Temperature Reduction of an Active Solar House by Using Chimney and Comparison of Room Temperature with the Conventional One.

A Thesis Submitted to the

Department of Mechanical Engineering

SONARGAON UNIVERSITY (SU)

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DECLARATION OF AUTHORSHIP

Course Title: Project and Thesis

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This is to certify that the thesis work entitled **"Temperature Reduction of an Active Solar House System by Using Chimney and Comparison of Room Temperature with the Conventional One"** has been carried out by Md. Toufiqur Rahman, Md. Nahid Hasan, Md. Abid Hasan and Mahmud Arefin in the department of Mechanical Engineering, Sonargaon University. We also declare that either this thesis work or any part of the paper has been submitted elsewhere for any degree.

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ABSTRACT

Solar Temperature reduce is another efficient use of renewable energy technology to help cool our homes and work places. The necessity for air-conditioning for our homes in hot areas around the world and the abundance of the sunshine within these areas has brought about a willingness to combine the two for the benefit of the people who live there. In contrast to other types of solar applications such as solar heating, the biggest demand for cooling occurs when the solar radiation is at its most intense, thereby making the marriage of solar thermal energy and solar cooling all the more attractive. Passive solar design, an idea within the growing trend of green building, is a creative way to use the sun to our advantage, both for heating and cooling, based on the design of buildings. Attempt has been made by engineers by increasing the thickness, changing the geometry of the outer wall and also tried several building materials to reduce temperature fluctuations for indoor environment in both summer and winter. The installation of heating and air conditioning to seek comfort in homes, offices and public places has created high energy consumption and consequently, increased the environmental pollution. One of the painters of sustainability in architecture is the use of natural energy and fossil energy consumption and minimum natural environmental conditions and climate so solar building designs which is a step towards its achieving. In this paper, has been expressed the important factors in solar buildings design. These factors are included external factors and internal factors.

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CHAPTER -1
INTRODUCTION

1.1 INTRODUCTION:

Solar energy is a renewable energy from the sun, which is available abundantly and freely every day. With fossil fuels disappearing rapidly and likely to be exhausted sooner or later, making use of solar energy is now more important than ever. Electrical power consumption is increasing day by day. Each and every part of our life Daily consuming electrical power (Industry, Housing, Farming, Agriculture etc.). Maximum electrical power is consuming in housing purpose. But most of the electrical power is generating by fossil fuel or nuclear energy. Unlikely the stock position is informing that the fossil fuel level decreasing rapidly due to consuming ratio increasing proportionally & the nuclear energy is not suitable for human. It is very dangerous and destructive. So we have to look at the solar power or renewable energy source. Bangladesh is a huge populated country. Though it has generally six (06) seasons but it can divide mainly two (2) seasons those are summer & winter. The temperature has very high in summer season. So, it is needed to keeping our house cool or normal temperature in this season. The winter season has very cold temperature. In this season is needed to keeping our house normal temperature. If we can use the solar temperature properly for house warming in winter season, we would be able to reduce the consumption rate of electrical power and home cost. We know, soil is not friendly for absorbing or desorbing heat. So, when the atmospheric temperature is high but soil temperature remains low and likely when the atmospheric temperature is low then the soil temperature is higher atmospheric temperature. If we use this deference temperature between soil and atmosphere for home cooling, then we would be able to reduce the electrical power consumption. So we have made a plant for cooling or warming home by fully solar and soil temperature depending on this concern. Which is very economic, renewable and eco-friendly?

1.2 HISTORY OF ACTIVE SOLAR HEATING AND COOLING PROCESS:

The Conservation House in Saskatchewan was built in 1977, and was a revolutionary building design that introduced passive solar heating and cooling to modern Passive House home building. Because let's get one thing straight - Passive Solar heating and cooling as a concept has been around for thousands of years. When early man was cold and it was sunny out he sat in the sun, when he was cold and it was overcast he sought shelter and lit a fire, unless of course it was sunny and he was too hot - and then he sought shelter too! The difference with the extraordinary and pioneering Conservation House in Northwest Regina was it was one of the first buildings in the world to combine airtightness, super insulation for homes and a heat recovery ventilation system in an attempt to produce Zero Energy homes by design.
Harold Orr has won many awards for his work, but he said he wasn't expecting the Order of Canada; "It almost floored me, I wasn't expecting this at all." He was inspired to do his work in energy efficient home design through growing up on the prairies of Canada in the 1930s. As he puts it; "When I was going to school in public school somebody had to get up in the middle of the night to put coal on the fire otherwise, we'd be cold in the morning".

Just think, if they'd had high performance stoves and fireplaces "back in the day," Harold Orr might have spent his life doing other stuff rather than advancing building technology for the planet's benefit! Later, at the University of Saskatchewan, he got more technical with his concerns, studying air leakage in homes, and then further research led to progressing the idea of passive solar design, which helps homes gain and retain natural heat from the sun through structural design and effective insulation choices (which is where traditional earth ships fall down and don't work in cold climates according to our Mike Reynolds).

Harold Orr wishes there were more passive solar energy homes in Saskatoon today, in fact throughout North America; "Everybody should be building the equivalent to the passive house," he said recently, and Eco Home agrees, though we do have "a thing" for non-toxic homes too, especially as high-efficiency homes tend to be more airtight, so the chemicals we choose to use in our homes and the materials we build them from are more important than ever.

1.3 PROBLEM STATEMENT:

As we know, Bangladesh is a most populated country. 160 million people are living in this country. It has 32173630 households and every household has average two or more house. Most of the house hold wants to get electricity for home cooling & warming and lighting purpose. Bangladesh government is trying to give electricity. But it is very difficult for giving electricity because we have limited underground fossil fuel to generation electricity. Most or the fossil fuel is imported by others country. It has needed huge amount of money for brought fossil fuel. If we can use the solar temperature for home cooling and warming so we can reduce the electrical power consumption and we would be able to fulfill all the households' minimum expect.

1. Now a day's pollution is a major issue for whole world. In case electrical power generations is consuming fossil fuel and produce the harmful gases its result gives pollution.
2. Day by day increasing electrical power consumption for home cooling or warming & many other works. Maximum electrical power is generating by fossil fuel. Which is not renewable? This resource will be finish as soon as possible.
3. The electrical power generation is not possible according to demand Due to limited fossil fuel. Maximum fossil fuel is imported from others country by high amount of money. This project can reduce the electrical power consumption and reduce high amount of cost.
4. Thus, the objective of the project or process plant can be created by low cost, eco-friendly for room cooling and warming.

5. The price of fuel is also, rising hence it is not efficient and economical. So, the solar house process is introduced. All these problems mentioned above, gave us the basic idea about what was required in the current situation.

The idea was to create a process plant which will reduce the electricity bill and electrical power consumption, which is generating by fossil fuel & which is cheap and compact.

This process plant has the capability and the economic value for fulfilling the needs of users. This Process plant is cost effective and also easy to maintain and repair for users.

1.4 SCOPES:

Source of temperature: Solar temperature collects from sun radiation.

Properties: Lighter weight, low cost components and easy operating.

Environmental advantages: Passive Solar based home cooling and heating are ecofriendly and help to reduce global warming effect.

Government support: Legislative/policy commitment to carbon reduction.

1.5 ADVANTAGE OF PASSIVE SOLAR HEATING:

Costs

Passive solar heating is not a new idea but it is something which is becoming more frequently used in modern buildings and homes. It considerably reduces the amount of heating required from other sources and also reduces carbon emissions and that is the most important factor to think about.

Efficiency

Passive solar energy makes more of the efficiency within the heating system of your home. It is not the main source of heating, hence the term ‘passive’, but it acts as a subsidiary or auxiliary form of heating which can be engaged as and when needed.

Conserving with Conservatories

Having a glass conservatory is a great form of passive solar heating. Many people would not even think of it as such, but the sun's heat will enhance the warmth in the conservatory and this will bring extra heat to nearby areas of the house. This will result in the need to use less gas or electric heating in those areas.

Building Design

Designers of new buildings now try to optimize the amount of energy they can derive from the sun. Careful planning helps to collect as much of the sun's heat as possible to reduce much of the need for gas or electric heating.

Building Materials

If you are building a new home, give serious consideration to materials and fabrics that offer great insulation.

South Facing

If you have a south facing garden or home, you can directly benefit from passive solar heating without doing much at all. The sun will shed light and warmth on that side of your home all year round. If you have large patio doors in that area of your home, you will spend less money heating that part of it. You may have noticed that even in winter, that side of your home still requires less heat than the rest of the house.

Renewable Energy

Everyone is searching for the ultimate in renewable and sustainable sources these days and the sun is the best answer to getting free renewable solar heating. It creates no carbon footprint whatsoever and you can take reasonably cheap steps to alter your home sufficiently enough to reduce your household bills by employing passive solar heating.

Silence is Golden

Having passive solar heating around your home also eliminates the constant use of noisy heating systems and furnaces, which will fire up during quiet times and disturb the peace. Reducing the need for noisy furnaces offers a peaceful time at home and promotes the enjoyment of your entertainment sources.

Air and ventilation

Not only can you benefit from passive solar heating to heat your home efficiently, but also you can rely on it to cool your home during hotter periods. If you are building a new home, you can plant trees on the south side of your house so that during the summer, they will offer a shade from the heat.

During the winter, when they have dropped their leaves, you will still get warmth coming in, too.

1.6 LIMITATION OF PASSIVE SOLAR HEATING:

Reliability

One of the major drawbacks of passive solar is that heating home depends entirely on the weather. While passive solar designs include features to maximize heating from the smallest exposure to the sun's warmth, bad weather can leave home feeling cold and dreary.

A prolonged winter storm can rob of heat at the worst possible time. Location not every region of the country receives enough sustained sunlight to make solar heating a good option. In northern climates, the harsh winters can overwhelm a passive solar heating system, making supplemental heating a must to keep home at a comfortable temperature.

Installations in colder areas also require more, and costly, insulation to keep heat from radiating back out through windows. In southern areas, prolonged sunlight can overheat, leaving it uncomfortably hot in the milder climate. A poorly designed passive solar system in a warmer area can lead to increased cooling costs, and can quickly eat up any savings offered by utilizing the sun's warmth.

Cost

While passive solar produces free heat once installed, designing home to take advantage of solar heating can be an expensive process. Choosing the proper windows is important, as some types of glass filter out more of the sun's energy and are unsuitable for passive solar installations. Redesigning rooms to use heat-absorbent materials can require remodeling, and even replacement of interior and exterior walls, to get the best effect.

Design

The idea of passive solar heating is simple, but using it effectively can require precisely configuring parts of home to take advantage of the angle of the sun.

Properly designed overhangs can let in welcome warmth in the winter months and block the sun's heat in the summer.

Bad design, however, can produce too much heat and glare when it is not welcome, and leave home cold in the wintertime. Consulting with a professional can mean the difference between a passive solar heating system that works and one that does not.

1.7 OBJECTIVES WITH SPECIFIC AIM:

- To concern about renewable energy.
- To know about passive solar home cooling and heating process by low cost.
- To be low Maintenance Cost.
- To be simple to operate and Safe.

CHAPTER-2
LITERATURE REVIEW

2.1 LITERATURE SURVEY:

Serkanet.al (2003) concluded that the energy-efficiency design strategies by passive solar components having the additional cost of about 9% of the total building cost, it is possible to save the total annual energy used in this specific residential building by 18%. It will save three types of energy need for the space conditioning and visual comfort (i. e., heating, cooling and lighting), 61% energy use reduction in heating is the maximum energy saving, lighting energy use is also decreased by 40%. However, in cooling energy need, there is an increase of 34%.

Andreas Athienitiset. al (2008) stated that Based on the design of the houses, it is expected that homes with low and near net-zero energy use can be designed in a cost effective manner within a period of about 5 years, provided a heat pump-based system is used for heating and heat is recovered from the PV system and efficiently utilized in the house.

Tanbiruj et.al (2010) finalized that the solar energy that receive naturally by a building can be used to heat the building without special devices to capture or collect sunlight in direct gain passive solar system. Passive solar heating can be apply by using of large sun-facing windows (south-facing in the Northern Hemisphere) and building materials. A well-insulated building with such construction element can absorb the sun's energy and reduce heating bills around 50 percent.

According to U.S Department of energy a special builder-friendly computer program called BuUderGWd.e has been developed to automate the calculations involved in telling out the four worksheets. The program operates like a spreadsheet: the user fills in values for the building and the computer completes the calculations.

Including all table lookups, and prints out the answers.

The results are the same as if you completed the worksheets manually but it is much faster more convenient and less prone to arithmetic error. Many design variations can be evaluated very quickly.

JavadSadeghsaberi et.al (2013) observed the different methods which use in passive solar energy building like direct gain, indirect gain, isolated gain etc.

NajmehNajafiet.al (2013) studied the experience in conventional architecture of Shiraz; it is possible to create an environmental and sustainable architecture.

Anil kumar (2013) concluded that concept of appliance of solar energy distribution through the use of a sun path diagram and the multiple ways in which this can be used for energy efficient buildings and also for evolving passive solutions possible in buildings and also provides an overview of the sun based passive solutions and design approaches possible in the case of buildings especially with reference to tropical countries.

AbdolvahidKahoorzadeh et.al (2014) shows passive solar elements like shading devices. Additional elements would keep the interior space at a more comfortable and stable temperature. Similarly, the indoor humidity can be controlled. Open the building up at night to ventilate and cool interior thermal mass. Close the buildings up during the daytime to keep the heat out. Therefore, with a standard passive solar system, dwellers feel more comfortable in terms of any conditions either cold weather or hot weather. It also has financial benefits. In fact, buildings require relatively small cooling or heating systems.

Singh et.al (2016) research that the height to width ratio of the built mass with each other and other physical features like trees, streets etc. can help not only in desirable thermal indoor conditions but, can also reduce the use of valuable land for other purposes.

According to design of P J Trade Centre (2016) observed that the shading device, orientation, vegetation, natural ventilation, concrete vent blocks and material act as effective passive design that plays an important role in achieving thermal comfort. The garden plaza and

trees planted around the building acts as filtration to cool the heated air. The uses of concrete vent blocks on parts of the building improve the space quality and enhance the ventilation for user's comfort. The concrete vent block also acts as shading device that allows air to flow in thus making the building naturally ventilated.

The natural ventilation and stack effect system used in PJ Trade Centre also help to enhance the ventilation system and fasten the time for the air to ventilate through the building. The orientation of the building helps supports the design of the concrete vent block as natural cooling strategy. The brick material on the building also helps to absorb heat to achieve an average temperate of the surrounding for thermal comfort.

2.2 SCOPE OF PRESENT WORK:

Bangladesh is a small but most populated country. About 160 million people are live in the country. It has 32173630 households and every household has average two or more house. Most of the house hold wants to get electricity for home cooling & warming and lighting purpose. Bangladesh government is trying to give electricity. But it is very difficult for giving electricity because we have limited underground fossil fuel to generation electricity. Most or the fossil fuel is imported by others country. It has needed huge amount of money for brought fossil fuel. If we can use the solar temperature for home cooling and warming so we can reduce the electrical power consumption and we would be able to fulfill all the households' minimum expect. So it has big scopes to use the passive solar house system process plant in Bangladesh.

CHAPTER-3
METHODOLOGY

3.1 Working process of Active solar home system:

Passive solar buildings use solar energy for its energy needs in different seasons. The Concept of passive solar buildings, performance and benefits are discussed. The rate of increasing population growth with increasing innovations in the field of industries and technologies has all together resulted in the increasing energy consumption enormously. This high consumption is a concern for sustainability. This has a negative impact on the environment and energy conservation.

So, an innovation in building construction that would perform with the existing energy, without exploiting any additional mechanical or electrical sources is called as passive solar building design concept. These buildings take the advantage of the climate, where it must be constructed. A proper site analysis would judge the performance of the building.

The concept of passive solar buildings is adopted in new buildings. But already existing buildings can be retrofitted to behave passively. The building is named passive solar buildings because we don't make use of any mechanical or electrical devices within the building to bring the concept.

The main concept of passive solar buildings is that it's building elements i.e. the windows, walls and the floors are made able to collect solar energy and store them. This energy is then used in the winter for warmth and used to reject the heat during the summer seasons.

The passive solar home cooling process plant work based on the following principles:

The first principle is based on the route of the sun in different seasons. The sun in winter will be traveling in a lower route compared to summer.

In winter, the south direction faced glass will help in energy absorption and storage in the building.

The location of thermal mass in a position enabling easy absorption of solar energy later would help in the easy release of the same during evening time.

The direct sun can be resisted by overhanging elements as shown in the figure below. These are also called control elements. Proper insulation enables warmth in winter and coolness in sum

3.2 COMPONENT REQUIRED

For construction this project we need some hardware components and software program. They are as follows.

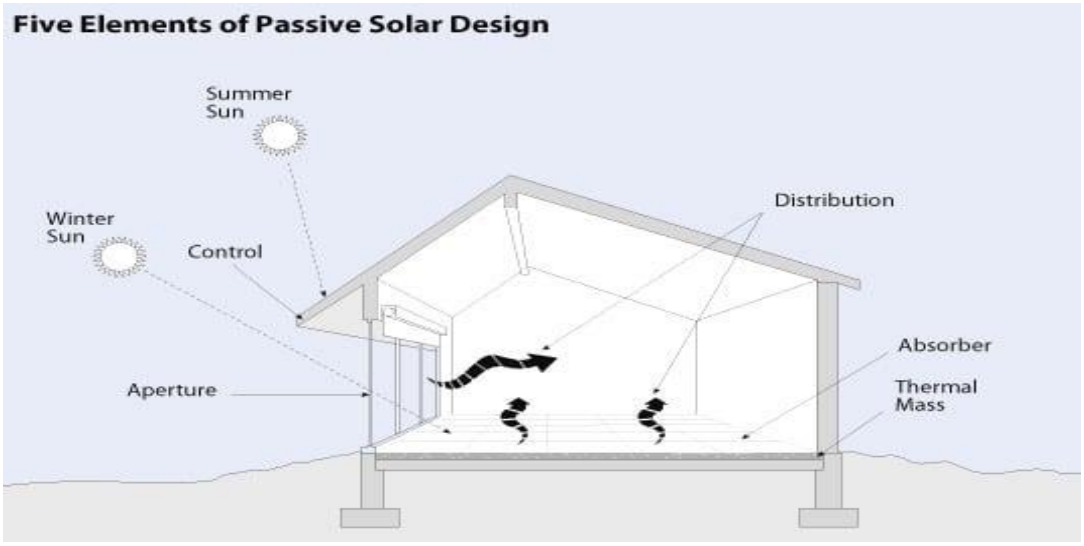


Figure: 3.1 Passive solar home

a) Room b) internal doors c) Walls d) Building
e) Furniture f) Place g) Equator h) Windows
i) Thermal mass.

3.2.1 Hardware Requirements:

a) Measurement Tap
b) Hacksaw
c) Hand Grinding Machine
d) Knife
e) Star Screw Driver
f) Electric Glue Gun
g) Tube Cutter
h) Scissors
i) Cutting player
j) Digital Temperature Measurement Device
k) Plywood

l) Copper Tube
m) Glue stick
n) Tube Elbow
o) Sun Protection Glass
p) Screw
q) Supply Fan
r) PVC Square Channel Tube
s) Duct Material
t) 2pin Plug
u) Electric Cable
v) Transparent Glass

3.2.2 Software Requirements:

Program using MS Word, Power Point, Auto Cad & Solid Work

3.3 TOOLS & INSTROMENTS:

Materials:

1. Plywood:

Plywood is a material manufactured from thin layers or "plies" of wood veneer that are glued together with adjacent layers having their wood grain rotated up to 90 degrees to one another. It is an engineered wood from the family of manufactured boards which includes medium-density fiber board (MDF) and particle board (chipboard).All plywood's bind resin and wood fiber sheets (cellulose cells are long, strong and thin) to form a composite material. This alternation of the grain is called cross-training and has several important benefits: it reduces the tendency of wood to split when nailed at the edges; it reduces expansion and shrinkage, providing improved dimensional stability; and it makes the strength of the panel consistent across all directions. There is usually an odd number of plies, so that the sheet is balanced—this reduces warping. Because plywood is bonded with grains running against one another and with an odd number of composite parts, it has high stiffness perpendicular to the grain direction of the surface ply. Smaller, thinner, and lower quality plywood may only have their plies (layers) arranged at right angles to each other.

Some better-quality plywood products will by design have five plies in steps of 45 degrees (0, 45, 90, 135, and 180 degrees), giving strength in multiple axes

The word ply derives from the French verb plier "to fold", from the Latin verb polio, from the ancient Greek verb.

Figure 3.2: Plywood

Application: Plywood is used in many applications that need high-quality, high-strength sheet material. Quality in this context means resistance to cracking, breaking, and shrinkage, twisting and warping.

Plywood is also used as an engineering material for stressed-skin applications. It has been used for marine and aviation applications since WWII.

Most notable is the British de Havilland Mosquito bomber, with a fuselage made of birch plywood sandwiching a balsa core, and using plywood extensively for the wings.

Plywood was also used for the hulls in the hard-chine Motor Torpedo Boats (MTB) and Motor Gun Boats (MGB) built by the British Power Boat Company and Vosper's.

Typical end uses of spruce plywood are:

Floors, walls, and roofs in home constructions

Wind bracing panels

Vehicle internal body work

Packages and boxes

Fencing

2. Copper Tube:

Copper tubing is most often used for heating systems and as a refrigerant line in HVAC systems. Copper tubing is slowly being replaced by PEX tubing in hot and cold water applications. There are two basic types of copper tubing, soft copper and rigid copper. Copper tubing is joined using flare connection, compression connection, pressed connection, or solder. Copper offers a high level of corrosion resistance but is becoming very costly.

Figure- 3.3: Copper Tube

Soft copper:

Soft (or ductile) copper tubing can be bent easily to travel around obstacles in the path of the tubing. While the work hardening of the drawing process used to size the tubing makes the copper hard or rigid, it is carefully annealed to make it soft again; it is therefore more expensive to produce than non-annealed, rigid copper tubing.

It can be joined by any of the three methods used for rigid copper, and it is the only type of copper tubing suitable for flare connections. Soft copper is the most popular choice for refrigerant lines in split-system air conditioners and heat pumps.

Rigid copper:

Rigid copper is a popular choice for water lines. It is joined using a solder/sweat, roll grooved, compression or crimped/pressed connection. Rigid copper, rigid due to the work hardening of

the drawing process, cannot be bent and must use elbow fittings to go around corners or around obstacles.

If heated and allowed to cool in a process called annealing, rigid copper will become soft and can be bent/ formed without cracking.

Soldered connections:

Solder fittings are smooth, and easily slip onto the end of a tubing section. The joint is then heated using a torch, and solder is melted into the connection. When the solder cools, it forms a very strong bond which can last for decades. Solder-connected rigid copper is the most popular choice for water supply lines in modern buildings. In situations where many connections must be made at once (such as plumbing of a new building), solder offers much quicker and much less expensive joinery than compression or flare fittings. The term sweating is sometimes used to describe the process of soldering pipes.

Compression connections:

Compression fittings use a soft metal or thermoplastic ring (the compression ring, "olive" or "ferrule") which is squeezed onto the pipe and into the fitting by a compression nut. The soft metal conforms to the surface of the tubing and the fitting and creates a seal. Compression connections do not typically have the long life that sweat connections offer, but are advantageous in many cases, because they are easy to make using basic tools.

A disadvantage in compression connections is that they take longer to make than sweat, and sometimes require re-tightening overtime to stop leaks.

Flare connections

Flare connections require that the end of a tubing section be spread outward in a bell shape using a flare tool. A flare nut then compresses this bell-shaped end onto a male fitting. Flare connections are a labor-intensive method of making connections but are quite reliable over the course of many years.

Crimped or pressed connections

Crimped or pressed connections use special copper fittings which are permanently attached to rigid copper tubing with a powered crimper. The special fittings, manufactured with sealant already inside, slide over the tubing to be connected. Thousands of pounds-force per square inch of pressure are used to deform the fitting and compress the sealant against the inner copper tubing, creating a water-tight seal.

The advantages of this method are that it should last as long as the tubing, it takes less time to complete than other methods, it is cleaner in both appearance and the materials used to make the connection, and no open flame is used during the connection process. The disadvantages are that the fittings used are harder to find and cost significantly more than sweat-type fittings.

3. Tube Elbow:

To an uneducated homeowner, pipe fittings are as numerous and confusing as choosing the right screw or nail for a construction project. The materials vary and the specific purpose, although precise, seems daunting to figure out. Here is a brief overview of pipe fittings, their

Figure-3.4: Elbow

purpose, and the materials offered. Obviously, pipe fittings are attached to the end of pipes that allow it to change direction, control the flow, and change the diameter of the pipe. Being a non-trivial part of plumbing and piping systems, consulting us with your need is definitely advised to save yourself time, money, materials, and headaches.

4. Sun Protection Glass:

Sun control glass units are designed to easily adjust the quality and characteristics of the light coming through the window. This is especially useful for buildings facades that are made mostly out of glass. Using a variety of solar control glazes, there is a possibility to adjust the light throughput (LT), light reflectance (LR), and the solar factor (g). To create a cozy and

comfortable environment, buildings should be equipped not only with warm but also light-permeable and solar-protected glass units.

Solar control glass, which can be toned, mirror or sun control glass, is used for the outer glass plate

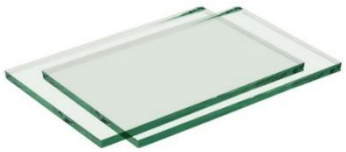


Figure-3.5: Sun Protector Glass

BLOWER:

Supply air fans, intake fans, supply fan and make-up air blowers are used for specific situations where fresh and or clean make-up air needs to be replaced at a quicker rate than what would normally take place.

If too much air is being exhausted from a space and the fresh air is not replaced quick enough, it can cause a negative pressure.

Sometimes a particular static pressure must be present in the area to meet certain requirements. Applications include labs, hospitals, and chemical plants, welding rooms, spray booth and more. Industrial Fans Direct can help you find the right air supply fan for your commercial or industrial needs.

Figure-3.6: Blower

2. Duct Material:

Ducts are conduits or passages used in heating, ventilation, and air conditioning (HVAC) to deliver and remove air. The needed airflows include for example, supply air, return air,

and exhaust air. Ducts commonly also deliver ventilation air as part of the supply air. As such, air ducts are one method of ensuring acceptable indoor air quality as well as thermal comfort.

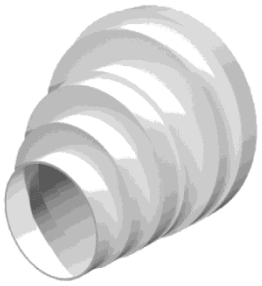


Figure-3.7: Duct

4. Electric Cable:

A wire is a single, usually cylindrical, flexible strand or rod of metal. Wires are used to bear mechanical loads or electricity and telecommunications signals. Wire is commonly formed by drawing the metal through a hole in a die or draw plate.

Wire gauges come in various standard sizes, as expressed in terms of a gauge number.

The term 'wire' is also used more loosely to refer to a bundle of such strands, as in "multi stranded wire", which is more correctly termed a wire rope in mechanics, or a cable in electricity.

Figure-3.8: Electric Cable

5. Transparent Glass:

Transparency is a physical property that we observe every day, though perhaps it is not one that we give a huge amount of thought to. Also known as diaphaneity or pellucidity,

transparency in materials allows light to pass through unaffected, thus making them see-though. Optically transparent materials are essential in many scientific and manufacturing applications and new ways of utilizing these are being worked on all the time, some of which are highlighted later in the article. But what makes a material transparent? It is all to do with how the atoms, and hence the electrons, in a material are arranged. If a photon (a particle of light) traveling through a solid meets an electron with an energy gap of equal energy, it will be absorbed by that electron as it 'jumps' to a higher energy level. This means that very little light can travel through the material without being absorbed, thus making the material opaque. However, with transparent materials, the energy gap is larger, so that the photons cannot excite the electrons into a higher energy level.

This allows the photons to pass through the material unaffected, making the material see-through.

So in essence, the interaction between light and a material is based on the light wavelength and the nature of the material.

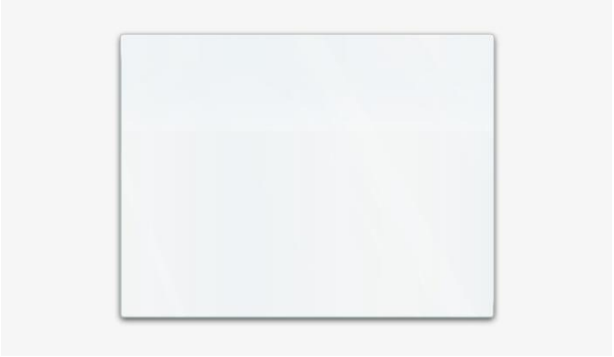


Figure-3.9: Transparent Glass

3.3.1 Measurement Tap:

Measuring tape is a flexible ruler used to measure distance. It consists of a ribbon of cloth, plastic, fiber glass, or metal strip with linear-measurement markings. It is a common measuring tool. Its design allows for a measure of great length to be easily carried in pocket or toolkit and permits one to measure around curves or corners. Today it is ubiquitous, even

appearing in miniature form as a keychain fob, or novelty item. Surveyors use tape measures in lengths of over 100 m. There are two basic types of tape measures with cases,

Spring return pocket tape measures and long tape measures. Spring return pocket tape measures will generally fit in a pocket. They are small; the case is up to about three inches across. The tape is returned to the case by a spring mechanism. Pocket tape measures have a tape 1 to 15 feet (0.30 to 4.57 m) in length and 1⁄4 to 3⁄4 inch (6.4 to 19.1 mm) across. When most people think of a tape measure, they are thinking of the pocket tape measure.

Figure-3.10: Measurement Tap

A second tape measure design is what is called the long tape. These are cased tape measures with tapes of 25, 50, 75, 100, 200, 300, and even 500 feet in length, designed for engineers and builders. Because surveying was usually done in rods, surveyors use long tapes of 33 feet (2 rods), and 66 feet (4 rods).

Surveyors also used 49 1⁄2 feet of a 50-foot tape for 3 rods and 99 feet of a 100-foot tape measure for 6 rods. Long tapes instead of being returned by a spring, were usually returned by hand crank.

3.3.2. Hacksaw:

A hacksaw is a fine-toothed saw, originally and mainly made for cutting metal. The equivalent saw for cutting wood is usually called bow saw.

Most hacksaws are hand saws with a C-shaped frame that holds a blade under tension. Such hacksaws have a handle, usually a pistol grip, with pins for attaching a narrow disposable

blade. The frames may also be adjustable to accommodate blades of different sizes. A screw or other mechanism is used to put the thin blade under tension.

Figure-3.11: Hacksaw

On hacksaws, as with most frame saws, the blade can be mounted with the teeth facing toward or away from the handle, resulting in cutting action on either the push or pull stroke. In normal use, cutting vertically downwards with work held in a bench vice, hacksaw blades are set to be facing forwards.

Uses: Hacksaws were originally and principally made for cutting metal, but can also cut various other materials, such as plastic and wood; for example, plumbers and electricians often cut plastic pipe and plastic conduit with them.

3.3.3. Hand Grinding Machine:

A grinding machine, often shortened to grinder, is one of power tools or machine tools used for grinding; it is a type of machining using an abrasive wheel as the cutting tool. Each grain of abrasive on the wheel's surface cuts a small chip from the work piece via shear deformation.

Figure-3.12: Hand Grinder

Uses: Angle grinders are versatile tools that can grind metal and cut tile, stucco and pavers, rout out mortar, plus they can sand, polish and sharpen. Learn to use an angle grinder to cut tile, mortar and pavers; make quick work of rust and loose paint removal; sharpen blades and cut or grind steel.

3.3.4 Electric Glue Gun:

Figure-3.13: Electric Glue Gun

Hot melt adhesive (HMA), also known as hot glue, is a form of thermoplastic adhesive that is commonly sold as solid cylindrical sticks of various diameters designed to be applied using a hot glue gun.

The gun uses a continuous-duty heating element to melt the plastic glue, which the user pushes through the gun either with a mechanical trigger mechanism on the gun,

Or with direct finger pressure. The glue squeezed out of the heated nozzle is initially hot enough to burn and even blister skin.

The glue is tacky when hot, and solidifies in a few seconds to one minute. Hot melt adhesives can also be applied by dipping or spraying, and are popular with hobbyists and crafters both for affixing and as an inexpensive alternative to resin casting.

Application: Hot-melt adhesives are as numerous as they are versatile. In general, hot melts are applied by extruding, rolling or spraying, and the high melt viscosity makes them ideal for porous and permeable substrates HMA are capable of bonding an array of different substrates including: rubbers, ceramics, metals, plastics, glass and wood.

3.3.5 Cutting player:

Diagonal pliers (or wire cutters or diagonal cutting pliers or diagonal cutters or side cutting pliers) are pliers intended for the cutting of wire (they are generally not used to grab or turn anything). The plane defined by the cutting edges of the jaws intersects the joint rivet at an angle or "on a diagonal", hence the name.

Figure-3.14: Cutting player

Uses: Diagonal pliers are useful for cutting copper, brass, iron, aluminum and steel wire. Lower quality versions are generally not suitable for cutting tempered steel, such as piano wire, as the jaws are not hard enough. Attempting to cut such material will usually cause indentations to be made in the jaws, or a piece to break out of one or both jaws, thus ruining the tool. However higher quality side cutters can cut hardened steel, such as 2 mm piano wire.

CHAPTER -4
EXPERIMENTAL DESIGN & PRINCIPLE

4.1 DESIGN & PRINCIPLE:

Solar energy is the most important renewable energy source available on-site. Therefore, application of solar energy has to play a major role in covering the energy demand for heating and cooling of buildings. A pre-condition to achieve a 'nearly zero energy' standard is to maximize energy saving and energy efficiency of buildings. This minimizes the remaining energy demand such that it becomes realistic to cover it by renewable energy sources. How far this can be achieved in a particular case depends on the building type and form, on its use and on the local climatic conditions. In this paper general solutions of solar energy systems for buildings are presented.

The two main technologies discussed are

1. photovoltaic systems which are used to operate a reversible heat pump which is used for heating, hot water production and cooling and
2. Solar thermal collector systems used for heating and hot water production and for cooling in combination with a thermally driven chiller system.

For the solar thermal solution, a detailed analysis of the achievable solar fractions for the example of a hotel building is investigated for various climatic conditions. For the example of Malta also an analysis of primary energy saving has been carried out and a detailed cost balance is presented.

4.2 SCHEMATIC DIAGRAM

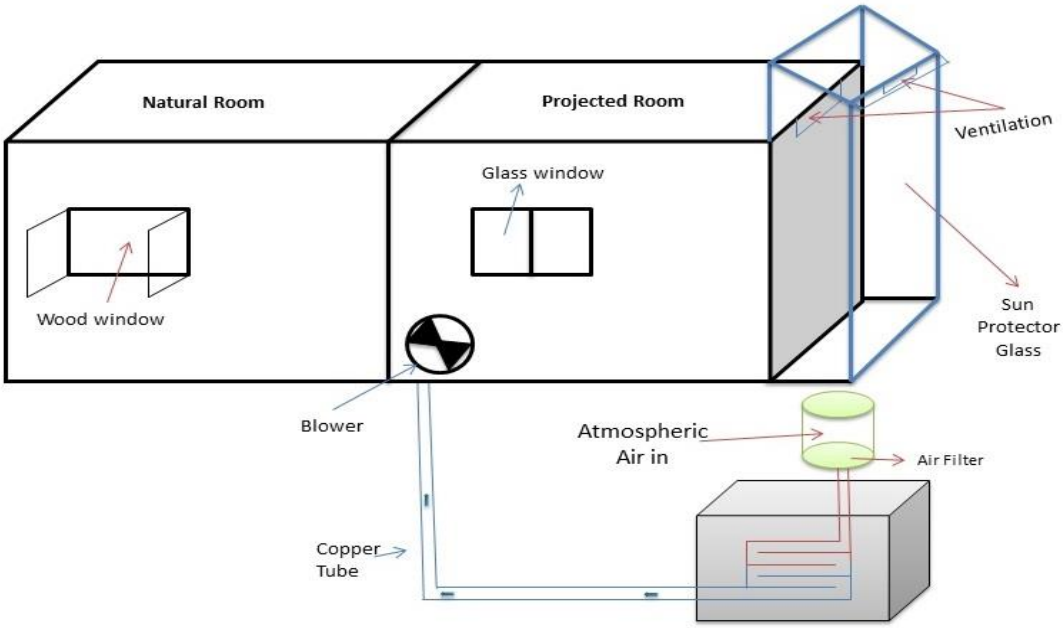


Figure 4.1: Schematic Diagram

4.3 CIRCUIT DIAGRAM OF BLOWER

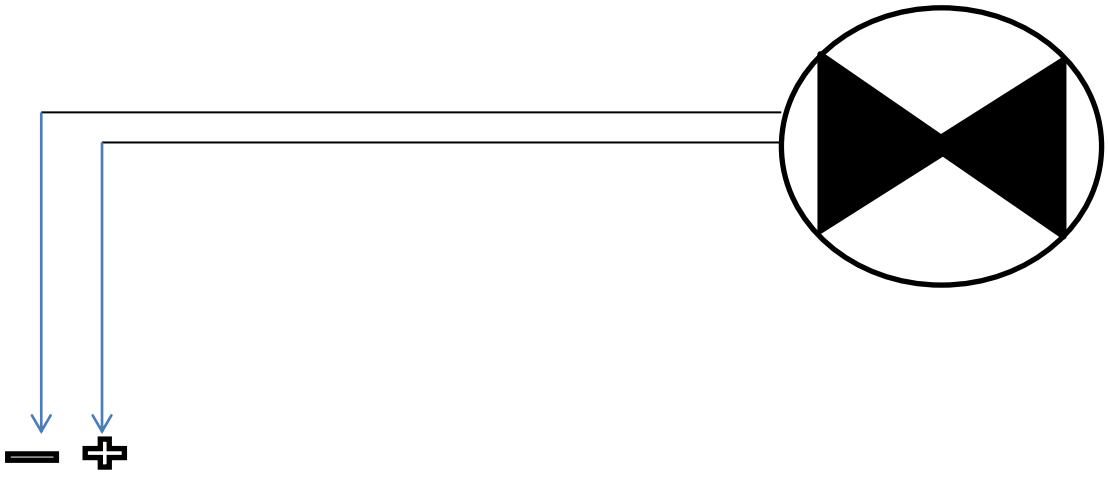


Figure 4.2 : Circuit diagram of blower

Supply air fans, intake fans, supply fan and make-up air blowers are used for specific situations where fresh and or clean make-up air needs to be replaced at a quicker rate than what would normally take place.

If too much air is being exhausted from a space and the fresh air is not replaced quick enough, it can cause a negative pressure.

Sometimes a particular static pressure must be present in the area to meet certain requirements. Applications include labs, hospitals, and chemical plants, welding rooms, spray booth and more. Industrial Fans Direct can help you find the right air supply fan for your commercial or industrial needs.

4.4. Digital Temperature Measurement Device:

Specifications: Humidity: 10%RH~99%RH Humidity accuracy: ±5%RH Humidity display resolution: 1%RH Temperature range: -10°C~50°C Temperature accuracy: ±1°C Resolution: 0.1°C Operating Voltage: 1.5V, or LR44 batteries (Not include) LCD Dimension: 36 * 16mm / 1.4 * 0.6in Probe cable length: 150cm / 59in Package List: 1 * Thermometer& Hygrometer (2 in 1) Feature: Clear and intuitive digital display of temperature and hygrometer values.

Figure-4.3: Digital Temperature Measurement Device

Measuring temperature from -10°C to 50°C. Measuring humidity from 10% to 99%RH. Comes with a probe, which makes it easy to use. Perfect for use in incubators, brooders, cigar rooms any other place that requires monitoring of temperature and humidity levels.

4.5 Room Description & design principal:

The first consideration for optimizing passive solar energy is to select a house site with adequate solar exposure. For solar heating in winter, a good measure of solar exposure is to have at least four hours of direct solar gain on the winter solstice. The best orientation is to have the “solar” side of the house face within 15 degrees of true south. In climates where summer heat is a major concern, it’s a good idea to aim the solar windows a little east of south to get morning sun in winter and avoid the intense western sun in the warm season.

Figure 4.4: Front side

Typically, you would locate the day-use rooms, such as a living room or family room, on the south portion of the home’s floor plan to allow the greatest amount of solar energy to penetrate these rooms on winter days. This layout also allows you to take advantage of the sunlight and view of the outdoors.

The “shell” of the house is composed of exterior insulated walls and “glazing,” or windows. In a conventional home, the window area is equally distributed on all four sides of the home, or the majority of the window area may be focused on the direction with the best view. For a passive solar design, one would locate more of the window area on the south side, which has the best solar access. Some windows would be placed on the east and west sides of the house for delighting and cross-ventilation with only a few windows to the north.

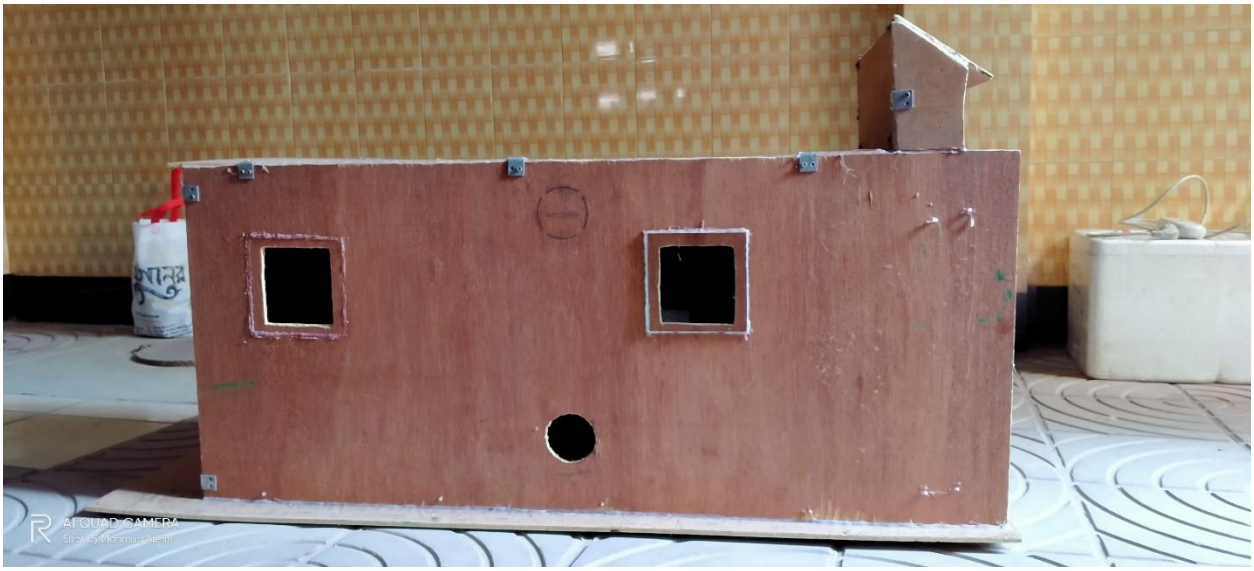


Figure:4.5: Home backside

The glazing is important. Choose high-quality, tightly constructed windows to reduce air infiltration. At a minimum, use double-insulated glass. Some of my favorite high-quality windows are Loewe metal-clad wood windows, but all-vinyl windows are more economical and perform well. Double glazing is adequate for most climates, although in locations with severe winter conditions; triple glazing is advisable to reduce heat loss and condensation on the glass.

Figure: 4.6 Top side

I usually recommend clear double glass for solar-oriented windows and “low-e” glazing on the other sides. Low-e glazing limits incoming heat in summer and reduces heat loss from the inside in winter. Using clear glass on the south wall windows allows more of the sun’s energy to warm the house in winter, when the sun will be able to enter the house through the south-facing windows. In colder climates, using isolative window drapes or blinds at night helps reduce overnight heat loss and increase comfort.

4.6 Soil Chamber:

Figure: 4.7 Soil Chamber

4.7 Design & description of Chimney:

A solar chimney – often referred to as a thermal chimney – is a way of improving the natural ventilation of buildings by using convection of air heated by passive solar energy. A simple description of a solar chimney is that of a vertical shaft utilizing solar energy to enhance the natural stack ventilation through a building. the solar chimney consists of a black-painted chimney. During the day solar energy heats the chimney and the air within it, creating an updraft of air in the chimney. The suction created at the chimney's base can be used to ventilate and cool the building below.[1] In most parts of the world it is easier to harness wind power for such ventilation as with a wind catcher, but on hot windless days a solar chimney can provide ventilation where otherwise there would be none.

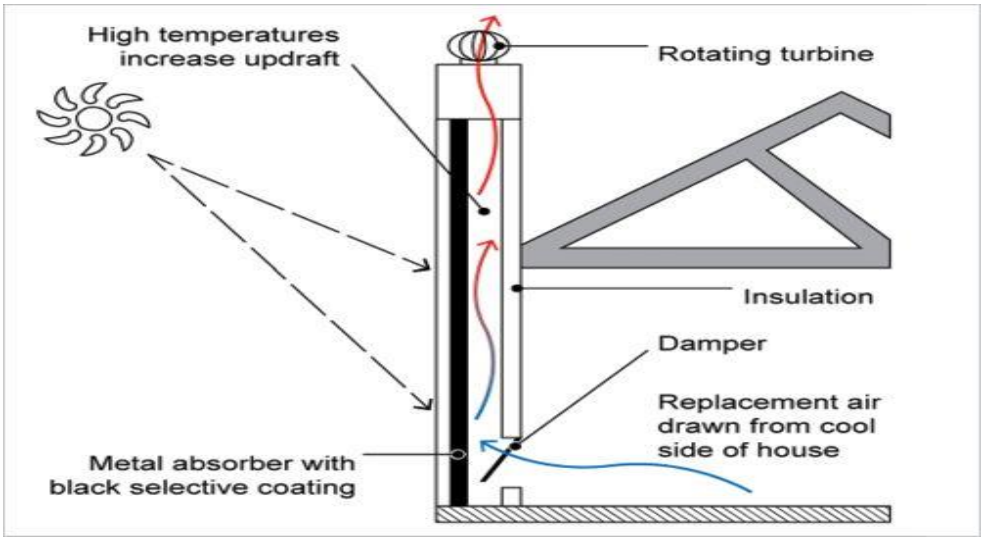


Figure: 4.8 Chimney design

There are however a number of solar chimney variations. The basic design elements of a solar chimney are:

- The solar collector area: This can be located in the top part of the chimney or can include the entire shaft. The orientation, type of glazing, insulation and thermal properties of this element are crucial for harnessing, retaining and utilizing solar gains.
- The main ventilation shaft: The location, height, cross section and the thermal properties of this structure are also very important.
- The inlet and outlet air apertures: The sizes, location as well as aerodynamic aspects of these elements are also significant.

4.8 Passive Solar Design Principles

• Areas for daytime use should have good solar exposure
• Solar shading for summer
• SIP walls (R-24+) and roof (R-31+), almost zero air infiltration
• Nontoxic materials
• Perimeter slab insulation (R-10)
• Ceiling fans for ventilation and cooling
• Stone veneer and hard plaster walls for thermal mass
• Clear insulated glazing for south-facing windows
• High-quality windows with at least double panes

4.9 WORKING PRINCIPLE

The solar chimney is one of the technologies which work on the principle of buoyancy, where air is heated through the greenhouse effect generated by solar radiation (heat energy) at low costs. The solar chimney is a passive solar ventilation system (non-mechanical) that can be installed on roofs or in walls. The heat is transferred through the convective cooling principle based on the fact that hot air rises upward; these chimneys reduce unwanted heat during the day by displacing interior (warm) air with exterior (cool) air. Solar chimneys are mainly made of a black, hollow thermal mass with an opening at the top as an exit for the hot air. The air in the room exits from the top of the chimney. The process can also be reversed for room heating

The most appropriate passive cooling strategies for your home — including orientation, ventilation, windows, shading, insulation and thermal mass — are determined by climate, so first identify your climate zone by reading Design for climate. You can then apply the more detailed advice here and in Passive solar heating.

The efficiency of the building envelope can be maximized in a number of ways to minimize heat gain:

a) Shading windows, walls and roofs from direct solar radiation
b) Using lighter clouded roofs to reflect heat
c) Using insulation and buffer zones to minimize conducted and radiated heat gains
d) Making selective or limited use of thermal mass to avoid storing daytime heat gains.

To maximize heat loss, use the following natural sources of cooling:

a) Air movement
b) Cooling breezes
c) Evaporation
d) Earth coupling
e) Reflection of radiation

4.10 WORKING PROCEDURE:

a) At First, the house must be air proof
b) Second, a chimney must be attached to the house
c) Sun protection glass is used in this chimney
d) Here two ventilation systems are placed on the wall of one room, the other on the upper part of the chimney.
e) Atmospheric air has been exploited to lower the soil's temperature through a blower.
f) Copper pipes have been used to change the temperature.
g) The temperature is changed by the air flowing through the room.
h) The room has ventilation to allow the air to flow through which hot air is released through the chimney.

CHAPTER - 5
DATA COLLECTION, ANALYSIS & DISCUSSION

5.1 ECONOMIC ANALYSIS:

Economic analysis Installation of a solar heating and cooling system leads to much higher investments compared to a conventional solution mainly due to the solar thermal collector field but also due to the more components which are needed, i.e. the thermally driven chiller in addition to the conventional chiller and the larger cooling tower. Due to the lower operation cost of the solar heating and cooling system an adequate cost comparison has to compare full life cycle cost (LCC) of the two systems. LCC includes all cost items over the whole system life time, i.e. investment, capital cost (depreciation over lifetime), energy cost and maintenance cost. It is interesting to note that for the smallest studied collector area (150 m²) no reduction of the LCC appears with increasing capacity of the thermally driven chiller. The reason is that almost all heat produced by the solar collector is used for either domestic hot water production or heating and thus only little use is made of the thermally driven

652 Hans-Martin Henning and Jurchen Doll / Energy Procedia 30 (2012) 633 – 653 chiller to cover part of the cooling load. For all other collector sizes there exist certain values of the thermally driven chiller that lead to a minimum of the LCC. For instance, a system with a solar collector area of 300 m² and a capacity of the thermally driven chiller of 30 kW leads to a LCC which is about 5.7 % below that of the conventional reference; the corresponding primary energy saving lies in the range of about 58 %. The largest investigated system (collector area 750 m²; TDC capacity 60 kW) leads to a slight increase of 3.4 % in the life cycle cost compared to the conventional solution and the corresponding primary energy saving is 79.5 %

Cost Analysis for Home cooling by AC:

Room Area m^2	Required AC	Power Consumption per day	Power consumption per month	Power Consumption cost for Bangladesh per day	Power Consumption cost for Bangladesh per month
1000 m^2	2 Tones	1.732KW×24Hrs= 41.56 unites	41.56×30=1247 unites	41.56×5.45=226 TK	226×30=6795TK

Cost Analysis for home cooling by using passive solar house plant:

Room Area M^2	Required Blower	Power Consumption per day	Power consumption per month	Power Consumption cost for Bangladesh per day	Power Consumption cost for Bangladesh per month
1000 M^2	1	0.2KW×24Hrs= 4.80 unites	4.80×30=144 unites	4.80×5.45=26TK	26×30=784TK

All data analysis for 1000m^2 room area

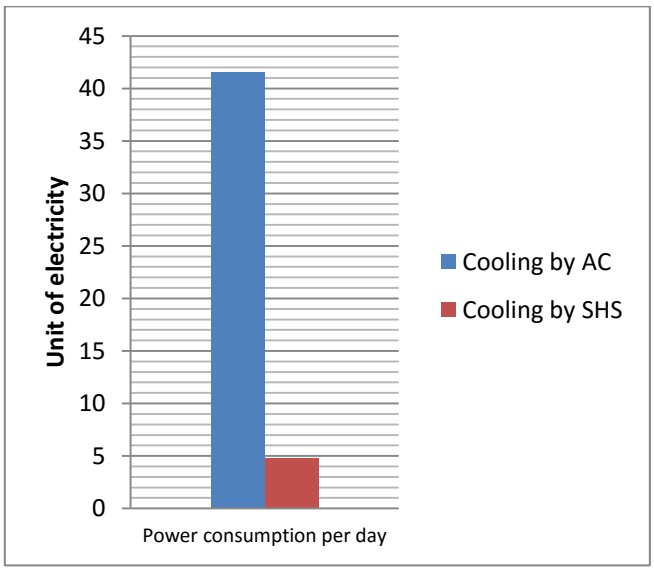


Figure: 5.1

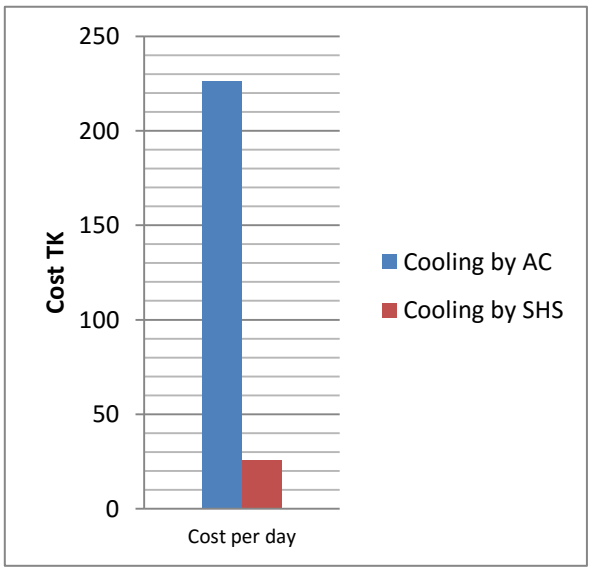
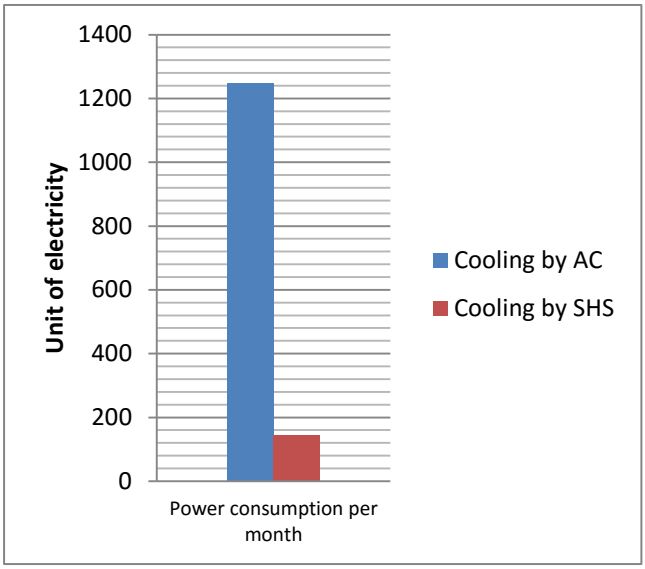


Figure: 5.2



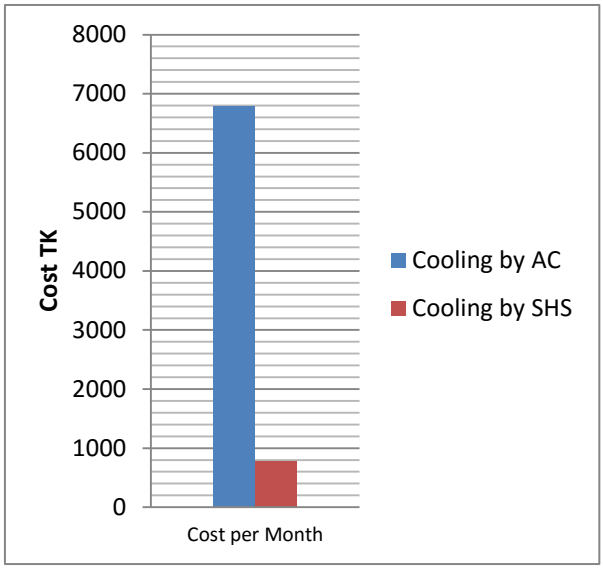


Figure: 5.3	Figure: 5.4

Cost Savings:

Power Consumption cost for Bangladesh per month by AC	:	6795TK
Power Consumption cost for Bangladesh per month by SHS	:	-784TK
Total Savings		**6011TK**

Total Savings: 88.27%

Winter Season room heating by Passive solar system:

Primary temperature	Time duration	Normal room temperature	Experimental room temperature
18°C	15min	18°C	22.7°C
18°C	30min	18°C	23.4°C

Summer season room cooling by Passive solar home system:

Primary temperature	Time duration	Normal room temperature	Experimental room temperature
32°C	15min	32°C	28°C
32°C	30min	32°C	26°C

CHAPTER- 6

CONCLUSION:

This brief discussion has been intended to introduce you to basic types of passive systems that may be used to heat buildings and thereby conserve energy, the roles of climate and solar availability in determining the feasibility of passive solar systems, and some guidelines that may be useful in undertaking feasibility studies and preliminary designs. This will give you a foundation for learning about and utilizing more technically rigorous methods that are available in the engineering literature.

FURTHER RECOMMENDATION:

- Include solar panel with Active solar home system for convert to full passive solar home system.
- Using triple glazing for increase room temperature.

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