments (Greenpeace 2010, Kendall 2008). The electrification of the drivetrian could lead to a sustainable technology path which benefits the consumer by lower and less volatile (electricity) prices for mobility (Schill 2010a, c). This discussion is encouraged by the fact that electric mobility is benefitting from high oil prices (Conrady 2012, Dijk et al. 2012). The rise of interest in the topic electric mobility may be particularly well traced by looking to the internet. This can be done by considering first the number of search inquiries of internet users over a time span and second by analyzing the number of hits displayed by search engines over a period for a specific topic. We have first investigated different frequently used keywords with Google Insight for Search (Fig. 1). There are three search inquiries related to electric mobility that were most often searched in Google: electric mobility, electric car and electric vehicle.

After that we have investigated the number of searches in the period from the beginning of 2004 till the end of June 2012. It turns out that especially the term ‘electric car’ was asked with peaks in 2006 and 2008.

2.2 PROJECT OBJECTIVES

The title of project work is “HYBRID ELECTRIC VEHICLE (HEV)”

To meet increasing fuel economy and emissions legislation, the automotive industry will need to undergo drastic changes in vehicle and engine designs. Unlike conventional vehicles on the road today, hybrid electric vehicles (HEV) are designed with a smaller engine and an on-board energy storage system. The smaller engine allows the vehicle to achieve better fuel economy and fewer emissions. The efficiency benefits of diesel engines over gasoline engines make the diesel engine a strong contender for further improving fuel economy. The integration of diesel-engine technology into a hybrid electric vehicle configuration is one of the most promising ways to comply with fuel-economy and emissions legislation. Using simulation software, it is possible to quickly and easily optimize the engine and vehicle prior to investing time and money into testing components and building prototypes. The ability to integrate an advanced engine simulation software output and an HEV simulation for the prediction of engine alterations on overall vehicle performance is a critical tool for the success of meeting vehicle emissions and fuel economy goals.

The objectives of the present work are:

- ❖ Study on renewable energy sources on the basis of performance, economy and applications.
- ❖ Design and construct a working unit model of hybrid electric vehicle using renewable energy sources.
- ❖ Cost analysis of HEV using renewable energy sources unit

CHAPTER – 3

DESIGN AND CONSTRUCTION

CHAPTER 3: DESIGN AND CONSTRUCTION

3.1 WIND ENERGY

Wind result from air in motion. Air in motion arises from a pressure gradient. On a global basis one primary forcing function causing surface winds from the poles toward the equator is convective circulation. Solar radiation heats the air near the equator, and this low density heated air is buoyed up. At the surface it is displaced by cooler more dense higher pressure air flowing from the poles. In the upper atmosphere near the equator the air thus tend to flow back toward the poles and away from the equator. The net result is a global convective circulation with surface wins from north to south in the northern hemisphere.

It is clear from the above over simplified model that the wind is basically caused by the solar energy irradiating the earth. This is why wind utilization is considered a part of solar technology.It actuality the wind is much more complex. The above model ignores the earth rotation which causes a coriolis force resulting in an easterly wind velocity component in the northern hemisphere. There is the further complication of boundary layer frictional effects between the moving air and the earth rough surface. Mountains, trees, buildings, and similar obstructions impair stream line air flow. Turbulence results and the wind velocity in a horizontal direction markedly increase with altitude near the surface. Local winds are caused by two mechanisms. The first is differential hating of land and water. Solar isolation during the day is readily converted to sensible energy of the land surface but is partly absorbed in layers below the water surface and partly consume in evaporating some of that water. The land mass becomes hotter than the water, which causes the air above the land to heat up and become warmer than the air above water. The warmer lighter air above the land rises and the cooler heavier air above the water moves into replace it. This is the mechanism of shore breezes. At night, the direction of the breezes is reversed because the land mass cools to the sky more rapidly than the water, assuming a sky. The second mechanism of local winds is caused by hills and mountain sides. The air above the slopes heats up during the day and cools down at night, more rapidly than the air above the low lands. This causes heated air the day to rise along the slopes and relatively cool heavy air to flow down at night. Wind turbines produce rotational motion; wind energy is readily converted into electrical energy by connecting the turbine to an electric generator. The combination of wind turbine and generator is sometimes referred as an aero generator. A step-up transmission is usually required to match the relatively slow speed of the wind rotor to the higher speed of an electric generator.

In India the interest in the windmills was shown in the last fifties and early sixties. A part from importing a few from outside, new designs was also developed, but it was not sustained. It is only in the last few years that development work is going on in many institutions. An important reason for this lack of interest in wind energy must be that wind, in India area relatively low and vary appreciably with the seasons. Data quoted by some scientists that for India wind speed value lies between 5 km/hr to 15-20 km/hr. These low and seasonal winds imply a high cost of exploitation of wind energy. Calculations based on the performance of a typical windmill have indicated that a unit of energy derived from a windmill will be at least several times more expensive than energy derivable from electric distribution lines at the standard rates, provided such electrical energy is at all available at the windmill site.

The above argument is not fully applicable in rural areas for several reasons. First electric power is not and will not be available in many such areas due to the high cost of generation and distribution to small dispersed users. Secondly there is possibility of reducing the cost of the windmills by suitable design. Lastly, on small scales, the total first cost for serving a felt need and low maintenance costs are more important than the unit cost of energy.

The last point is illustrated easily: dry cells provide energy at the astronomical cost of about Rs.300 per kWh and yet they are in common use in both rural and urban areas. Wind energy offers another source for pumping as well as electric power generation. India has potential of over 20,000 MW for power generation and ranks as one of the promising countries for tapping this source. The cost of power generation from wind farms has now become lower than diesel power and comparable to thermal power in several areas of our country especially near the coasts. Wind power projects of aggregate capacity of 8 MW including 7 wind farms projects of capacity 6.85 MW have been established in different parts of the country of which 3 MW capacity has been completed in 1989 by DNES. Wind farms are operating successfully and have already fed over 150 lakes units of electricity to the respective state grids. Over 25 MW of additional power capacity from wind is under implementation. Under demonstration

Programmer 271 wind pumps have been installed up to February 1989. Sixty small wind battery charges of capacities 300 watts to 4 kW are under installation. Likewise to stand-alone wind electric generators of 10 to 25 kW are under installation.

3.1.1 CONVERSION PRINCIPLES BLOCK DIAGRAM

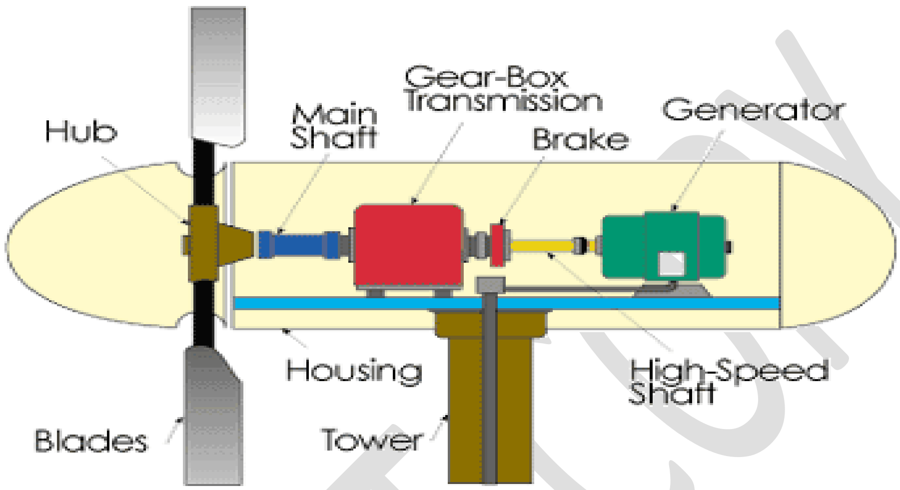


Figure. 4

A wind turbine is a machine that converts wind energy into electricity. The generators are connected to battery charging circuits and finally to large utility grids. In windmills the wind passes through the airfoil section of the blades and the lift produced generates a torque which is then transformed to electricity in the generator .The conversion of the wind energy into the mechanical energy of the turbine and then finally to electricity. As the output of the wind turbine is dependent on the availability of the winds it is intermittent and undependable. They can however be used along with conventional generators in a large grid and can reduce the loads of these generators when they are generating. The other option is to use storage devices like batteries and then discharge the electricity uniformly.

3.1.2 NATURE OF THE WIND

The circulation of air in the atmosphere is caused by the non-uniform heating of the earth surface by the sun. The air immediately above a warm area expands; it is forced upwards by cool, denser air which flows in from surrounding areas causing a wind. The nature of the terrain, the degree of cloud cover and the angle of the sun in the sky are all factors which influence this process. In general, during the day the air above the land mass tends to heat up more rapidly than the air over water. In coastal regions this manifests itself in a strong onshore wind. At night the process is reversed because the air cools down more rapidly over the land and the breeze therefore blows off shore the main planetary winds are caused in much the same way: Cool surface air sweeps down from the poles forcing the warm air over the topics to rise. But the direction of these massive air movements is affected by the rotation of the earth and the net pressure areas in the countries-clockwise circulation of air around low pressure areas in the northern hemisphere, and clockwise circulation in the southern hemisphere. The strength and direction of these planetary winds change with the seasons as the solar input varies.

Despite the winds intermittent nature, wind patterns at any particular site remains remarkably constant year by year. Average wind speeds are greater in hilly and coastal areas than they are well inland. The winds also tend to blow more consistently and with greater strength over the surface of the water where there is a less surface drag.

Wind speeds increase with height. They have traditionally been measured at a standard height of ten meters where they are found to be 20-25% greater than close to the surface. At a height of 60 m they may be 30-60% higher because of the reduction in the drag effect of the earth surface

3.1.3 WIND POWER

The power in the wind can be computed by using the concept of kinetics. The wind will works on the principle of converting kinetic energy of the wind to mechanical energy. We know that power is equal to energy per unit time. The energy available is the kinetic energy of the wind. The kinetic energy of any particle is equal to one half its mass times the square of its velocity, or

$1/2m\ V^2$. The amount of air passing in unit time, through an area A, with velocity V, is AV, and its mass m is equal to its volume multiplied by its density ρ of air, o

$$m=\rho AV$$

(m is the mass of air transverse the area A swept by the rotating blades of a wind mill type generator).

Substituting this value of the mass in the expression for the kinetic energy, we obtain, kinetic energy = $1./2\ \rho AV.V^2$ watts.

$$=1/2\ \rho AV^3 \text{ watts}$$

Equation tells us that the maximum wind available the actual amount will be somewhat less because all the available energy is not extractable-is proportional to the cube of the wind speed. It is thus evident that small increase in wind speed can have a marked effect on the power in the wind.

Equation also tells us that the power available is proportional to air density 1.225 kg/m^3 at sea level). It may vary 10-15 percent during the year because of pressure and temperature change. It changes negligibly with water content. Equation also tells us that the wind power is proportional to the intercept area. Thus an aero turbine with a large swept area has higher power than a smaller area machine; but there are added implications. Since the area is normally circular of diameter D in horizontal axis aero turbines, then $A = \prod/4\ D^2$, (sq.m), which when put in equation gives,

$$\text{Available wind power } P\alpha = \tfrac{1}{2}\ \rho\ \pi/4\ D^2V^3 \text{ watts}$$

$$= 1/8\ \rho\pi\ D^2V^3$$

3.1.4 PRESSURE AND VELOCITY GRAPH

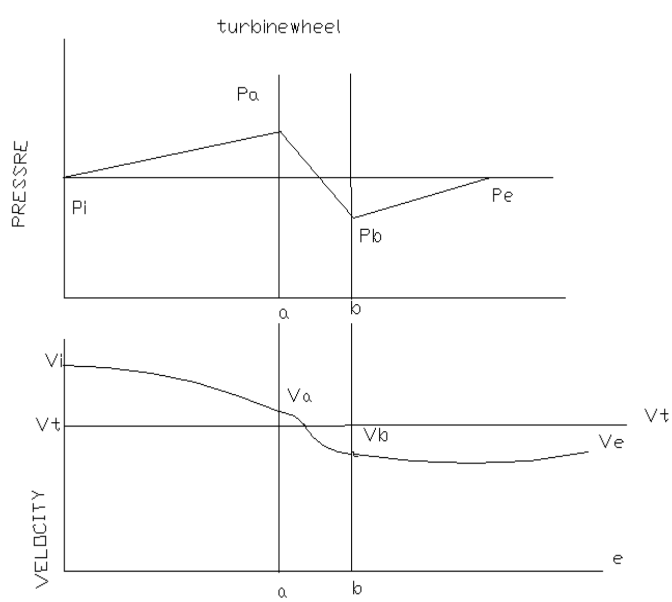


Figure 5

The power extracted by the rotor is equal to the product of the wind speed as it passes through the rotor (i.e. V_r) and the pressure drop Δp. in order to maximize the rotor power it would therefore be desirable to have both wind speed and pressure drop as large as possible. However, as V is increased for a given value of the free wind speed (and air density), increases at first, passes through a maximum, and the decreases. Hence for the specified free-wind speed, there is a maximum value of the rotor power.

The fraction of the free flow wind power that can be extracted by a rotor is called the power-coefficient; thus

$$\text{Power coefficient} = \frac{\text{Power of wind rotor}}{\text{Power available in the wind}}$$

Where power available is calculated from the air density, rotor diameter, and free wind speed as shown above. The maximum theoretical power coefficient is equal to 16/27 or 0.593. This value cannot be exceeded by a rotor in a free-flow wind-stream.

3.1.5 MAXIMUM POWER

The total power cannot be converted to mechanical power. Consider a horizontal-axis, propeller-type windmill, henceforth to be called a wind turbine, which is the most common type used today. Assume that the wheel of such a turbine has thickness αb. Let p_i and V_i are the wind pressure and velocity at the upstream of the turbine. V_e is less than V_i because the turbine extracts kinetic energy.

Considering the incoming air between I and a as a thermodynamic system, and assuming that the air density remains constant (since changes in pressure and temperature are very small compared to ambient), that the potential energy is zero, and no heat or work are added or removed between i and a, the general energy equation reduces to the kinetic and flow energy-terms only:

3.1.6 WIND ENERGY CONVERSION

Traditional windmills were used extensively in the middle Ages to mill grain and lift water for land drainage and watering cattle. Wind energy converters are still used for these purposes today in some parts of the world, but the main focus of attention now lies with their use to generate electricity. There is also growing interest in generating heat from the wind for space and water heating and for glass-houses but the potential market is much smaller than for electricity generation.

The term “wind mill” is still widely used to describe wind energy conversion systems, however it is hardly adopt .Description any more. Modern wind energy conversion systems are more correctly referred to as ‘WECS, aero generations, ‘wind turbine generators, or simply ‘wind turbines. The fact that the wind is variable and intermittent source of energy is immaterial of some applications such as pumping water for land drainage – provided, of course, that there is a broad match between the energy supplied over any critical period and the energy required. If the wind blows, the job gets done; if it does not, the job waits.

However, for many of the uses to which electricity is put, the interruption of supply may be highly inconvenient. Operators or users of wind turbines must ensure that there is some form of back-up to cover periods when there is insufficient (or too much) wind available. For small producers, back-up can take the form of:

(i) Battery storage,

(ii) Connection with the local electricity distribution system; or

For utilities responsible for public supply, the integration of medium – sized and large wind turbines into their distribution network could require some additional plant which is capable of responding quickly to meet fluctuating demand.

3.1.7 ENVIRONMENTAL ASPECTS

Wind turbines are not without environmental impact and their operation is not entirely risk-free. Following are the main effects due to a wind turbine.

(i) Electromagnetic interference. Interference with TV and other electromagnetic communication systems is a possibility with wind turbines as it is with other tall structures. TV interference is most likely in areas where there is a weak signal because of the distance from the transmitter, where existing reception is none too good due to the surrounding hills and where the wind turbine is exposed in good position to receive and scatter the signals. Dispensing with aerials and sending TV signals by cable in areas that would otherwise be affected can overcome interference.

(ii) Noise. The noise produced by wind farms falls into two categories. The first type is a mechanical noise from the gearbox, generating equipment and linkages and the second type of aerodynamic in nature produced by the movement of the turbine blades. One component of the latter is the broad band noise which ranges up to several kilo hertz and the other is a low frequency noise of 15-20 Hz. Revolving blades generate noise which can be heard in the immediate vicinity of the installation, but noise does not travel too far.

(iii) Visual Effects. Megawatts power generating wind turbines are massive structures which would be quite visible over a wide area in some locations. Variety characteristics such as color pattern, shape, rotational speed and reflectance of blade materials can be adjusted to modify the visual effects of wind turbines including the land scape in which they are installed.

3.2 SOLAR ENERGY

Solar energy is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaics, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis.

It is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on how they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. 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.

3.2.1 DIRECT METHOD OF UTILIZATION OF SOLAR ENERGY:

The most useful way of harnessing solar energy is by directly converting it into electricity by means of solar photo-voltaic cells. Sunshine is incident on Solar cells, in this system of energy Conversion that is direct conversion of solar radiation into electricity. In the stage of conversion into thermodynamic from is absent. The photo-voltaic effect is defined as the generation of an electromotive force as a result of the absorption of ionizing radiation. Energy conversion devices, which are used to convert sunlight to electricity by use of the photo-voltaic effect, are called solar cells.

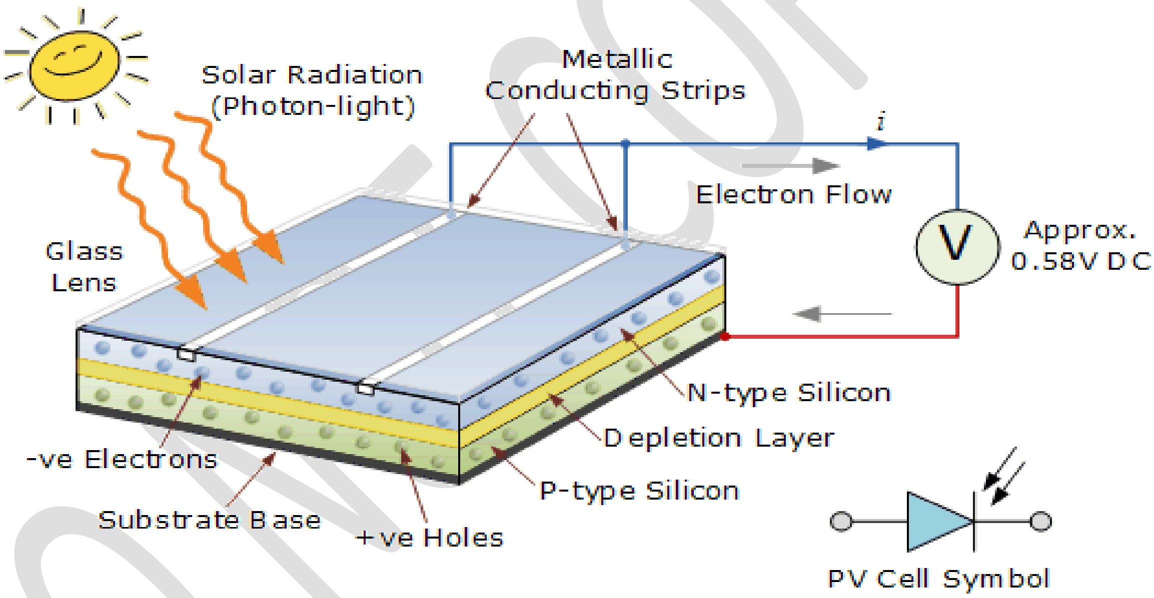


Figure. 6

In recent years photo-voltaic power generation has been receiving considerable attention as one of the more promising energy alternatives. The reason for this rising interest lie in PV's direct conversion of sunlight to electricity, the non-polluting nature of the PV widespread are of PV generation has been hampered by economic factors. Here to force, the low cost of conventional energy sunlight has obviated the development of a broad-based PV technology. At the present time, PV generation can be justified only for special situations mostly for remote sites where utility lines on other conventional means of furnishing energy may be prohibitively expensive and is one of the most attractive non-conventional energy sources of proven reliability from the micro to the Mega-watt level.

Like other energy system this system also has some disadvantages

(1) Distributed nature of solar energy,
(2) Absence of energy storage,
(3) Relatively high capital cost.

3.2.2 PHOTOVOLTAIC PRINCIPLES:

The photo-voltaic effect can be observed in nature in a variety of materials that have shown that the best performance in sunlight is the semiconductors as stated above. When photons from the sun are absorbed in a semiconductor, that create free electrons with higher energies than the created there must be an electric field to induce these higher energy electrons to flow out of the semi-conductor to do useful work. A junction of materials, which have different electrical properties, provides the electric field in most solar cells.

To obtain a useful power output from photon interaction in a semiconductor, three processes are required.

1) The photon has to be absorbed in the active part of the material and result in electrons being excited to a higher energy potential.
2) The electron hole charge carriers created by the absorption must be physically separated and moved to the edge of the cell.
3) The charge carriers must be removed from the cell and delivered to useful load before they lose extra potential.

For completing the above processes a solar cell consists of:-

(a) Semi-conductor in which electron hole pairs are created by absorption of incident solar radiation.
(b) Region containing a drift field for charge separation
(c) Charge collecting fronts and back electrodes.

The photo-voltaic effect can be described easily for p-n junction in a semi-conductor. In an intrinsic semi-conductor such as silicon, each one of the four valence electrons of the material atom is tied in a chemical bond, and there are no free electrons at absolute zero. If a piece of such a material is doped on one side by a five valance electron material, such as arsenic or phosphorus, there will be an excess of electrons in that side, becoming an n-type semi-conductor.

The excess electrons will be practically free to move in the semi-conductor lattice. When a three valence electron material, such as boron dopes the other side of the same piece, there will be deficiency of electrons leading to a p-type semi-conductor. This deficiency is expressed in terms of excess of holes free to move in the lattice. Such a piece of semi-conductor with one side of the p-type and the other, of the n-type is called p-n junction. In this junction after the protons are absorbed, the free electrons of the n-side will tends to flow to the p-side, and the holes of the p-side will tend to flow to the n-region to compensate for their respective deficiencies. This diffusion will create an electric field from the n-region to the p-region. This field will increase until it reaches equilibrium for V, the sum of the diffusion potentials for holes and electrons.

3.3 SOUND ENERGY

In physics, **e**nerg**y** (from the Greek ἐνέργεια - *energeia*, "activity, operation", from ἐνεργός - *energos*, "active, working"[1]) is a quantity that can be assigned to every particle, object, and system of objects as a consequence of the state of that particle, object or system of objects. Different forms of energy include kinetic, potential, thermal, gravitational, sound, elastic, light, and electromagnetic energy. The forms of energy are often named after a related force. German physicist Hermann von Helmholtz established that all forms of energy are equivalent - energy in one form can disappear but the same amount of energy will appear in another form. Energy is subject to a conservation law. Energy is a scalar physical quantity. In the International System of Units (SI), energy is measured in joules, but in some fields other units such as kilowatt-hours and kilocalories are also used. Any form of energy can be transformed into another form. When energy is in a form other than heat, it may be transformed with good or even perfect efficiency, to any other type of energy. In all such energy transformation processes, the total energy remains the same. Energy may not be created nor destroyed. This principle, the conservation of energy, was first postulated in the early 19th century, and applies to any isolated system. According to Noether's theorem, the conservation of energy is a consequence of the fact that the laws of physics do not change over time.

Although the total energy of a system does not change with time, its value may depend on the frame of reference. For example, a seated passenger in a moving airplane has zero kinetic energy relative to the airplane, but non-zero kinetic energy (and higher

3.3.1 TRANSFORMATION OF ENERGY

At its highest points the kinetic energy is zero and the gravitational potential energy is at maximum. At its lowest point the kinetic energy is at maximum and is equal to the decrease of potential energy. If one (unrealistically) assumes One form of energy can often be readily transformed into another with the help of a device- for instance, a battery, from chemical energy to electric energy; a dam: gravitational potential energy to kinetic energy of moving water (and the blades of a turbine) and ultimately to electric energy through an electric generator. Similarly, in the case of a chemical explosion, chemical potential energy is transformed to kinetic energy and thermal energy in a very short time. Yet another example that there is no friction, the conversion of energy between these processes is perfect, and the pendulum will continue swinging forever.

Energy gives rise to weight and is equivalent to matter and vice versa. The formula $E = mc^2$, derived by Albert Einstein (1905) quantifies the relationship between mass and rest energy within the concept of special relativity. In different theoretical frameworks, similar formulas were derived by J. J. Thomson (1881), Henri Poincare (1900), Friedrich Hasenohrel (1904) and others (see Mass-energy equivalence History for further information). Since c^2 is extremely large relative to ordinary human scales, the conversion of ordinary amount of mass (say, 1 kg) to other forms of energy can liberate tremendous amounts of energy ($\sim 9x10^{16}$ joules), as can be seen in nuclear reactors and nuclear weapons. Conversely, the mass equivalent of a unit of energy is minuscule, which is why a loss of energy from most systems is difficult to measure by weight, unless the energy loss is very large. Examples of energy transformation into matter (particles) are found in high energy nuclear physics.

In nature, transformations of energy can be fundamentally classed into two kinds: those that are thermodynamically reversible, and those that are thermodynamically irreversible. A reversible process in thermodynamics is one in which no energy is dissipated (spread) into empty energy states available in a volume, from which it cannot be recovered into more concentrated forms (fewer quantum states), without degradation of even more energy. A reversible process is one in which this sort of dissipation does not happen. For example, conversion of energy from one type of potential field to another is reversible, as in the pendulum system described above. In processes where heat is generated, quantum states of lower energy, present as possible exicitations in fields between atoms, act as a reservoir for part of the energy, from which it cannot be recovered, in order to be converted with 100% efficiency into other forms of energy. In this case, the energy must partly stay as heat, and cannot be completely recovered as usable energy, except at the price of an increase in some other kind of heat-like increase in disorder in quantum states, in the universe (such as an expansion of matter, or a randomization in a crystal).

As the universe evolves in time, more and more of its energy becomes trapped in irreversible states (i.e. as heat or other kinds of increases in disorder). This has been referred to as the inevitable thermodynamic heat death of the universe. In this heat death the energy of the universe does not change, but the fraction of energy which is available to do produce work through a heat engine, or be transformed to other usable forms of energy (through the use of generators attached to heat engines), grows less and less.

3.3.2 SOUND

Sound energy is also a type of wave motion. We are heard by others when we talk because of the sound energy we produce. It is due to the effect of the air molecules vibrating when we talk. The vibrating molecules hit our eardrums, which enable us to hear others talk. Sound energy may be converted into electrical energy for transmission, and later the electrical energy can be converted back into sound energy at the receiving end. An example of such transformations could be seen in the microphone and the loudspeaker. Sound, like heat energy is easily lost. The transformation of one form of energy into another may be accompanied by losses in the form of sound and/or heat that are often not desirable.

Sound is a form of mechanical vibration, which propagates through any mechanical medium. Sound is a vibration or wave of air molecules caused by the motion of an object. The wave is a compression wave where the density of the molecules is higher. This wave travels through the air at a speed dependent on the temperature. A sound wave contains energy, which in turn means it can make things move. However, if the wave strikes something solid, the wave will bounce back -- an echo. Sound energy can be changed into other forms of energy, e.g. electrical energy, and vice versa; this is one of its properties that allow us to communicate by telephone.

3.3.3 MICROPHONES

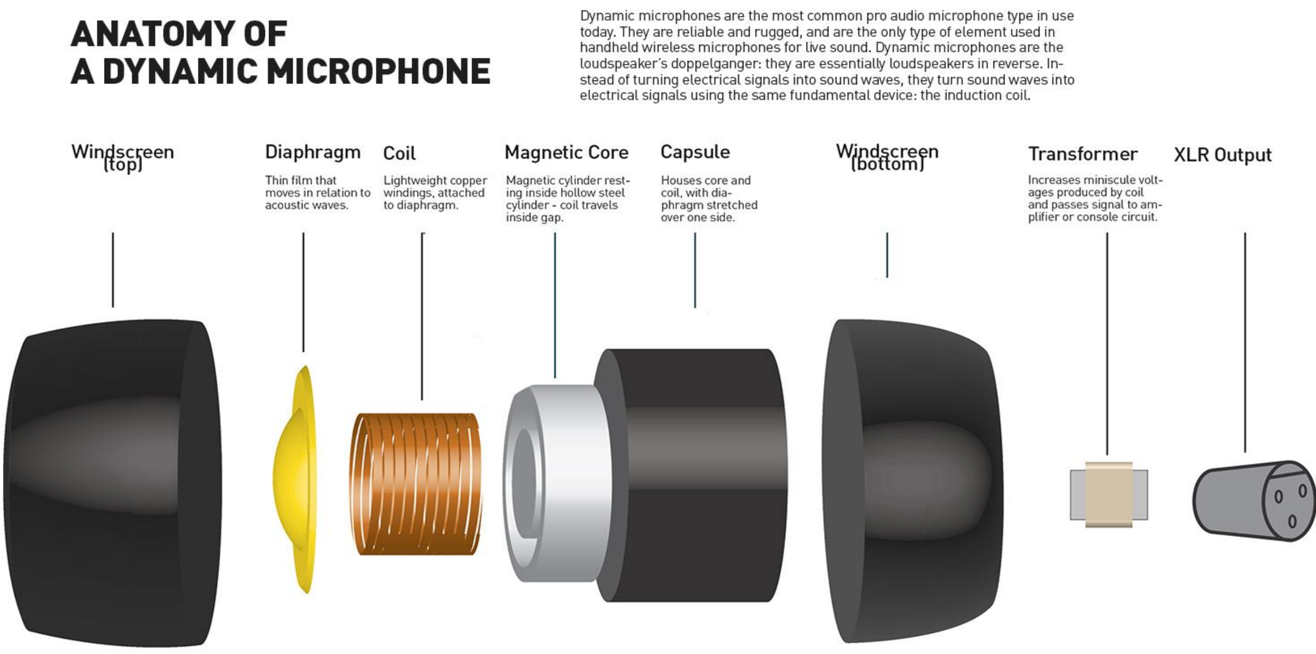


Figure . 7

Sound energy we can hear travels only so far before it soaks away into the world around us. Until electrical microphones were invented in the late 19th century, there was no satisfactory way to send sounds to other places. You could shout, but that carried your words only a little further. You couldn't shout in New York City and make yourself heard in London. And you couldn't speak in 1715 and have someone listen to what you said in 1750. Remarkably, such things are possible today: by converting sound energy into electricity and information we can store, microphones make it possible to send the sounds of our voices, our music, and the noises in our world to other places and other times. How do microphones work/ let's take a closer look

Photo: A high-quality, professional microphone typical of the ones used by radio DJs. Photo by Gary Ward courtesy of US Navy.

3. 3.4 MICROPHONES REVERSE OF LOUDSPEAKER

If you've read our article on loudspeakers, you'll already know how microphones work because they're literally loudspeakers working in reverse. Indeed, you can actually take a loudspeaker and wire it into an electrical circuit so it works as a microphone if you speak into it. Intercoms (electrical gadgets that allow you to speak to someone in the next room) often have a combined loudspeaker/microphone. It works as a microphone when you press a button to speak into it and as a loudspeaker when the person next door pushes the button on their intercom instead. It's exactly the same piece of equipment working in two different ways. How's that possible?

In a loudspeaker, electricity flows into a coil of metal wire wrapped around (or in front of) a permanent magnet. The changing pattern of electricity in the coil creates a magnetic field all around it that pushes against the field the permanent magnet creates. This makes the coil move. The coil is attached to a big flat disc called a diaphragm or cone so, as the coil moves, the diaphragm moves too. The moving diaphragm pushes air back and forth into the room and creates sound waves we can hear.

In a microphone, there are almost identical parts but they work in reverse. Sound waves created by your voice push against a diaphragm, making a coil move near to a magnet. This makes an electric current flow through the coil into an electrical circuit. By using this current to drive sound recording equipment, you can effectively store the sound forever more. Or you could amplify (boost the size of) the current and then feed it into a loudspeaker, turning the electricity back into much louder sound. That's how PA (personal address) systems, electric guitar amplifiers, and rock concert amplifiers work.

3.3.5 HOW MICROPHONES WORK

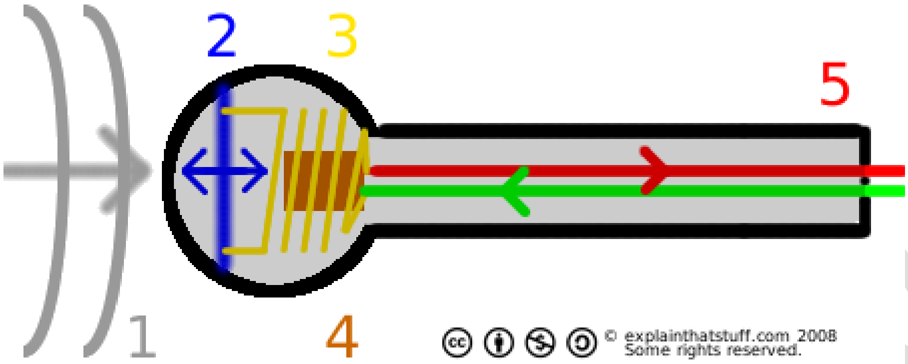


figure 8

1. Sound waves carry energy toward the microphone.
2. The diaphragm moves back and forth when sound waves hit it.
3. The coil, attached to the diaphragm, moves back and forth as well.
4. The permanent magnet produces a magnetic field that cuts through the coil. As the coil moves back and forth through the magnetic field, an electric current flows through it.
5. The electric current flows out from the microphone to an amplifier or sound recording device.

3.3.6 TYPEOF MICROPHONES

All microphones turn sound energy into electrical energy, but there are various different kinds that work in slightly different ways. Dynamic microphones are just ordinary microphones that use diaphragms, magnets, and coils. Condenser microphones work a slightly different way by using a diaphragm to move the metal plates of a capacitor (an electric-charge storing device) and generate a current that way. Most microphones are omnidirectional, which means they pick up sound equally well from any direction. If you're recording something like a TV news reporter in a noisy environment, or a rare bird tweeting in a distant hedgerow, you're better off using a unidirectional microphone that picks up sound from one specific direction. Microphones described as cardioid and hyper cardioid pick up sounds in a kind of "heart-shaped" (that's what cardioid means) pattern, gathering more sound from one direction than another. As their name suggests, you can target shotgun microphones so they pick up sounds from a very specific location because they are highly directional. Wireless microphones use radio transmitters to send their signals to and from an amplifier or other audio equipment (that's why they're often called "radio mics").

Microphones convert acoustic energy into electrical energy: sound makes mic's membrane vibrate, the vibrations make the material (for example coal dust) placed beneath the membrane to be pressed periodically - in accordance with the sound waves received - the electrical resistance of the material changes in the same key, and so the direct current passing through the material is thus changing its amplitude. Or it may be two membranes forming a capacitor whose capacity, changing in accordance with the sound waves pressing, is then processed in an electronic processor.

3.4 SHOCK ABSORBERS

3.4.1. REGENRATIVE SHOCK ABSORBER

A regenerative shock absorber is a type of shock absorber that converts parasitic intermittent linear motion and vibration into useful energy, such as electricity. Conventional shock absorbers simply dissipate this energy as heat.

When used in an electric vehicle or hybrid electric vehicle the electricity generated by the shock absorber can be diverted to its powertrain to increase battery life. In non-electric vehicles the electricity can be used to power accessories such as air conditioning. Several different systems have been developed recently, though they are still in stages of development and not installed on production vehicles.

DESIGN -1

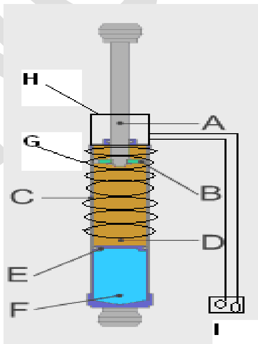


Figure 9

The project introduces a novel passive suspension system for ground vehicles.

H– solenoid coil

G- spring action to provide motion

I– electrical energy out

A- permanent magnets to provide induced emf

DESIGN -2

Another design to generate electricity by shock absorbers

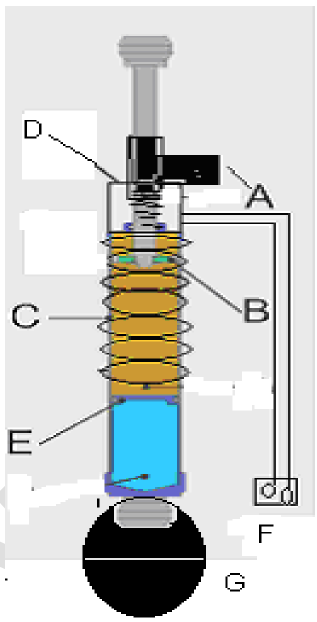


Figure .10

A-Generator – Stepper motor

B- Rod to connect wheel

C- Rubber spring/cover to protect dust.

E - Shocker rod area d– rack and pinion gear assembly

G- Wheel

F– Electricity out for battery charging

Modifications in the above structure, a modified design is shown for the shocker motion provided by rack and pinion gear assembly that generates power. The motor (generator) will operate clock and anti -clock to operate as it sense the path the above design is very impractical in this way and further holes or bumps on the road. Shocker rod activates rack and pinion up and down motion that run the motor (generator) in clock and anti -clock motion.

Area required for actual implementation in vehicle. This is just an idea.

3.4.2. ELECTRICITY GENERATING SHOCK ABSORBERS

Figure. 11

While some study ways of electronically controlling the shock absorbers and giving you a smooth and steady ride, and others are seeking ways to convert the heat generated by the engine into electricity, a team of undergraduate MIT students invented a shock absorber that harnesses the energy from the very bumps it hits. Several truck manufacturers and the U.S. military have given them attention, and planned to use their technology in their cars.

While hybrid cars recover braking energy, by the same dynamo principle (applying a big consumer on a coil linked to the wheel, while the magnetic chassis opposes it). The system works like a reversed DC motor. The same principle is applied in these students' shock absorbers, only in a somewhat more efficient way: they use a hydraulic system forcing a fluid through a turbine attached to a generator (the inverted DC motor I was talking about earlier).

The system is controlled by an active electronic system that optimizes the damping, providing a smoother ride than conventional shocks while generating electricity to recharge the batteries or operate electrical equipment.

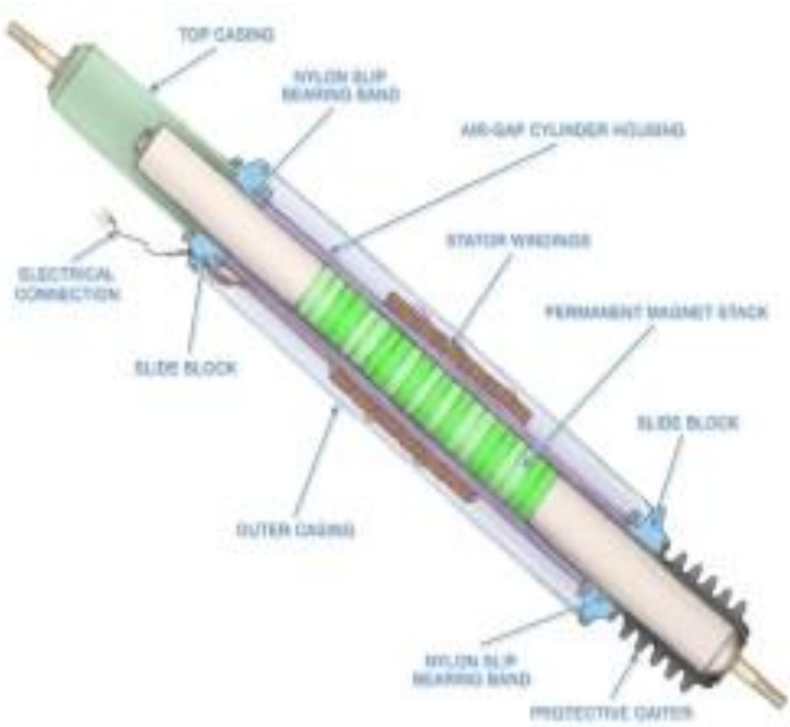


figure.12

3.4.3 SHOCK ABSORBER – AN INTRODUCTION

A shock absorber in common parlance (or damper in technical use) is a mechanical device designed to smooth out or dampen a sudden shock impulse and dissipate kinetic energy. It is analogous to a resistor in an electric RLC circuit.

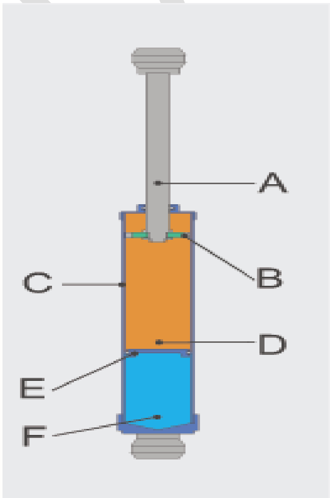


Figure 13

Shock absorber with internal reservoir. The components are: the rod (A), the piston with seals (B), the cylinder (C), the oil reservoir (D), the floating piston (E), and the air chamber (F).

3.4.4 EXPLANATION

Shock absorbers must absorb or dissipate energy. One design consideration, when designing or choosing a shock absorber is where that energy will go. In most dashpots, energy is converted to heat inside the viscous fluid. In hydraulic cylinders, the hydraulic fluid will heat up, while in air cylinders, the hot air is usually exhausted to the atmosphere. In other types of dashpots, such as electromagnetic ones, the dissipated energy can be stored and used later.

3.4.5 DESCRIPTION

Pneumatic and hydraulic shock absorbers commonly take the form of a cylinder with a sliding piston inside. The cylinder is filled with a fluid (such as hydraulic fluid) or air. This fluid filled piston/cylinder combination is a dashpot.

3.4.6 APPLICATIONS

Shock absorbers are an important part of automobile and motorcycle suspensions, aircraft landing gear, and the supports for many industrial machines. Large shock absorbers have also been used in structural engineering to reduce the susceptibility of structures to earthquake damage and resonance.

Figure.14

Rear shock absorber and spring of a BMW R75/5 motorcycle

3.4.7 VEHICLES SUSPENSION

In a vehicle, it reduces the effect of travelling over rough ground, leading to improved ride quality. Without shock absorbers, the vehicle would have a bouncing ride, as energy is stored in the spring and then released to the vehicle, possibly exceeding the allowed range of suspension movement. Control of excessive suspension movement without shock absorption requires stiffer (higher rate) springs, which would in turn give a harsh ride. Shock absorbers allow the use of soft (lower rate) springs while controlling the rate of suspension movement in response to bumps. They also, along with hysteresis in the tire itself, damp the motion of the unsparing weight up and down on the springiness of the tire. Since the tire is not as soft as the springs, effective wheel bounce damping may require stiffer shocks than would be ideal for the vehicle motion alone.

Spring-based shock absorbers commonly use coil springs or leaf springs, though torsion bars can be used in torsional shocks as well. Ideal springs alone, however, are not shock absorbers as springs only store and do not dissipate or absorb energy. Vehicles typically employ both springs or torsion bars as well as hydraulic shock absorbers. In this combination, "shock absorber" is reserved specifically for the hydraulic piston that absorbs and dissipates vibration.

3.4.8 STRUCTURES

Applied to a structure such as a building or bridge it may be part of a seismic retrofit or as part of new, earthquake resistant construction. In this application it allows yet restrains motion and absorbs resonant energy, which can cause excessive motion and eventual structural failure.

3.4.9 TYPES OF SHOCK ABSORBERS

There are several commonly-used approaches to shock absorption:

* Hysteresis (hysteresis is like a "memory" of the material, if you press down rubber disks, they tend to back to it's normal uncompressed state as the precession of fingers is relieved) of structural material, for example the compression of rubber disks, stretching of rubber bands and cords, bending of steel springs, or twisting of torsion bars. Hysteresis is the tendency for otherwise elastic materials to rebound with less force than was required to deform them. Simple vehicles with no separate shock absorbers are damped, to some extent, by the hysteresis of their springs and frames.

* Dry friction as used in wheel brakes, by using disks (classically made of leather) at the pivot of a lever, with friction forced by springs. Used in early automobiles such as the Ford Model T, up through some British cars of the 1940s. Although now considered obsolete, an advantage of this system is its mechanical simplicity; the degree of damping can be easily adjusted by tightening or loosening the screw clamping the disks, and it can be easily rebuilt with simple hand tools. A disadvantage is that the damping force tends not to increase with the speed of the vertical motion.

* Solid state, tapered chain shock absorbers, using one or more tapered, axial alignment(s) of granular spheres, typically made of metals such as nitinol, in a casing.

* Fluid friction, for example the flow of fluid through a narrow orifice (hydraulics), constitute the vast majority of automotive shock absorbers. An advantage of this type is that using special internal valving the absorber may be made relatively soft to compression (allowing a soft response to a bump) and relatively stiff to extension, controlling "jounce", which is the vehicle response to energy stored in the springs; similarly, a series of valves controlled by springs can change the degree of stiffness according to the velocity of the impact or rebound. Specialized shock absorbers for racing purposes may allow the front end of a dragster to rise with minimal resistance under acceleration, then strongly resist letting it settle, thereby maintaining a desirable rearward weight distribution for enhanced traction. Some shock absorbers allow tuning of the ride via control of the valve by a manual adjustment provided at the shock absorber. In more expensive vehicles the valves may be remotely adjustable, offering the driver control of the ride at will while the vehicle is operated. The ultimate control is provided by dynamic valve control via computer in response to sensors, giving both a smooth ride and a firm suspension when needed. Many shock absorbers contain compressed nitrogen, to reduce the tendency for the oil to foam under heavy use. Foaming temporarily reduces the damping ability of the unit. In very heavy duty units used for racing and/or off-road use, there may even be a secondary cylinder connected to the shock absorber to act as a reservoir for the oil and pressurized gas. Another variation is the Magneto rheological damper which changes its fluid characteristics through an electromagnet.

* Compression of a gas, for example pneumatic shock absorbers, which can act like springs as the air pressure is building to resist the force on it. Once the air pressure reaches the necessary maximum, air dashpots will act like hydraulic dashpots. In aircraft landing gear air dashpots may be combined with hydraulic damping to reduce bounce. Such struts are called oleo struts (combining oil and air) [3].

* Magnetic effects. Eddy current dampers are dashpots that are constructed out of a large magnet inside of a non-magnetic, electrically conductive tube.

* Inertial resistance to acceleration, for example prior to 1966 [4] the Citroën 2CV had shock absorbers that damp wheel bounce with no external moving parts. These consisted of a spring-mounted 3.5 kg (7.75 lb) iron weight inside a vertical cylinder [5] and are similar to, yet much smaller than versions of the tuned mass dampers used on tall buildings

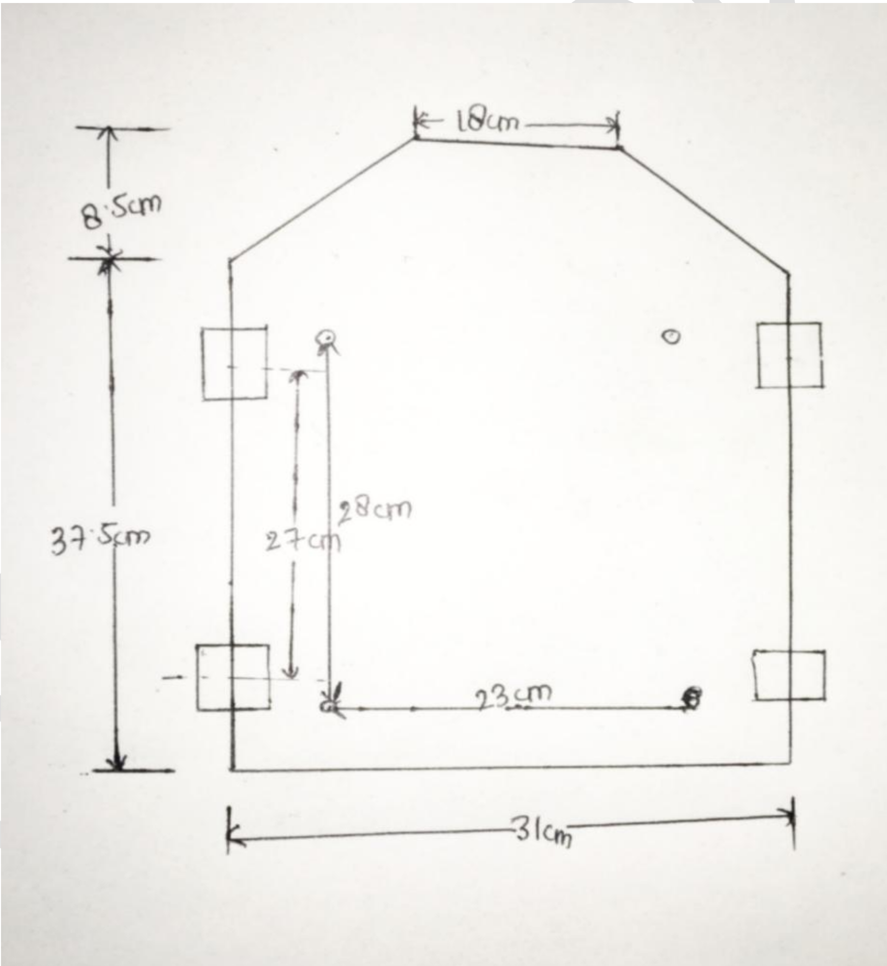
* Composite hydro pneumatic devices which combine in a single device spring action, shock absorption, and often also ride-height control, as in some models of the Citroën automobile.

* Conventional shock absorbers combined with composite pneumatic springs with which allow ride height adjustment or even ride height control, seen in some large trucks and luxury sedans such as certain Lincoln and most Land Rover automobiles. Ride height control is especially desirable in highway vehicles intended for occasional rough road use, as a means of improving handling and reducing aerodynamic drag by lowering the vehicle when operating on improved high speed roads.

3.5 ASSEMBLY OF HEV

STEP 1- Firstly we purchase or collect all component of HEV that is needed such as nut bolt, cardboard, solar plate, transformer, wire, DC motor, dynamometer etc.

STEP 2- Take two hard board sheet, Cut them with as shown in diagram.

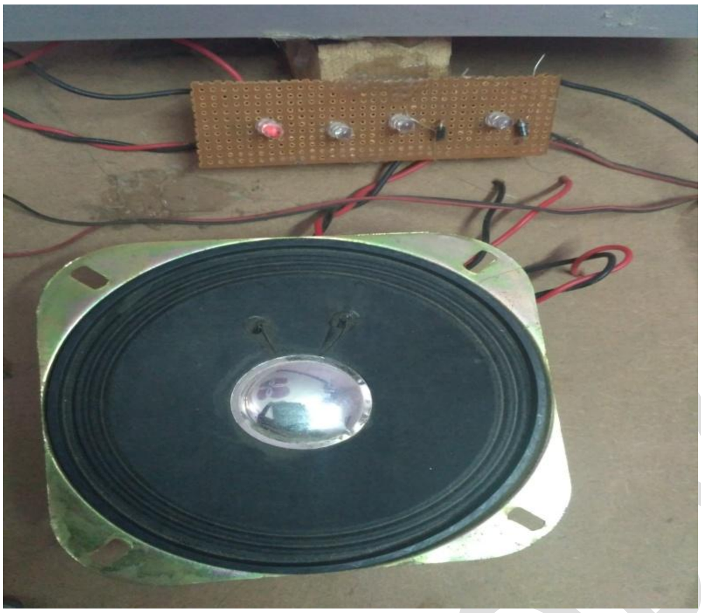


STEP 3- Drill two hole for one wheel (d=9.7cm) and for four drilled hole as shown in above diagram.

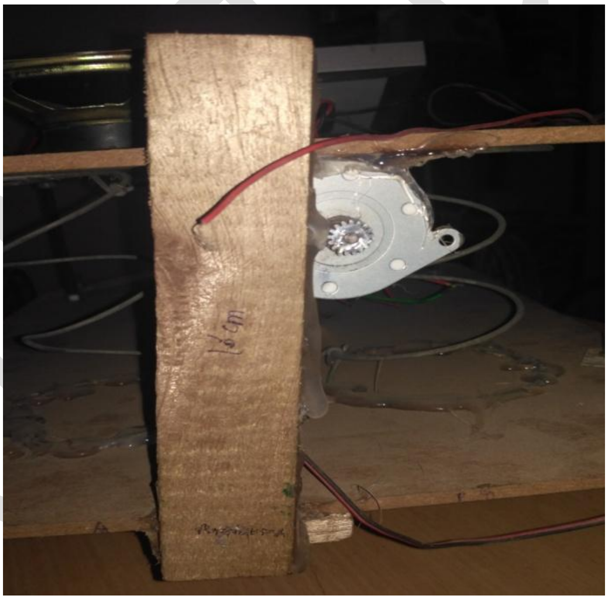
STEP4- And 2 rear wheel are driven by 2 DC motor (12V) and 2 front wheel is free.

STEP 5- And 4 hole is drilled in both sheet to assemble with nut & bolt (h=13cm, d=1.6cm) and open helical coil spring is fixed between them.

STEP 6- PCB plate contains four LED, each LED indicate each power of source.

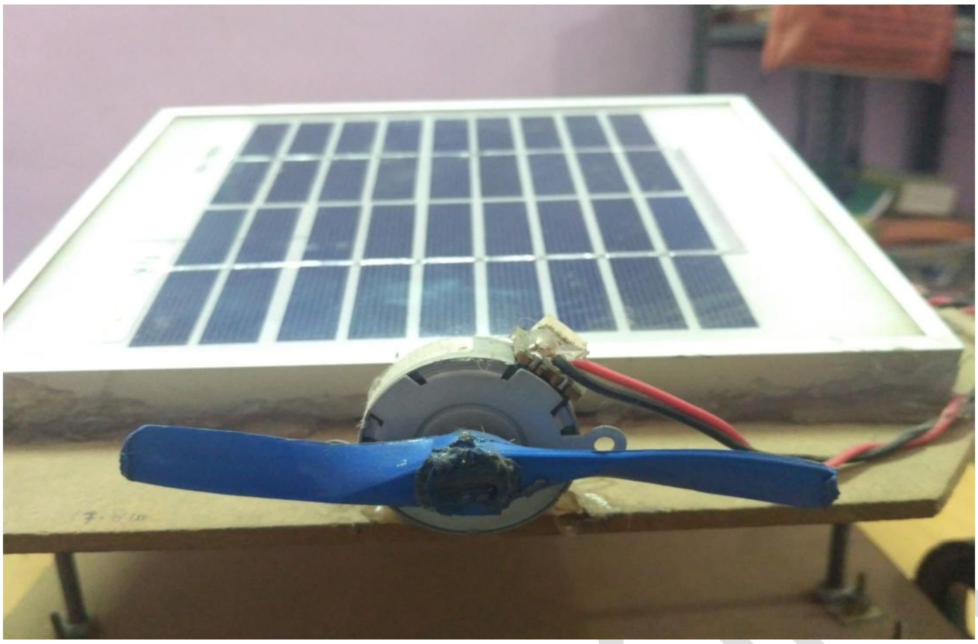


STEP 7- A wooden strip is fixed to lower hard board to drive dynamometer and a transformer setup to increase power given by speaker.



STEP 8- A solar plate (9V) is used to absorb solar rays and a dynamometer for wind and these three sources (Dynamometer 1, solar plate, Dynamometer 2) are connected with PCB plate, A circuit is designed in PCB plate for power storage in battery.

Dimension of solar plate (18cm×21cm)

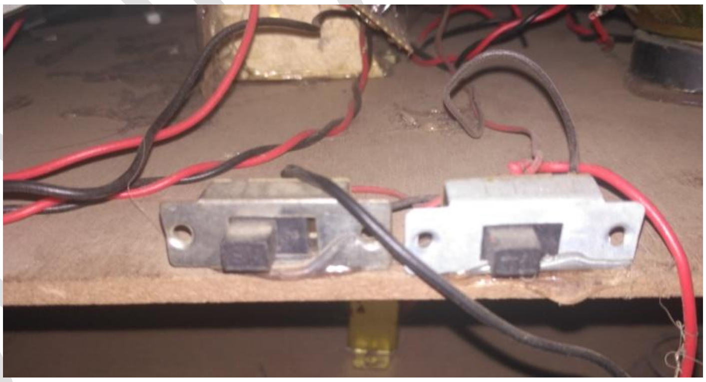


STEP 9- After that PCB is connected with switches via wire to drive the HEV.

Switch 1 – Forward movement.

Switch 2- Backward movement.

And battery is connected for power storage.



CHAPTER – 4

COST ANALYSIS

CHAPTER 4: COST ANALYSIS

4.1 COST ESTIMATION

To ensure sustained and healthy growth of hybrid electric vehicle (HEV), it is necessary to rationally evaluate the cost of production of Energy and to determine a selling rate which should be acceptable to consumers and attractive for investors.

EXPENDITURE TABLE

S.NO	COMPONENT NAME	QUANTITY	PRICE
1	SOLAR PANEL	1	700
2	TRANSFORMER	1	200
3	BATTERY	1	500
4	DC MOTOR	2	500
5	SPEAKER	1	200
6	DYNAMOMETER	2	500
7	WHEEL	4	250
8	WOODEN PLATE	2	100
9	OTHER COMPONENTS		800
10	**TOTAL COST**		**3750**

LABOUR COST: Drilling, Soldering, Gluester, Screw Tightning, Sheet Cutting, Finishing:

Cost = Rs. 800

TRANSPORTATION COST: Rs 1000

OVERHEAD CHARGES: The overhead charges are arrived by "Manufacturing cost"

Manufacturing Cost = (Material Cost + Labour cost + Transportation Cost)

= Rs. (3750 + 800 + 1000)

= Rs. 5550

Overhead Charges = 10% of the manufacturing cost

= Rs. 555

TOTAL COST:

Total cost = (Material Cost + Labour cost + Transportation Cost + Overhead Charges)

= Rs. (3750 + 800 + 1000 + 555)

Total cost for this project = Rs**. 6105**

CONCLUSION

The design of the project envisages a household power system which could have its own generation and replication of all functions performed by the electricity board towards energy control within the household itself including load shedding, per room power switching control etc. However on analyzing the completed project based on current status only some main functions of a control center were possible to replicate in the working system. The following controls have been successfully implemented:

- Power on/off control
- Monitoring control

However control functions like load shedding and each room switching control could not be actuated because of the programming conditional complexity involved. The actuation of these controls requires an actual household as only then the conditional instances can be encapsulated in program modules. Since for principle display such an arrangement is not possible, hence under current implementation the controls have been limited. The actuation of the system in future on actual households would allow for greater programming flexibility and as such all designed controls could be conceptualized and tested to display a completely independent household power system with integrated generation, transmission, distribution and control.

FUTURE SCOPE OF PROJECT

The hybrid car designs of the future are including sports car models that have been all-time favorites with the world in the past and are now being revived with the brand new hybrid engine in mind. With a mindset of grasping and expanding the propulsion features that are somewhat limited in today's hybrid car designs, there are retro styling efforts that are focusing on providing hybrid cars with optional V8 engine capacities.

There are considerations in place to use solar cells in the framework of hybrid automobiles. The future hybrid car will need to focus more on greenhouse gases that negatively affect the environment as well as a hybrid car that will be even more fuel efficient. Speculations are on about the future of hybrid cars. With relatively new technology, some believe that hybrid cars are fast turning into the cars of future. Consumers are ready to take chance with the advance technology which hybrid cars have on offer. Today, Honda and Toyota are the two prominent companies producing hybrid cars.

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