SOLAR SUNFLOWER

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ABSTRACT— This paper describes about a technology, which is the future of solar market. It is based on solar tracking and prevention of degradation of solar panels. A device which opens and closes by detecting sun rays and tracking the vertical irradiance of sun, it is not only a clean source of energy but also it produces 40 % more energy than regular solar panels. A single solar sunflower can generate up to 4000 KW-hr per year i.e. comparable to an average household's daily use. This device is fully automated which helps in its own protection from strong winds or rainfall. Hence it is also known as smart flower.

Keywords— Solar, smart flower, automated, storage, irradiance, self utilization.

I. INTRODUCTION

OVERVIEW OF RENEWABLE ENERGY TECHNOLOGIES:

This section provides an overview and brief description, including fundamentals, of the different renewable energy technologies, wind, solar, bioenergy, hydro, and geothermal energy [10]. One of the first aspects to consider is the cost of renewable energy technologies. However, this is not an easy question to answer because, as with many energy technologies, many factors affect cost and different sources of information use different criteria for estimating cost. In many cases [7], the environmental benefits of renewable energy technologies are difficult to take into account in terms of cost savings through less pollution and less damage to the environment. When trying to calculate the cost of these technologies is often best to take a life cycle cost approach, as these technologies often have high up-front capital costs but very low operation and maintenance costs [4]. And of course, there is usually no fuel cost!

Table 1 below shows average energy generation costs (in kWh) for a variety of renewable energy technologies in

Europe. The table clearly shows that the minimum to average generation costs for these technologies vary widely between different technologies, and within the same technology, according to differences in national markets and resource conditions. This means that one technology can be cheaper in one country than in another. One of the first aspects to consider is the cost of renewable energy technologies [10]. However, this is not an easy question to answer because, as with many energy technologies, many factors affect cost and different sources of information use different criteria for estimating cost. In many cases, the environmental benefits of renewable energy technologies are difficult to take into account in terms of cost savings through less pollution and less damage to the environment. When trying to calculate the cost of these technologies is often best to

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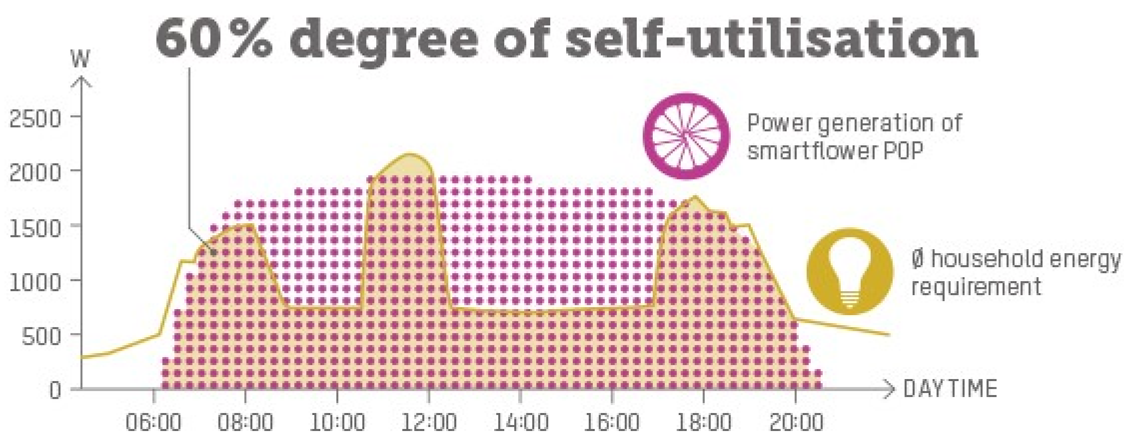
Table-1.1:-Minimum to average generation costs for the main green electricity technologies in EU15a:

Technology	Range (minimum to average) of electricity **generation cost (€/MWh)b**
Wind onshore	50-80
Small-scale hydro	40-140
Biomass using forestry residues	40-80
Photo voltaics	> 450

Source [3]

SOLAR SUNFLOWER

The Solar Sunflower, a Swiss invention developed by Air light Energy, D solar (a subsidiary of Air light), and IBM Research in Zurich, uses something called HCPVT to generate electricity and hot water from solar power. HCPVT is a clumsy acronym that stands for "highly efficient concentrated photovoltaic/thermal." In short, it has reflectors that concentrate the sun—"to about 5,000 suns," Gianluca Ambrosetti, Airlight's head of research told me—and then some highly efficient photovoltaic cells that are capable of converting that concentrated solar energy into electricity, without melting in the process. Airlight/Dsolar are behind the Sunflower's reflectors and superstructure, and the photovoltaics are provided by IBM [9].



II. PROPOSED METHODOLOGY

This sunflower is a solar sunflower that combines both photovoltaic solar power and concentrated solar thermal power in one neat, aesthetic package that has a massive total efficiency of around 80 percent.

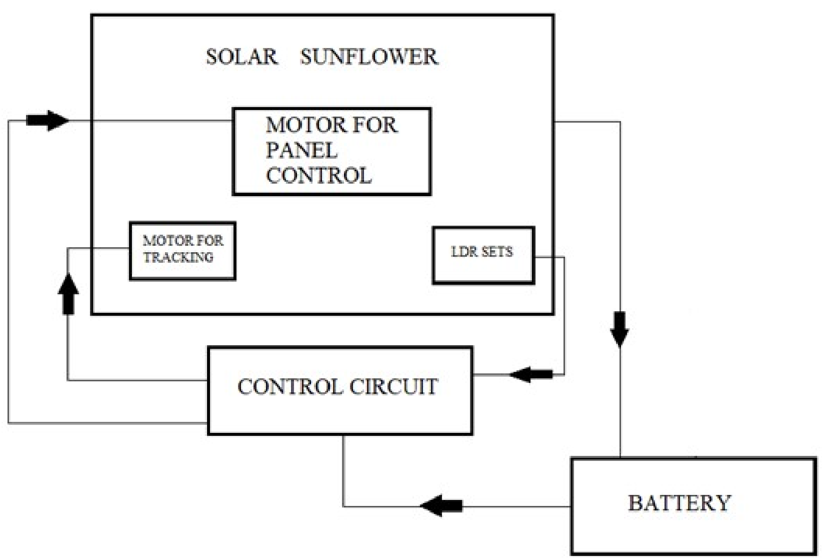
The two constituent technologies of the Solar Sunflower—concentrated solar thermal power and photovoltaic solar power—are both very well known and understood at this point, and not at all exciting. What's special about the Sunflower, however, is that it combines both of the technologies together in a novel fashion to attain much higher total efficiency. Bear with me, as this will take a little bit of explaining [9].

The reflectors are simply slightly curved, mirrored panels. Airlight has tried a variety of different reflector materials, from glass to mylar, but it looks like they have finally settled on aluminium foil, which isn't prohibitively expensive and has very high reflectance. Aluminium foil does need additional material to protect it from the elements, though, as it's very flimsy. The Sunflower has six "petals," each consisting of six reflectors. At the focal point of the 36 reflectors there are six collectors, one for each block of six reflectors.

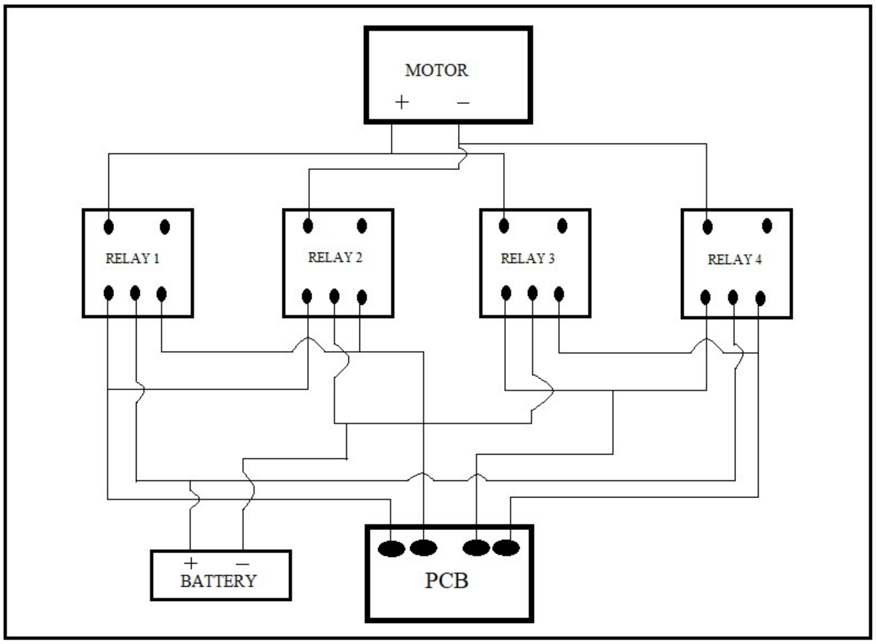
The collectors are where most of the magic occurs. To begin with, each collector has an array of gallium-arsenide (GaAs) photovoltaic cells. GaAs is much more efficient at converting sunlight into electricity (38 percent in this case, versus about 20 percent for silicon), but it's much, much more expensive. With the Sunflower, though, space is at a premium: the sunlight is only focused on a very small region, so you need to use the absolute best cells available. The GaAs array in each collector only measures a few square centimetres, and yet it can produce about 2 kilowatts of electricity (so, one Sunflower generates about 12kW of electricity in total).

Photovoltaic cells, like most semiconductors, become less efficient as they get hotter. The GaAs cells used by the Sunflower have a max operating temperature of around 105°C. The problem is, when you focus the power of 5,000 suns on a single point, things get a lot hotter than 105°C. During one test, Airlight told me that they used the reflectors to melt a hole in a lump of iron (which has a melting point of 1538°C); during another test, the reflectors were misaligned.

PROJECT CIRCUIT DIAGRAM



CONTROL CIRCUIT DIAGRAM



III. EXPERIMENTAL SETUP

Project Components

1. CAPACITOR

Capacitors are passive circuit elements that can be used to store energy in the form of an electric field. In the simplest case, a capacitor is a set of parallel metal plates separated by a dielectric substance. Electric charges build up on the opposite plates as a voltage is applied to the capacitor.

A **capacitor** is a passive two-terminal electrical component that stores electrical energy in an electric field. The effect of a capacitor is known as capacitance. While capacitance exists between any two electrical conductors of a circuit in sufficiently close proximity, a capacitor is specifically designed to provide and enhance this effect for a variety of practical applications by consideration of size, shape, and positioning of closely spaced conductors, and the intervening dielectric material [5]. A capacitor was therefore historically first known as an electric condenser.

The physical form and construction of practical capacitors vary widely and many capacitor types are in common use. Most capacitors contain at least two electrical conductors often in the form of metallic plates or surfaces separated by a dielectric medium. A conductor may be a foil, thin film, sintered bead of metal, or an electrolyte. The nonconducting dielectric acts to increase the capacitor's charge capacity. Materials commonly used as dielectrics include glass, ceramic, plastic film, paper, mica, and oxide layers. Capacitors are widely used as parts of electrical circuits in many common electrical devices. Unlike a resistor, an ideal capacitor does not dissipate energy.

2. RESISTOR

A **resistor** is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment. Practical resistors as discrete components can be composed of various compounds and forms. Resistors are also implemented within integrated circuits.

The electrical function of a resistor is specified by its resistance: common commercial resistors are manufactured over a range of more than nine orders of magnitude. The nominal value of the resistance falls within the manufacturing tolerance, indicated on the component.

3. DIODE

In electronics, a **diode** is a two-terminal electronic component that conducts primarily in one direction (asymmetric conductance); it has low (ideally zero) resistance to the current in one direction, and high (ideally infinite) resistance in the other. A semiconductor diode, the most common type today, is a crystalline piece of semiconductor material with a p–n junction connected to two electrical terminals. A vacuum tube diode has two electrodes, a plate (anode) and a heated cathode. Semiconductor diodes were the first semiconductor electronic devices. The discovery of crystals' rectifying abilities was made by German physicist Ferdinand Braun in 1874. The first semiconductor diodes, called cat's whisker diodes, developed around 1906, were made of mineral crystals such as galena. Today, most diodes are made of silicon, but other semiconductors such as selenium and germanium are sometimes used.

4. CRYSTAL OSCILLATOR

A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a precise frequency.This frequency is commonly used to keep track of time, as in quartz wristwatches, to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits incorporating them became known as crystal oscillators, but other piezoelectric materials including polycrystalline ceramics are used in similar circuits.

A crystal oscillator, particularity one made of quartz crystal, works by being distorted by an electric field when voltage is applied to an electrode near or on the crystal. This property is known as electrostriction or inverse piezoelectricity[5]. When the field is removed, the quartz - which oscillates in a precise frequency - generates an electric field as it returns to its previous shape, and this can generate a voltage. The result is that a quartz crystal behaves like an RLC circuit.

A crystal oscillator is an electronic oscillator circuit that uses a piezoelectric resonator, a crystal, as its frequency-determining element. *Crystal* is the common term used in electronics for the frequency-determining component, a wafer of quartz crystal or ceramic with electrodes connected to it. A more accurate term for it is piezoelectric resonator. Crystals are also used in other types of electronic circuits, such as crystal filter.

5. ATMEGA8 IC

A monitoring and protection circuit for 1-cell and 2-cell Li-ion applications that require high security and authentication, accurate monitoring, low cost, and high utilization of the cell energy.

The microcontroller includes 8KB self-programming flash program memory, 512-Bytes SRAM, 256-Bytes EEPROM, 1 or 2 cells in series, over-current, high-current and short-circuit protection, 12-bit voltage A/D converter, 18-bit coulomb counter current A/D converter, and debugWire interface for on-chip debug.

The device features autonomous battery protection during charging and discharging, and supports very accurate accumulated current measurements using an 18-bit ADC with a resolution of 0.84??V. It also supports up to 4 MIPS throughput at 4MHz. 1.8 - 9V operation.

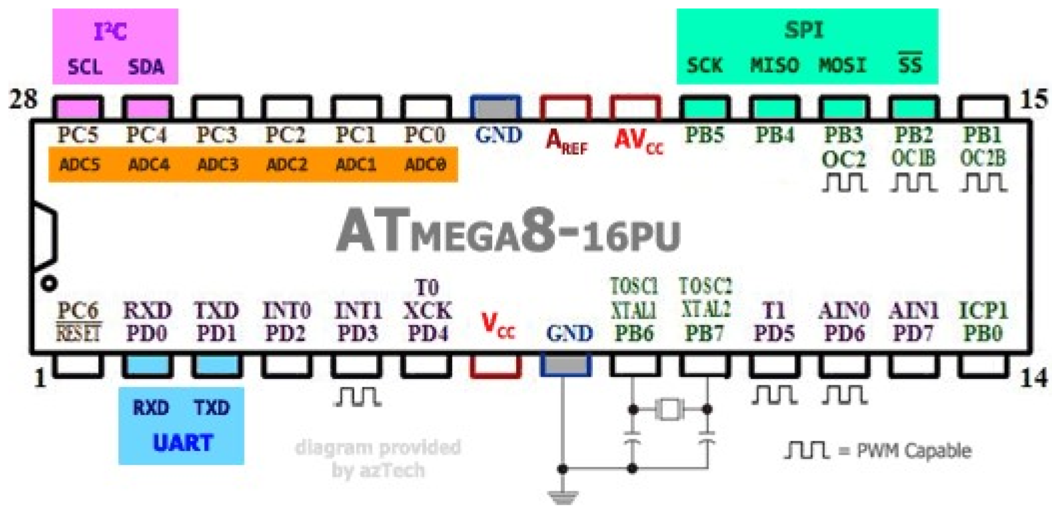


FIGURE : ATMEGA8 IC (Source 6)

6. L293D IC

From microcontroller we can not connect a motor directly because microcontroller can not give sufficient current to drive DC motors.Motors driver is a current enhancing device ,it can also be act as switching Device .Thus we insert motor driver in between motor andmicrocontroller.Motor driver take the input signals from microcontroller and generate corresponding output for the motor.

This is a motor driver IC that can drive two motor simultaneously. L293D IC is a dual H-bridge motor driver IC. One H-bridge is capable to drive a dc motor in bidirectional. L293D IC is a current enhancing IC as the output from the sensor is not able to drive motors itself so L293D is used for this purpose. L293D is a 16 pin IC having two enables pins which should always be remain high to enable both the H-bridges. L293B is another IC of L293 series having.

1 L293D can run a motor up to 600 mA whereas L293B can run up to 1 A.

2 L293D has protection diode whereas L293B doesn't have any such protection diode. Need to add the protection diode manually.

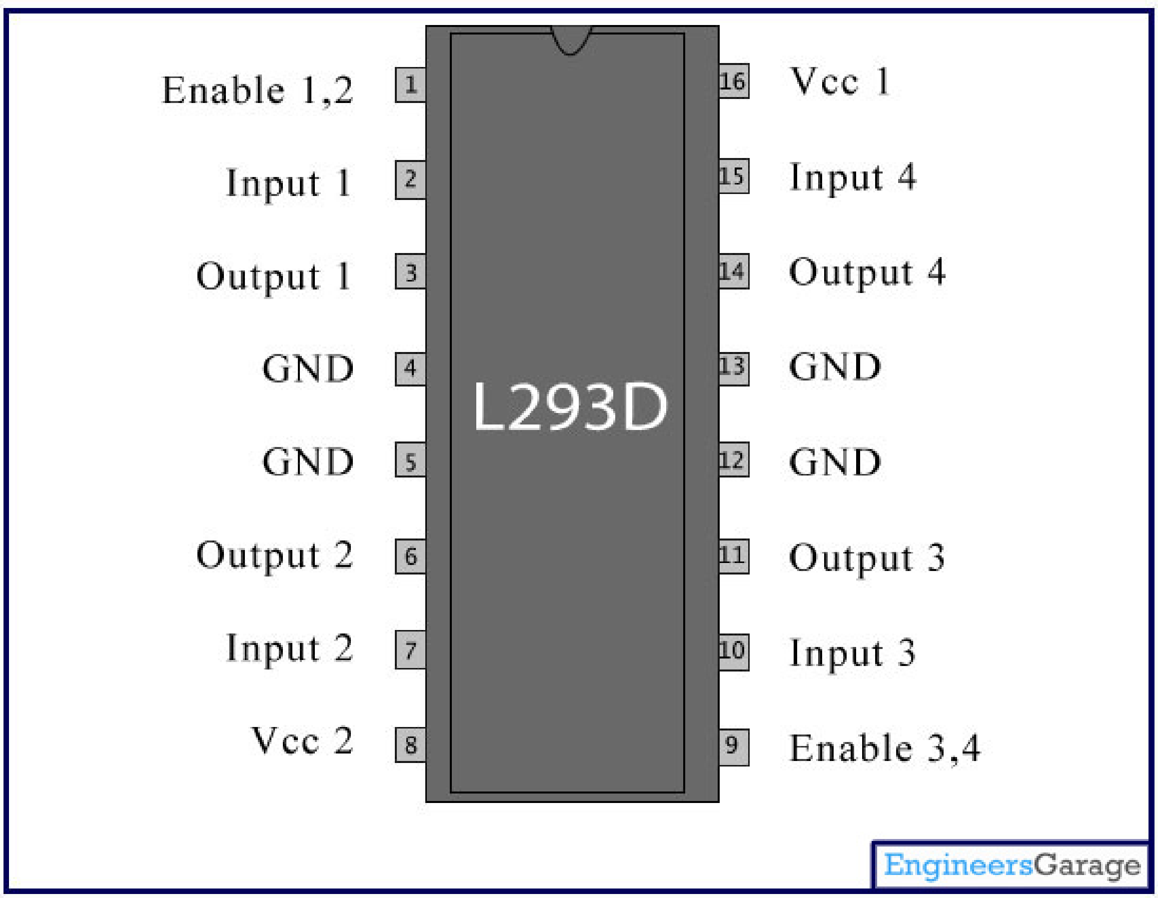


Figure : L293D IC

7. LDR

A light dependent resistor or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radition . Hence they are light sensitive devices.They are also called photo conductive cells or simly photocells. They are made up of semiconductor materials having high resistance. There are many different symbols used to indicate a **LDR**, one of the most commonly used symbol is shown in the figure below. The arrow indicates light falling on it.

8. RELAY

A **relay** is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back. Repeated pulses from the same input have no effect. Magnetic latching relays are useful in applications where interrupted power should not be able to transition the contacts.

Magnetic latching relays can have either single or dual coils. On a single coil device, the relay will operate in one direction when power is applied with one polarity, and will reset when the polarity is reversed. On a dual coil device, when polarized voltage is applied to the reset coil the contacts will transition. AC controlled magnetic latch relays have single coils that employ steering diodes to differentiate between operate and reset commands.

9. MOTOR

Introduction

30 RPM Side Shaft 37mm Diameter Compact DC Gear Motor is suitable for small robots / automation systems. It has sturdy construction with gear box built to handle stall torque produced by the motor. Drive shaft is supported from both sides with metal bushes. Motor runs smoothly from 4V to 12V and gives 30 RPM at 12V. Motor has 6mm diameter, 22mm length drive shaft with D shape for excellent coupling.

Table below gives fairly good idea of the motor's performance in terms of RPM vs voltage at no load and that of stall torque at different voltages.

Important Note: This motor will be bit noisy while running. For long life, this motor is not recommended for application requiring dynamic torque of more than 3 kg-cm.

Specifications

- RPM: 30 at 12V
- Voltage: 4V to 12V
- Stall torque: 28 Kg-cm at stall current of 1.3 Amp.
- Shaft diameter: 6mm
- Shaft length: 22mm
- Gear assembly: Spur
- Brush type: Carbon
- Motor weight: 143gms

10. WIRES AND CONNECTORS

Discover the vast selection of high-quality automotive wire connectors and terminals available from Waytek. You'll find ring terminals and spade terminals for single conductor wire termination and splicing, or connecting to various circuit protection devices, along with a variety of multi-pin connectors, fully sealed for those extreme and harsh environments. From battery boots and battery lugs to wire connectors, quick disconnect terminals, butt connectors and more, Waytek is Wired To Serve™ your wire connector and terminal needs

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Whether you’re looking for a convenient way to connect individual wires or simply protect your existing wire/cable, it’s important to have the right parts. Waytek carries the wire/cable and wire protection products/accessories that boats, automobiles and industrial equipment require. For more information, and to view Waytek’s huge selection of terminal and connector related products, click on the links below.

IV. SOFTWARE AND PROGRAMME USED

Software

- Programmable Notepad
- HD boot Flash

Program

```
#include<avr/io.h>

#include<util/delay.h>



int main( )

{
```

```
int C=0;
int D=0;
int E=0;
int F=0;
int i,j,k;
DDRD=0XF0;
PORTD = 0X00;
DDRC = 0X00;
PORTC = 0X00;
DDRB=0X0C;
while (1)
{
if(((PINC & 0X01) == 0X00) && (C==0))
{
PORTB=0X0A;
_delay_ms(2600);
PORTB=0X00;
C=C+1;
}
if(((PINC & 0X04) == 0X00) && (D==0))
```

```
{
for(i=0;i<=23;i++)
{
PORTD = 0X20;
_delay_ms(10);
PORTD = 0X00;
_delay_ms(300);
}
D=D+1;
}
if(((PINC & 0X08) == 0X00) && (E==0) && (D==1))
{
for(j=0;j<=10;j++)
{
PORTD = 0X20;
_delay_ms(10);
PORTD = 0X00;
_delay_ms(300);
}
E=E+1;
```

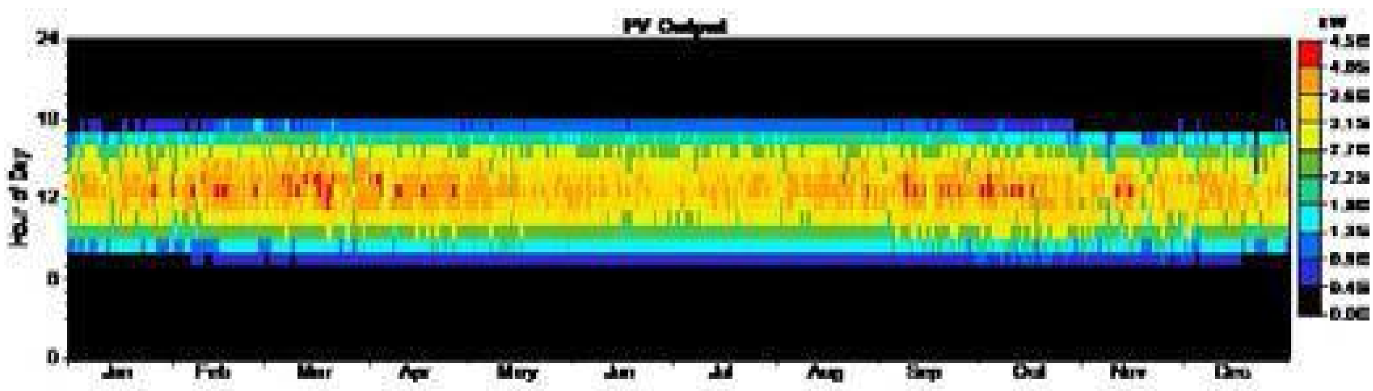
```
}
  if(((PINC & 0X08) != 0X00) && (E==1) && (F==0))
   {
   for(k=0;k<=27;k++)
{
PORTD = 0X80;
_delay_ms(10);
  PORTD = 0X00;
 _delay_ms(300);
   }
 PORTB=0X05;
  _delay_ms(2600);
 PORTB=0X00;
 F=F+1;
}


 }


  C=0;
   D=0;
```

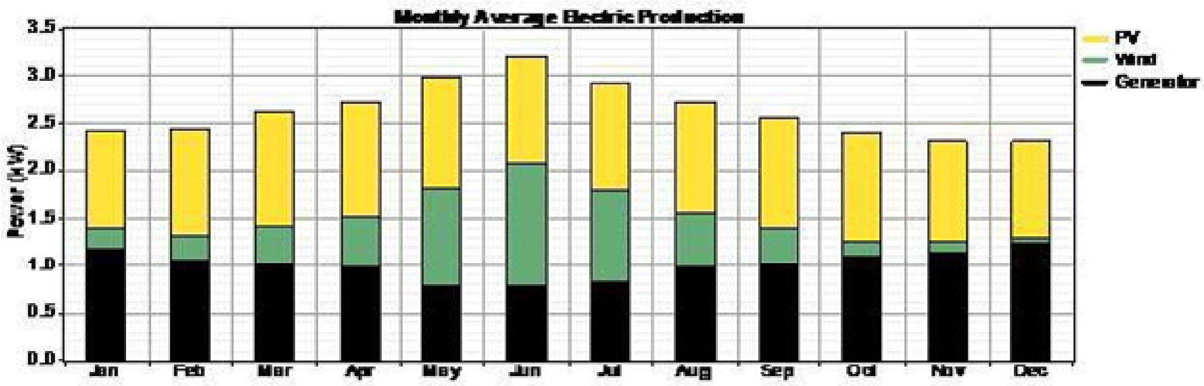
E=0;

F=0;

}

V. SIMULATION RESULTS OF HYBRID POWER SYSTEM





All the results have been simulated with Homer Energy Simulations [8], which is monitored by NASA for accurate measurements

VI. CONCLUSION

Renewables can be used for both electricity and heat generation. There is a wide range of renewable energy technologies suitable for implementation in developing countries for a whole variety of different applications. Renewable energy can contribute to grid-connected generation but also has a large scope for off-grid applications and can be very suitable for remote and rural applications in developing countries.

SUMMARY OF TECHNOLOGIES AND APPLICATIONS:

Renewable energy technology Energy service/application Wind – grid-connected Supplementing mains supply. Power for low to medium electric power and stand-alone turbines, needs. Occasionally mechanical power for agriculture purposes. wind pumps PV (solar electric) – Supplementing mains supply. Power for low electric power needs. grid-connected, Water pumping stand-alone, pumps Solar thermal – Supplementing mains supply. Heating water. Cooking. Drying crops. grid-connected, water heater, cookers, dryers, cooling Bio energy Supplementing mains supply. Cooking and lighting, motive power for small industry and electric needs. Transport fuel and mechanical power. Micro and pico hydro Low-to-medium electric power needs. Process motive power for small industry. Geothermal Grid electricity and large-scale heating. Village-scale Mini-grids usually hybrid systems (solar-wind, solar-diesel, wind-diesel, etc.). **SELF-UTILISATION OF AROUND**

60%.

Smartflower POP achieves a degree of self-utilisation of around 60% – a significant improvement over a comparable rooftop unit, which averages just around 30%. Now that is what we call smart!

- POWER OUTPUT AS PER PVGIS(1), LOCATION ROME

5.100 kWh - **SMARTFLOWER POP 2,31 KWP**

6.250 kWh - **ROOFTOP SYSTEM 4 KWP**

Efficiency gain by personal consumption -183%

ACKNOWLEDGEMENT

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