Sonu Kushwah, 2022, 10:3
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

Estimation of Electricity Saving in VCRS Based air conditioner by Using Solar Energy

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Abstract- The development of renewable energy is on the rise worldwide because of the growing demand on energy, high oil prices, and concerns of environmental impacts. In recent years, progress on solar-powered air conditioning has increased as nowadays, air conditioning system is almost a must in every building if we want to have a good indoor comfort inside the building. Therefore, this paper focuses in the design and construction of a VCRS based air conditioner by using solar energy. The air conditioning system can be operated on solar and can be used in non-electrified areas. As we all known, solar energy is cost effective, renewable and environmentally friendly.

Keywords- Solar, VCRS, solar energy, air conditioner.

I. INTRODUCTION

Air conditioner is an electrical device that it run on electricity and by using it cool the air and also destroy the germs in the air and this gives us healthy and safe air, years, fans and coolers in homes. AC is being used a lot instead of AC was invented by Wills Heavil and Carrier, he invented AC in the year 1902, which runs on electricity, he used such in a company in Brooklyn city, he invented AC to protect himself from heat.

And through this they cooled the hot environment around them. It is more important like tool room, machine room, printing press, food industry, chemical plant; along with we also use it to control moisture in Textile Company.

Window air conditioner system is such a system that we put in any window, in which all the parts of AC are put together in one place and it is installed in the house or office in such a way that half of the AC is inside the room and half of it.

It is outside, its indoor unit has cooling coil which cools the room has fan blower which sends air inside the room which is cooled capillary tube which reduces the pressure of our refrigerant Operational panel Which sets the temperature accordingly and controls the speed of the blower Dry filter which filters the moisture or dirt inside the refrigerant. It comes in the form of a separate pipe to drain, its call outdoor unit. This can put it on any wall of the room because here it can be found in very little space and the outer part of it, It can put it in a place where we do not need space, which would be the outer part of it. It consists of compressor, condenser.

Fig 1. Split Air Conditioner.

Air conditioner is an electric machine that works on VCRS; by this we reduce the temperature. In this we

use HCF (hydro fluoro carbon as refrigerant). Here an operator compresses the incoming gas, which increases the temperature and pressure of the gas and the gas starts moving towards the condenser.

According to the law of Biel and Chalas, the temperature of the refrigerant starts increasing on increasing the pressure and the same work is done by the compressor. And today in such a process, we keep running again and again, due to which we reduce the temperature of any place and object, this process is also called vapor compression system.

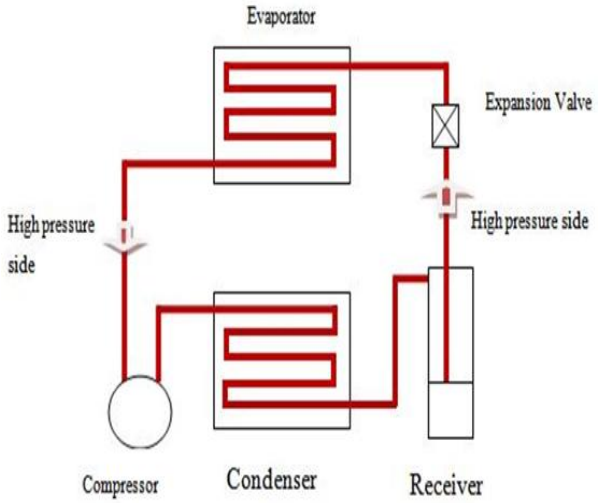

Fig 2. Working of AC in VCRS System.

II. VAPOUR COMPRESSION REFRIGERATION SYSTEM

In this, when the run an AC, fridge, then It's work on this process, that is, we use VCRS, when it is also use VCRS, then by this compress any substance which is in liquid state, There use vapor or convert to gaseous state VCRS is a system in which there is a fluid which keeps circulating inside it and this whole process takes place in a closed system. The appliances used by us like AC and fridge in which VCRS is used, mainly 2 parts. In which there is a mechanical system and the other is an electrical system, in which except us, our AC.

In this, the high pressure vapour coming through our discharge line is converted into liquid or our vapour gas is cooled by rotating it inside the line i.e. the vapour is converted into liquid and the gas which is rotate the vapour. By cooling, the refrigerant it is use in AC fridge reduces its temperature and converts the refrigerant into liquid and this work of condenser is called condensation and sends the gas to the filter where the silicon in the filter is filled with tablets that absorb moisture and act as a gas filter. It is also call it capillary tube when our refrigerant comes from the condenser then both its temperature pressure is very high and the refrigerant comes in the form of liquid and as soon as it reaches the expansion valve and by this the pressure of the refrigerant is controlled. Because the diameter of this pipe is very small.

Today's modern using most because today's is required to run most we depend on this equipment life like. Mobile, TV, Fridge, Fan, Cooler, AC etc. types of we run not possible to run them without for this need to energy, main source our society, also consider heat. Because get about 31% that use make food, business etc. And the largest part of the energy we use comes from oil and coal and it's There is also a great need for renewable energy sources to maintain sustainability.

A lot need for a pollution on the earth which includes water pollution, air pollution. There is soil pollution and due to this pollution, the danger on the earth is also increasing, as well as their reduction is also happening due to the use of these sources, while a lot of pollution is spreading from non-renewable energy sources like petrol, diesel, gas etc. And due to the use of coal, the smoke and ash emanating from it is also spreading very much pollution.

Today's time, there is a great need industrial areas petrol are used generate due there is a lot of pollution, due out for the same energy, our last century was completely dependent on hydrocarbons and petroleum substances, which provide energy to the world economy. Was brought in a new direction and the world had progressed very rapidly. Seeing the increasing threat to human life due to the increasing pollution on the earth, the whole world has moved towards the use of solar energy to make electricity in another way to control the pollution on the earth. Due to pollution, many types of diseases are spreading in human life, in which diseases like cancer, heart disease, breathlessness, etc. For this, we use solar energy and this can also control the amount of fuel shortage in the coming time.

III. RESEARCH METHODOLOGY

1. Calculation of coal and electricity bill saving. By using solar system for 1.5 tone AC:

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In this Thesis work, talk about air conditioner, how many watt units of electricity our air conditioner takes, according When our, then how many watts does consume and how much does there and what its efficiency ratio and how many tons AC and how many have such a its basis quality, It's tell in the star rating and in such a situation, how much electricity is consumed, we can find out from that and also find out the price of AC.

Fig 3. 1.5 Ton Air conditioner.

to the star rating, the cost of AC is less and more like AC with 5 star rating is more expensive and AC with 3 star rating is less and AC with 5 star rating has more power consumption and those with 3 star rating The power consumption of AC is less and the cooling capacity of AC with 3 star rating is less than AC with 5 star rating. Inverter when run, how long time does run and how much electricity consumes, we find out the amount of electricity we use according to the star rating.

Energy Efficiency Ratio of 3 star air conditioner is 3.25 Our air conditioners which are of star rating it shows the efficiency of our air conditioner that how many units of electricity our air conditioner will take and how much electricity it will save and our air conditioner at temperature Depends on how much power WoW consumes !

If we run two air conditioners at 22℃ temperature and 26 ℃ temperature then the power consumption of 22℃ air conditioner is more When we talk about the unit of how many units of our air conditioner power consumption, then we calculate what is the star rating in our AC and according to that star rating, how much power our AC consumes, we will tell below. Show in the table according to the use of different star rating in normal ac in the below.

Table 1. 5 Star split AC.

Model in ton	Power consumption	Unit \ Hour
1.0	0.98 kw	1.0
1.5	1.50 kw	1.5
2.0	1.75 kw	1.7

Table 2. 3 Star split AC.

Model in ton	Power consumption	Unit \ Hour
1.0	1.50 kw	1.50
1.5	2.09 kw	2.09
2.0	2.50 kw	2.50

Table 3. 2 Star split AC.

Model in ton	Power consumption	Unit \ Hour
1.0	1.70 kw	1.7
1.5	2.17 kw	2.17
2.0	2.70 kw	2.70

Our air conditioner which is of 1 ton has 12000 BTU (British thermal unit) and 1.5 ton AC has 18000btu (British thermal unit) and our 1.5 ton AC has a power consumption of 2090 watt whose power supply There is 220 to 250 volts which is equal to 50 Hz and 1 PH and we divide it by the power supply to get it in amperes.

Table 4. 4 Ton split AC power consumption unit in hour.

1.5 Ton	Hour	Unit	Cooling Capacity
	6	12.54	100%
	12	25.08	100%
	15	31.35	100%

Calculation of unit burning by coal:

Only one kilogram of coal has about 60000 kg calorie, that is why after 30% its quantity is,

$= \frac{30}{100}$

Conversion of electricity = 0.3

$$\frac{\mathbf{6000 \times 0.3}}{\mathbf{1000}}$$

Unit of coal burning = 2.09

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Total coal which is

$$\frac{1}{2.09}$$

1 unit electricity generates cola burning = 0.47kg ..... [30]

By burning about 500 gm of coal by us, we get the production of 1 unit of electricity, if we talk about 1.5 ton AC which is taking 31.35 units of electricity after running 15 hours in a day, then the average amount of coal burning is

$$31.35 \times 0.47$$

$$=14.73kg$$

Search and Selection of solar off Grid system Best Suited for run 190 liter Refrigerator:

This is the standard model of mono perc panel, other, due to the cell being cut halfway, the efficiency of our panel cell is high and if for any reason the shadow of any object falls on one part of our panel, then our panel continues to work and The output of our cell is not much less mono half cut panels have 9busvars due to which the flow of current in our panels is good whereas mono crystalline and polycrystalline panels have 5busvars.

Whose V.O.C (open circuit voltage) is around 49 volts and ISC (short circuit current) is 11 amps, itsthis are of A Great, its weight is about 24 kg, when the sunlight is more then its ampere is 7.9 and the voltage is 58 when we remove the generation of electricity.

Voltage × Ampere = Watt

$$7.9 \times 58 = 458.2 \text{ watt}$$

The junctions in this are divided into 3 parts in which one is negative and the other is positive and the third junction is used for parallel connection to both the parts. When talk that it have to run 1.5 ton AC from solar panel then for this we can install 7 panels of 440 watts which is total of 3080 watts i.e. we install 3kva panels which run our 1.5 ton ac and we charge the battery from the panel itself as we install off grid system.

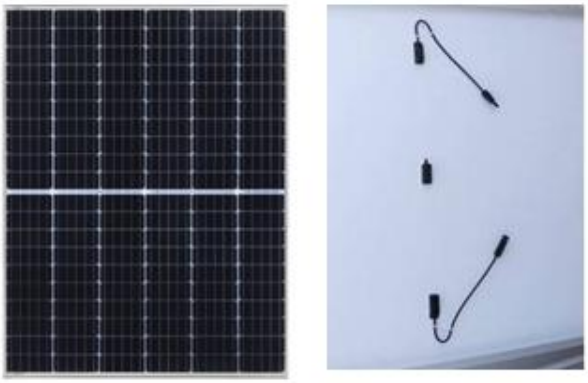

Fig 4. Mono Half Cut Solar Panel.

When the run 1.5 ton AC from solar system, for that Because by using this panel, it get power for our AC in less space, the information about the panel we are using is given in the table below.

There is use this panel because efficiency of this panel is very good 10 year manufacturing warranty and space saving, super strong frame, cell conversion efficiency high and works well even in shade Compare to other solar panels. When they consider the whole system which is of 3KVA.

IV. SOLAR INVERTER

This inverter normal in Are costlier than inverter, through this inverter, we can run any type of equipment, it also has display indications which tell us how our system is working like mains available shows that electricity is available in the house Is Solar Charging When our battery is charged by solar system then solar charging is on battery is charged from grid then grid mood is on.

Fig 5. Inverter PCU.

There is eco mode due to which we get high voltage from which we run fan valve etc. electrical equipment it gives overload signal.

It has a helpline number which is visible to us when there is any kind of fault in our inverter and it also has alarms which will alert us when there is battery low overload short circuit and fault.

1. Solar Battery:

C10 = 150Ah

C = 150Ah ÷ 10h

C = 15A

Fig 6. Solar Battery.

This means that the battery it have takes a load of 15 amps in 10 hours, it can charge or discharge it in 10 hours through the battery, this standard of our life of our about 7-8 years. And this C10, cannot use more than that because get energy from only for about 10 hours and that time our them of is also high and Its backup is to 25% more than our normal same our inverter which is call normal their life is around 4 to 6 years and it can also take them up to C20, this battery is a little cheaper and Their backup is less than solar battery, it lasts only about volts, which have spongy led and led oxide electrodes.

IV. RESULT AND DISUSSION

In this work talk about a normal AC, it takes around 2 units in 1 hour which runs on full load and runs for 15 to 18 hours in our home or office which is 3 star rating AC which that takes 9 amps of current when we take out the unit of such

Unit of 1.5 Ton AC = Power Consumption in Watt × Time × Day / 1000

2090 × 1×1 / 1000

Unit of 1.5 Ton AC = 2.09

When the run such a device whose power consumption is 2090 and we run that such for 1 hour, then its unit is 2.09 and we run such for 12 to 15 hours approx. Then if the run AC for 12 and 15 hours respectively, then it consumes 25.08 and 31.35 units of electricity in 1 day and we run AC for 1 month, then the electricity consumed by our AC when we use AC for 15 hours daily run till the 30 day.

Then

31.35 × 30 = 940.5 unit

Table 5. Unit Using per Month

	Running hour\ Per Day	3 Month Unit	12 Month Unit
1.5 Ton Air Conditioner	1	188.1	762.85
	12	2257.2	9154.2
	15	2821.5	11442.75

And when the run such AC in summer season then it runs for 3 months (90 days) then total consumption by that AC which is 15 hours per day in 3 months using AC

3 months total consumption = 2821.5 unit

The coal burning in 1 unit of electricity production is approximately.

1/2.09 = 0.47kg

By burning about 500 gm of coal by us, we get the production of 1 unit of electricity, if we talk about 1.5 ton AC which is taking 31.35 units of electricity after running 15 hours in a day, then the average amount of coal burning is

31.35 × 0.47

=14.73kg

Table 6. Using of Coal Grade.

Coal grade	Coal Name	Carbon Content (%)	Ash Content (%)	Heat Content (%)	Price of Coal in rupees
A	Anthracite	92-98	12-20	26-33	20-17
B	Bituminous	60-80	6-12	24-35	16-14
C	Lignite	60-70	6-19	10-20	13-11

By using A Grade Coal burning about 15 kg of coal, 31.35 units are obtained and the cost of coal is RS 20

per kg and the cost of 15 kg of coal is Rs 300, due to which we get 31.35 units and in 1 year 5378.47 kg of coal is burnt then our 1.5 AC Lasts 1 year and 5378.47 kg coal is available in approx Rs 107569.4 and we can save Rs 107569.4 coal by using panel. About 6000 kcal from 1 kg of coal and 30% conversion into electricity, the amount converted from thermal energy to electricity.

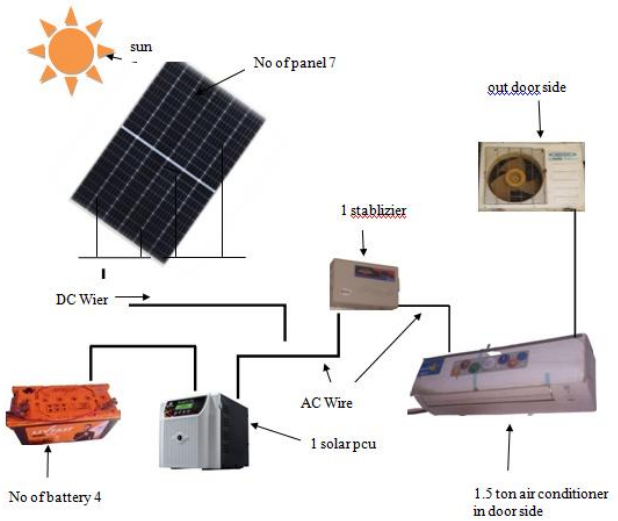

Fig 7. Quantity use in off grid solar system.

V. CONCLUSION

In today's modern era, where our urban area is developing a lot, the rural areas of our country are lagging behind. We are not able to use many electrical appliances in rural areas and due to this the rural area is becoming more backward and in many rural areas, electricity is available only for 8 to 10 hours, in that too there is a power cut many times. To overcome this problem, we can use solar system in rural areas, which is a very good way, it is very beneficial to overcome the problem of electricity in rural areas.

The solar system we are using, and colliding with each other. There is also a problem of our electrical appliances like TV, bulb, fridge, cooler, fan, and AC etc.

When our AC runs on electricity, it consumes 31.35 units of electricity for running for 15 hours, which consumes about 11442.75 units of electricity in 1 year and in our country, India, the main source of electricity, depends on coal. That is, about 90% of the electricity in our country is produced by burning coal and when we burn coal for the production of electricity gives us a lot of benefits, due to which we get rid of the problem of electricity bill because we get electricity from it for 25 to 30 years, we can also avoid rising electricity rates and at the same time we can also stop environmental pollution. we get back in 5 to 6 years because we get rid of electricity bill. the price also increases.

To install a solar system, some people find its disadvantages in such a way that for some people the biggest problem in installing a solar system is money because the investment has to be done in one go and if the cleaning of the panel is not done on time. If so, then the power generation is reduced and due to this, if the panels are not installed in the right direction, then they are not able to give the full generation of electricity and this harms us and every year its power generation decreases and where We use it there, if the shadow of a bird or any object falls on the panel, then the power efficiency is reduced through the panel.

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