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Enhancing HVAC Efficiency: Load Calculation for Energy Conservation and Sustainability

25 April 2024 | Technical Topic Webinar

Presented by:
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Agenda

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Introduction - Presenter

Mr Frikkie Marx

With 38 years of postgraduate experience, including approximately 22 years in academics and training, Frikkie specializes in consultation within the fields of Electromagnetic Compatibility (EMC), Power Electronics (PE), and Information Technology (ICT).

He has served as a lecturer at institutions such as Denel, RAU(UJ), Wits, Technikon SA(UNISA), and EIT.

Additionally, Frikkie is a member of the SABS EMC and Power Electronics committee and has held the position of Vice-chairman of the Electrical Engineering Advisory Committee at Unisa, previously serving in the same role at Technikon SA.

His prior professional engagements include roles at SA Railways, Navy, Armscor, and Denel.

Introduction

- Paris 2024 says its Olympic Games will be the **greenest** in the event's history.
- HVAC systems of the future will use technologies such as more geothermal heat pumps, solar power, smart thermostats, and even ice-powered air-conditioning to reduce their energy use and overall environmental impact.
- Plans include powering the Athlete's Village with **geothermal** and **solar energy**.
- Paris is keeping buildings cool with river water, instead of air conditioning.

Paris Expanding the Cooling System

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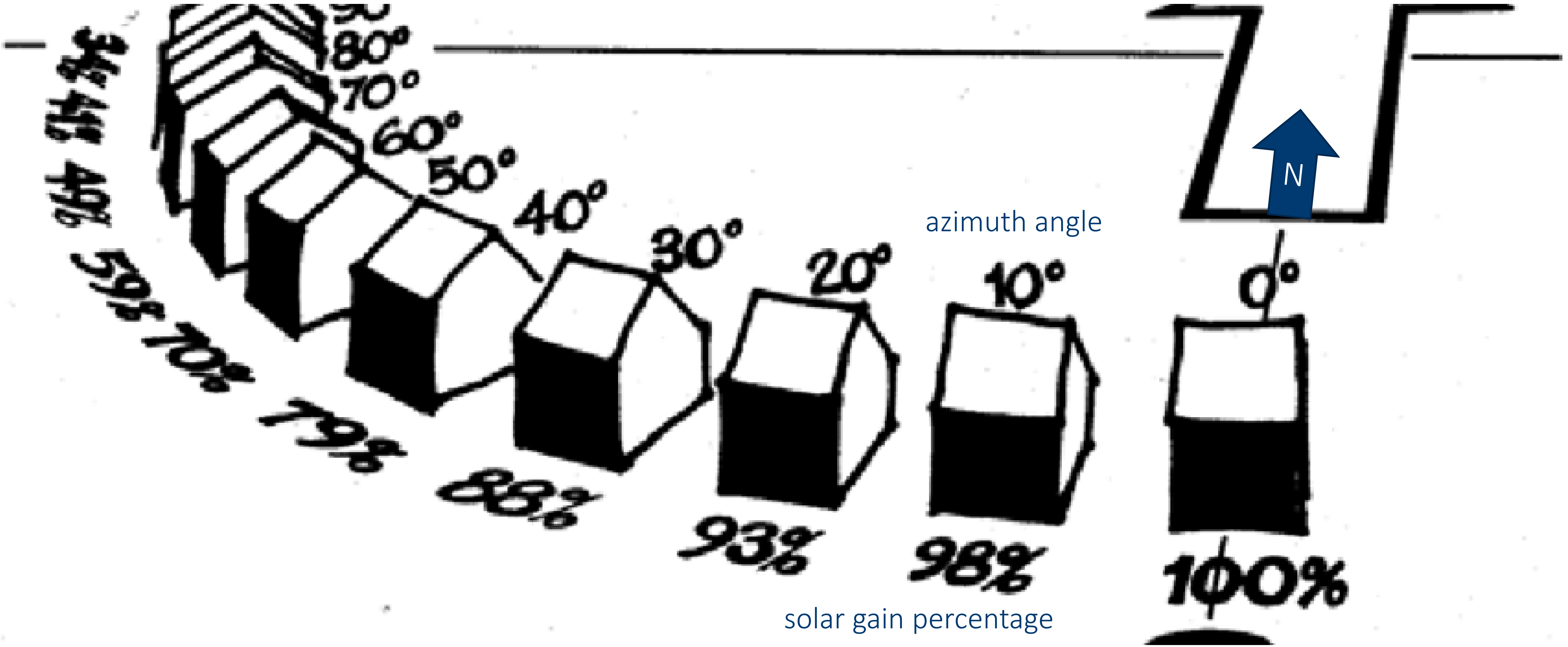
- Paris is expanding an **urban cooling system** which draws water from the Seine River.
- It **draws water from the Seine River for cooling power stations** that pump cooled water through underground pipes to buildings that use it instead of individual air conditioning units.
- The buildings pick up the **coolness of water** that we deliver and will use it **for air-conditioning**.
- Employees work on a the access stairs to an underground urban cooling network power station developed by Fraicheur de Paris, using water from the Seine river to generate air conditioning used by an increasing number of buildings and public spaces, in Paris, France, August 24, 2023.

No AirCon No Problem at Paris 2024

- "We **designed these buildings** so that they would be comfortable places to live in in the summer, in 2024 and later on, and we don't need air conditioning in these buildings because **we oriented the facades** so that they wouldn't get too much sun during the summer, and the facades, the **insulation is really efficient**," Yann Krysinski, who is in charge of the delivery of venues and infrastructure at Paris 2024, told Reuters.
- "We also are providing **naturally cool water** that we're getting from underground to cool the air of these apartments.
- So you will not need air conditioning in the summer here.“
- After the Games, some 6,000 people will live in the neighbourhood, which spans the suburban areas of Saint Ouen, Saint Denis and L'Ile Saint Denis.

Oriented Facades for Max Solar Gain



Insulation is Really Efficient

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For environmental reasons, the Olympic Village for the Paris 2024 Olympic Games has been designed without air conditioning. **Many federations have expressed concern. What about France?**

- We will occupy three buildings – one of which we will share – to house 450 people. Only one façade of these three buildings faces south.
- All are equipped with **cooling floors**, like a very large part of the village, and are surrounded **by balconies, which provide shade** underneath.
- The windows have **shutters**.
- Finally, we have **single-leaf openings**, not large bay windows.
- I was also impressed by the glass used: **Triple glazing**, very efficient - outer laminated glass with COOL-LITE XTREME 70/33 coating on the inside, 16 mm Super Spacer Triseal Premium Plus Black as a warm edge, and an 8 mm float glass.

Comparison of HVAC System Types

1. Heating and cooling split systems
- Heating and cooling split systems are known to be the most common types of HVAC systems. As the name would imply, the system is split between two main units, one for heating and one for cooling.

2. Hybrid split system
- The hybrid system of HVACs carries similar features to the split systems but they do have some basic differences. These systems are on the rise due to their ability to mitigate energy costs through their electric hybrid heating system, which differentiates them from the other types of HVAC systems.

3. Duct free (Mini-split)
- A duct-free or mini-split system comes with a huge upfront cost and a list of benefits for particular needs and applications. These types of HVAC units are individual units in each room, providing greater independent control.

4. Packaged heating and air conditioning system
- A packaged HVAC system contains everything including the compressor, condenser and evaporator in a single unit which is usually placed on the roof or near the foundation. It fulfills both the cooling and heating needs of a house.

HVAC Split System Air Conditioners

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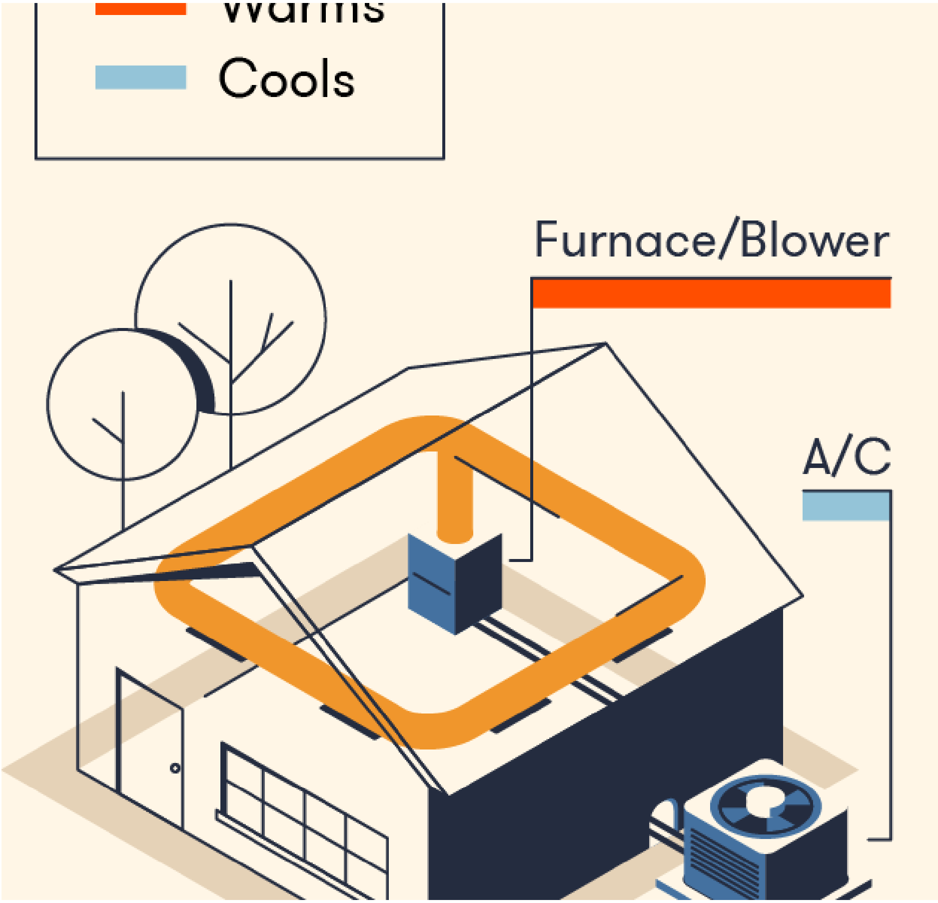
- It’s called a split system because the indoor and outdoor components are separated or split from each other and are connected by refrigerant piping and control wiring.
- The split system is made up of the Outdoor unit, often called the condensing unit, because this is where the refrigerant condenses from a gas back into a liquid, and an indoor unit where the evaporator is located.
- The indoor unit can be called an Air Handling Unit (AHU), Fan Coil or a Furnace with Coil.
- Split systems come in two basic configurations, either as cooling only or as a Heat Pump.

Key Feature: One thermostat controls temperature for entire unit



HVAC Split System Air Conditioners

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Advantages and Disadvantages of an HVAC Split System Air Conditioner

- One of the biggest benefits is that they come as a packaged unit, already engineered by the manufactured with matching outdoor and indoor units.
- Split systems are less invasive for re-modelling projects, allowing smaller refrigerant piping to be run to a space instead of larger air ducts. This is beneficial when the indoor space is several floors below the roof, as no vertical duct shafts are required as with a Rooftop unit.
- Split system outdoor units weight less than a one piece packaged unit.
- Split systems require smaller openings in the structure for refrigerant piping to pass from the outdoor unit to the indoor unit, as opposed to air ducts.
- Split System outdoor units are smaller than Rooftop Units, so they are easier to hide. This can be important when the building has large skylights or line of sight code compliance issues.

HVAC Hybrid Split System

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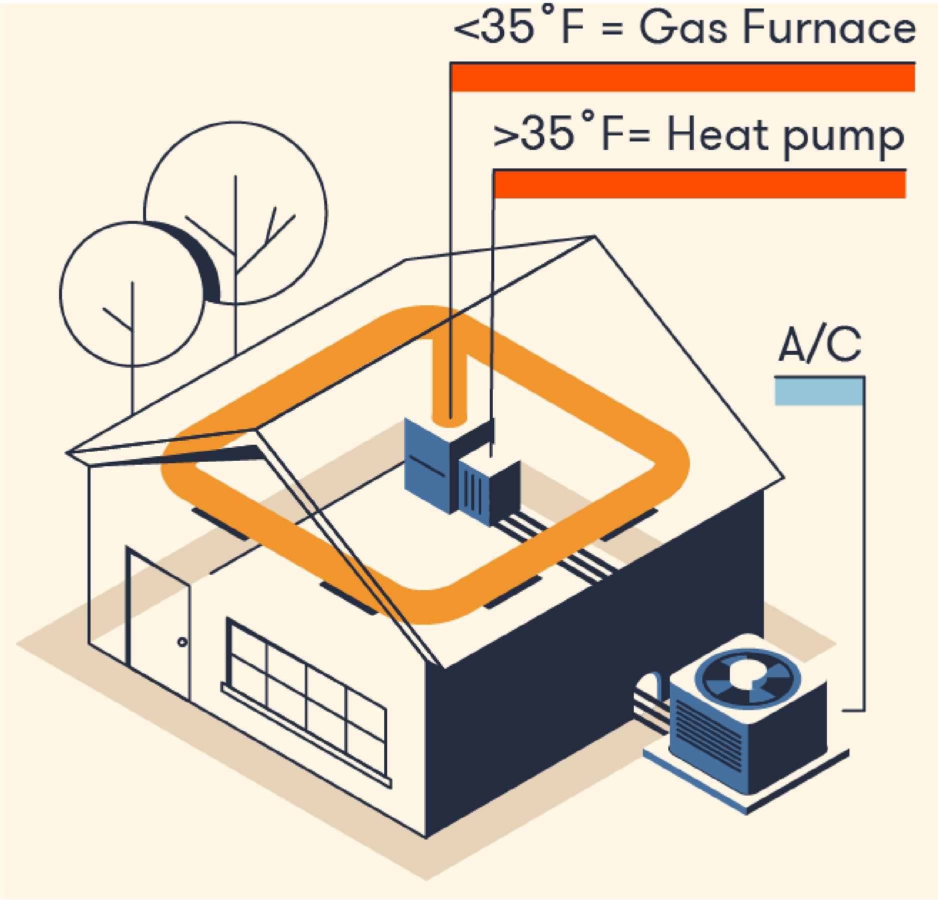
- The hybrid system of HVACs carries similar features to the split systems but they do have some basic differences.
- This particular HVAC system carries a hybrid heating system which is counted as one of its unique features that helps lowering energy costs.
- The capacity to switch between gas power, which is faster and more complete, to electricity which is more efficient and quieter, allows homeowners to determine the way they want to heat up their homes.
- This system is also dependent on traditional ducts and thermostats and it offers all the advantages of a split system with an additional benefit of conserving energy and reducing utility bills - **Key Feature:** Reduces energy consumption



HVAC Hybrid Split System

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Advantages and Disadvantages of an HVAC Hybrid Split System Air Conditioner

- These systems are on the rise due to their ability to mitigate energy costs through their electric hybrid heating system, which differentiates them from the other types of HVAC systems. The hybrid split system uses both a furnace and an electric heat pump.
- A heat pump is a much more efficient energy alternative than relying on electricity alone.
- It means that only during colder days you will use the gas for heating.
- The hybrid heat split system is the best choice for your home in warmer regions.
- Hybrid systems can be manually operated to control room temperature saving additional used energy.
- This system will help to cool and dehumidify your home efficiently..

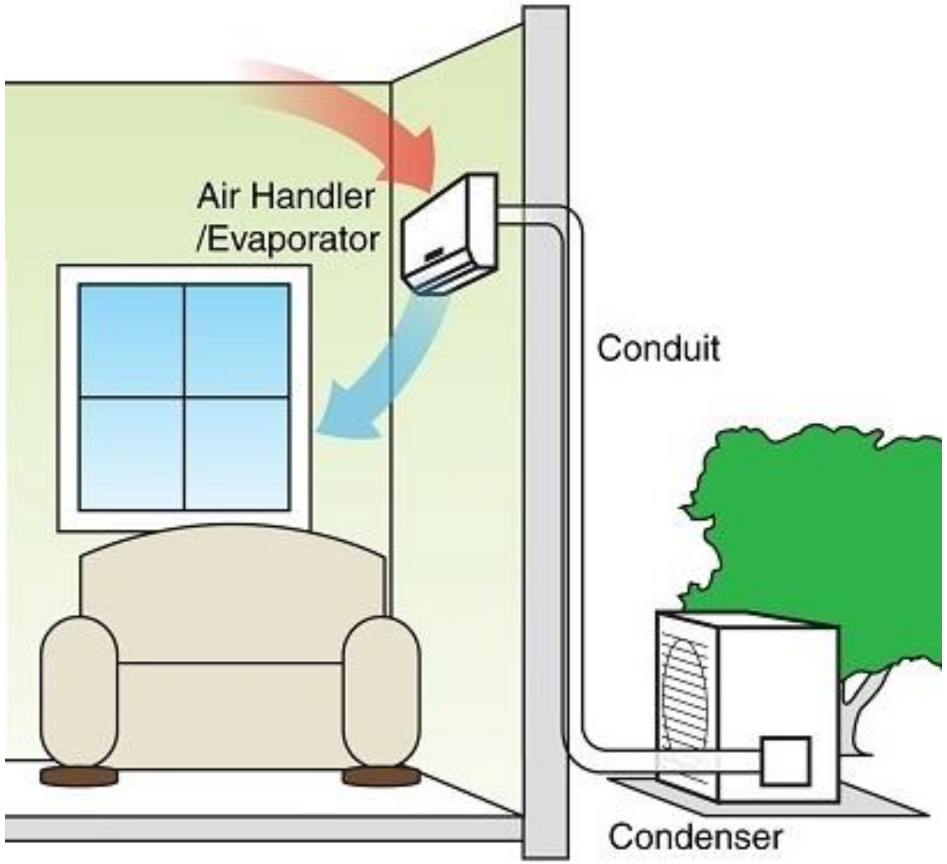
Duct Free or Ductless (Mini-split)

- The ductless or mini split air conditioning system consist of two units: a condenser that sits outside and an evaporator/air handler that sits inside.

- Coolant passes between the two units, carrying the heat from indoors to the outdoor unit where it is released.

- Some ductless systems aren't just an air conditioner, they are what's called a 'heat pump'. That means when it gets cold outside it can reverse direction and bring warm air in (as long as it doesn't drop below about -7° C).

- This can be helpful if you want to use your furnace less, as heat pumps are incredibly efficient. **Key Feature:** Provides ductless temperature control for individual spaces



Duct Free (Mini-split)

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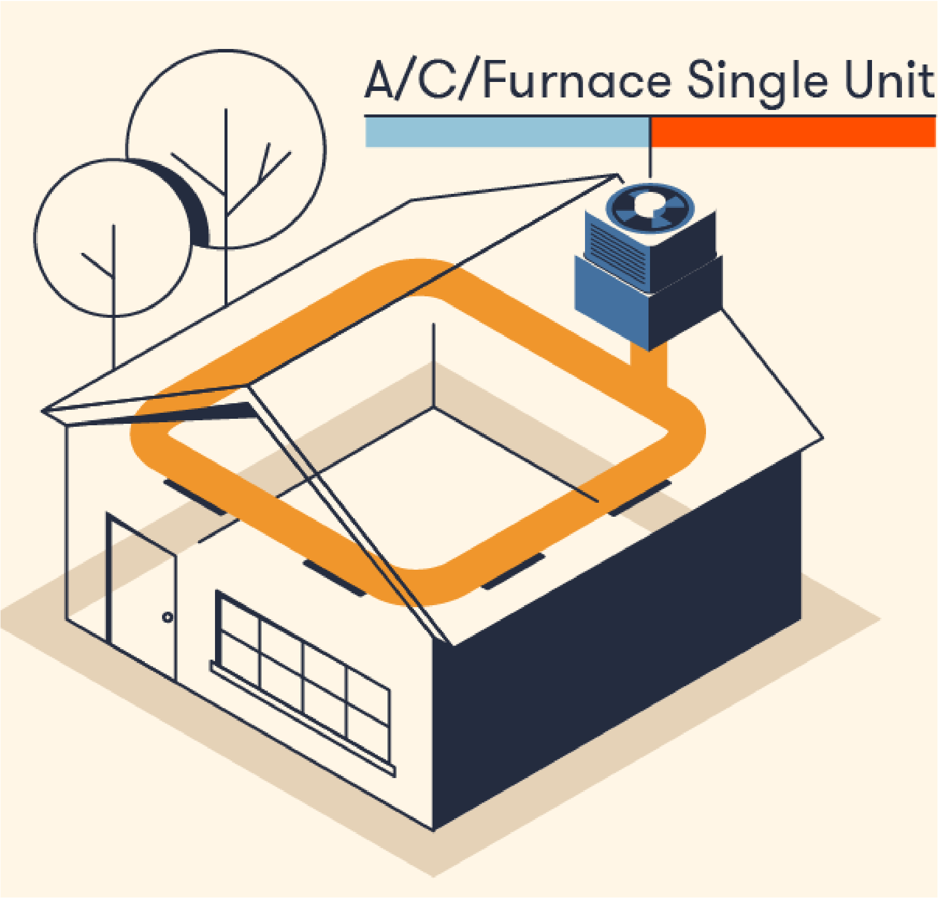
Advantages and Disadvantages of an Duct free (Mini-split) System Air Conditioner

- When you're indoors, a central AC is invisible. A ductless system, however, requires a vent in the ceiling or slim unit on the wall.
- A duct-free, or mini-split system is a unique system with large upfront costs, but big benefits for certain needs and applications.
- If you have no ductwork, it will cost much less to install a ductless system "from scratch".
- Most ductless systems just plain don't have enough power to cool a large home.
- As a general rule, ductless systems are quieter.
- These types of HVAC units are individual units in each room, providing greater independent control.

Packaged Heating & Aircon System

- A package HVAC unit combines multiple units, such as an air conditioner and heater, into a single unit.
- Split systems, on the other hand, divide each system into its own unit, so your heater and air conditioner are separate.
- They are generally used in warmer climates, since the heating system is not as powerful as other options.
- The unit is usually placed outside.
- The heat is generally electrically generated, but other forms can combine gas and electric abilities.
- **Key Feature:** Single unit is easy to maintain



Packaged Heating & Aircon System

Advantages and Disadvantages of a Packaged heating & Air Conditioner System

- A packaged system is not as energy efficient as a split-system.
-
- The components of a packaged system are all housed outdoors. As a result, they are more susceptible to the negative effects of the weather can develop rust sooner.
- It is generally easier to achieve a higher efficiency with a split system than with a packaged system.
- This is because split systems come with higher efficiency ratings than packaged units.
- However, without a well sized and operating duct system your overall heating and cooling system will be limited.

What is HVAC Load Calculation?

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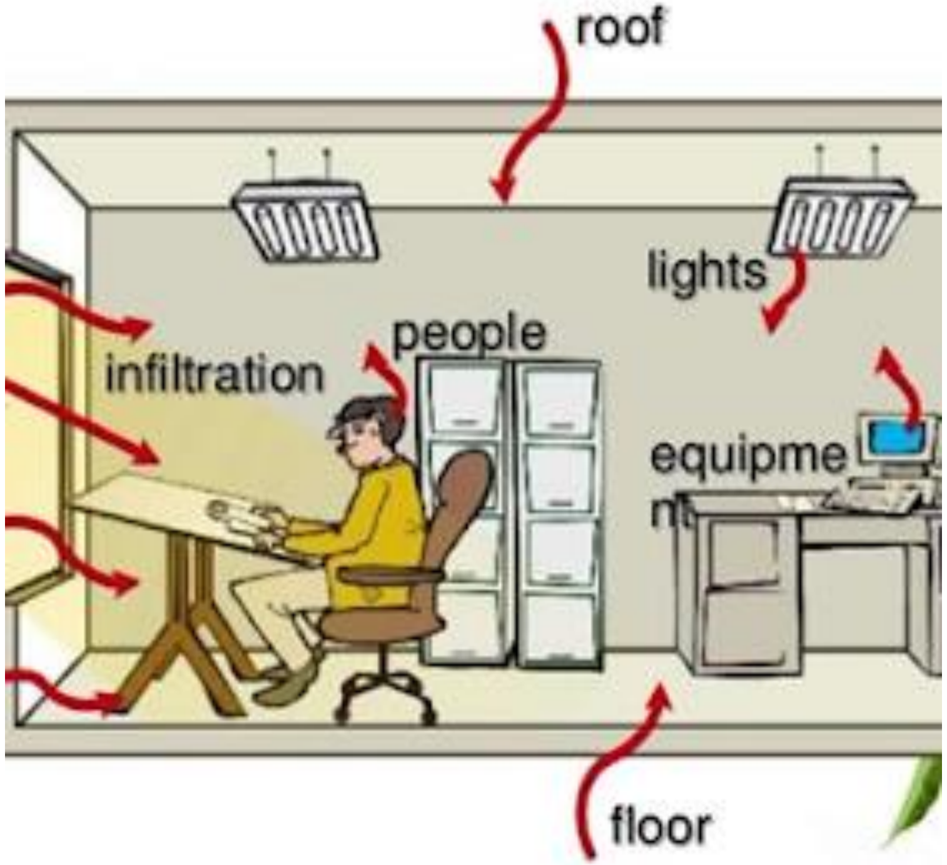
HVAC load calculation determines the heating and cooling needs of a building based on factors such as size, orientation, insulation, and occupancy. Other critical information includes:

- Amount of sunlight that enters the space
- The heat generated by appliances and electronics

- Accurately sizing an HVAC system is crucial to performance. An **undersized system** will need help to keep up with the heating and cooling demands of the building, leading to increased energy usage and costs.

- On the other hand, an **oversized system** will cycle on and off more frequently, leading to decreased energy efficiency and increased wear and tear.

- **Correct load calculation** can help contractors select a suitably sized HVAC system to meet the building's heating and cooling needs. As a result, it ensures optimal performance and energy efficiency.



What Is the Load?

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The **measure of energy** the HVAC system needs to add or remove from a space to provide the desired level of comfort.
– **Btu/**h
• Tonnage Not the size of the HVAC system- is not a measurement of your air conditioner's weight.
In HVAC terms, it's another way to describe your unit's cooling capacity
– First piece of information needed
– 12,000 Btu/h = 1 Ton Cooling
BTU is short for **B**ritish **T**hermal **U**nit
One ton of cooling (also called refrigeration) refers to the amount of heat needed to melt a pound of ice over 24 hours.

• Heating & Cooling Loads can be highly variable

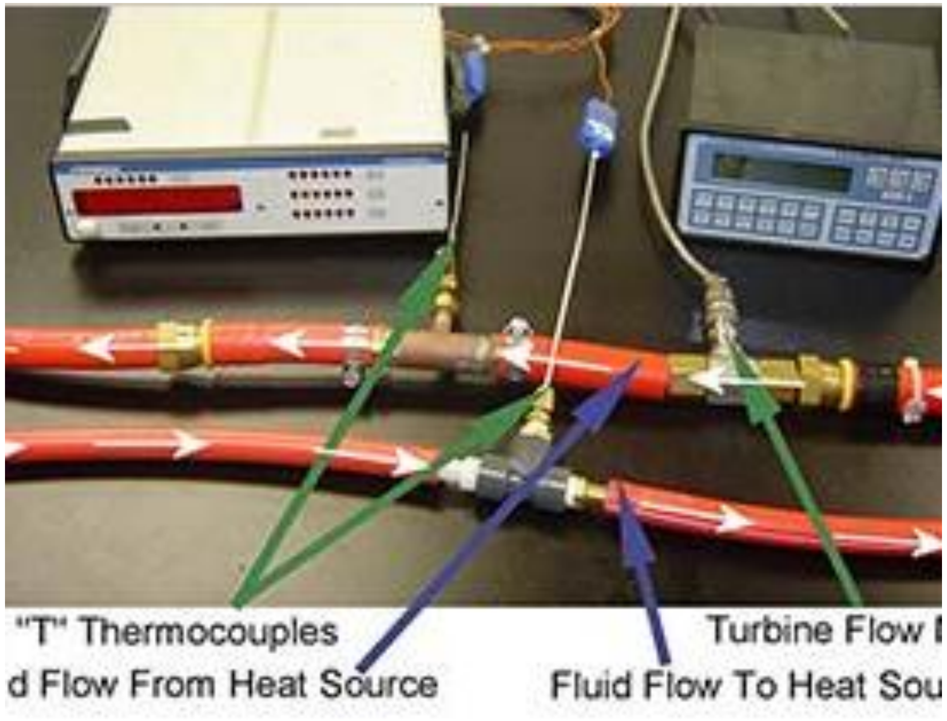
- Samsung AR3000 Air Conditioner 12000 BTU – White
- Aircon Installation Service 9000 To 18000 Btu

How to Measure your Heat Load

- A quick and dirty method of estimating heat load is to assume that all electrical energy entering a process is converted to heat.

- To determine heat load more accurately, use the heat transfer equation: $Q = m \times Cp \times \Delta T$ where:
  - Q = heat load (W [BTU/hr])
  - m = mass flow rate (kg/s [lb/hr])
  - Cp = specific heat (J/g-K [BTU/lb °F])
  - ΔT = change in temperature (°C [°F])

- To determine Q using the above heat transfer equation, you will need to obtain the values m and ΔT experimentally.



ure 1: Test Setup to Measure your Heat Loc

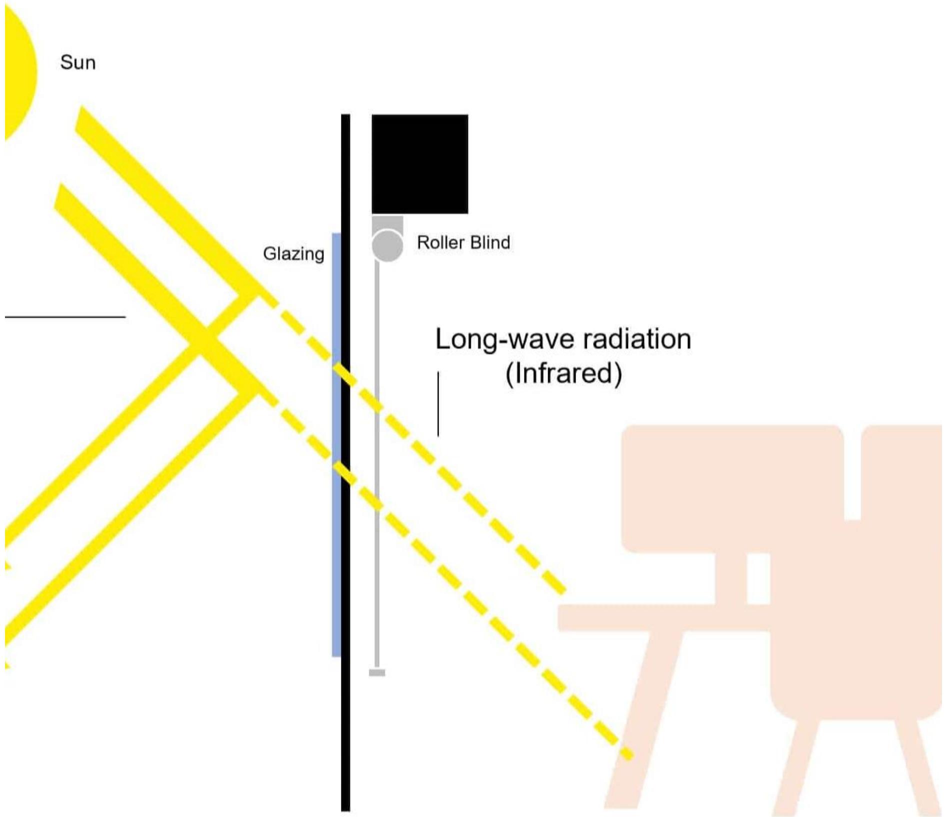
Heat Load or Heat Gain

- A building or room gains heat from many sources. Inside occupants, computers, copiers, machinery, and lighting all produce heat.

- Warm air from outside enters through open doors and windows, or as ‘leakage’ though the structure.

- However the biggest source of heat is solar radiation from the sun, beating down on the roof and walls, and pouring through the windows, heating internal surfaces.

- The sum of all these heat sources is know as the **heat gain** (or heat load) of the building, and is expressed either in **BTU** (British Thermal Units) or **kW** (kilowatts).



Quick Calculation for Offices

- For offices with average insulation and lighting, 2/3 occupants and 3/4 personal computers and a photocopier, the following calculations will suffice:

- Heat load (BTU) = Length (ft.) x Width (ft.) x Height (ft.) x 4
  Heat load (BTU) = Length (m) x Width (m) x Height (m) x 141

- Example, for a room measuring 5m x 4m x 3m = 60 x 141 = 8,460 BTU

- For every additional occupant add 500 BTU.
- So, if four extra occupants arrive, the heat load will be: 8,460 + (500 x 4) = 10,460 BTU.

- Heat load (and heat gain) can also be expressed in kilowatts (kW).
- To convert BTU to kW, 1 BTU = 0.00029307107 kW. from example above, 10,460 BTU = 3.065 kW.

A More Accurate Load Calculation

A more accurate heat load calculation for any type of room or building

- If there are any additional significant sources of heat, for instance floor to ceiling south facing windows, or equipment that produces lots of heat, the above method will underestimate the heat load. In which case the following method should be used instead

- The heat gain of a room or building depends on:
    - The size of the area being cooled
    - The size and position of windows, and whether they have shading
    - The number of occupants
    - Heat generated by equipment and machinery
    - Heat generated by lighting

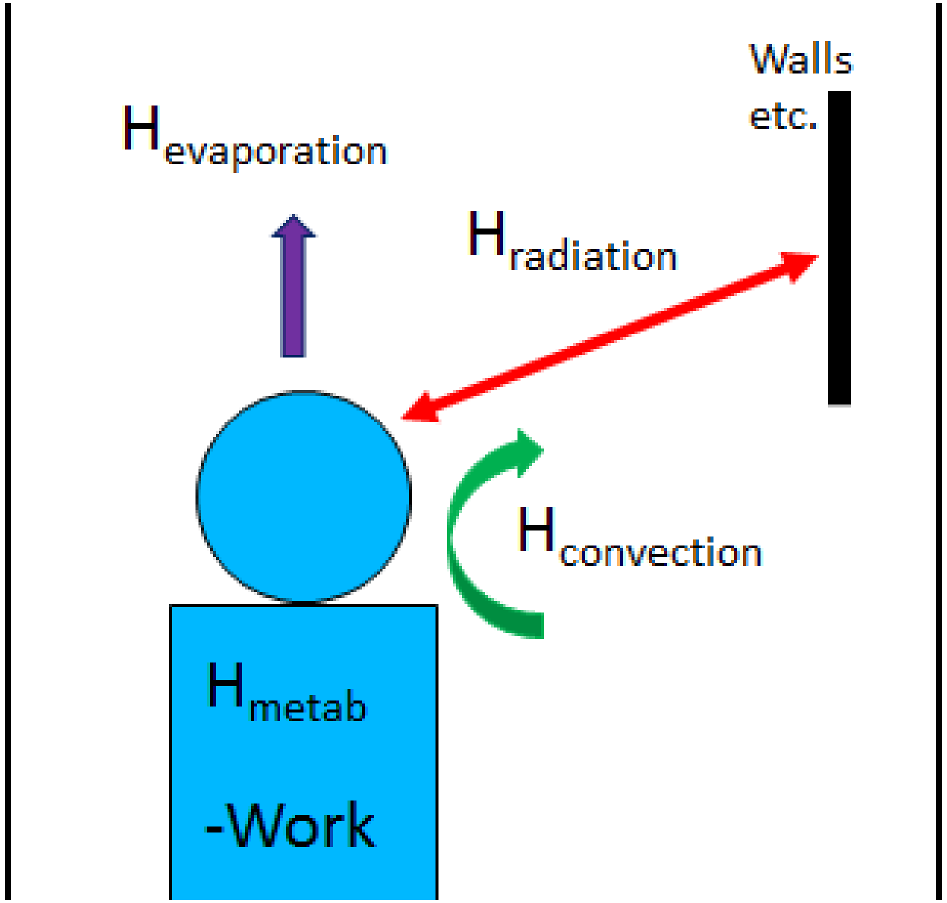
- By calculating the heat gain from each individual item and adding them together, an accurate heat load figure can be determined.

Comfort Conditions

The feeling of comfort people experience in an air-conditioned place depends upon the following five main factors:

- Supply of oxygen and removal of carbon-dioxide
- Removal of body heat dissipated by the occupants
- Removal of body moisture dissipated by the occupants
- To provide sufficient air movement and air distribution in occupied space
- To maintain the purity of air by removing odour and dust.

- Real comfort cannot be achieved unless the above-mentioned factors are properly controlled.
- Simultaneous control of all these factors is essential in order to produce a satisfactory environment for human comfort.



Heat Transfer from the Human Body

- The phenomenon of heat lost from the body can be represented by the equation;
- $H_{metabolism} – Work = H_{evaporation} \pm H_{convection} \pm H_{radiation} + H_{respiration} + H_{stored}$

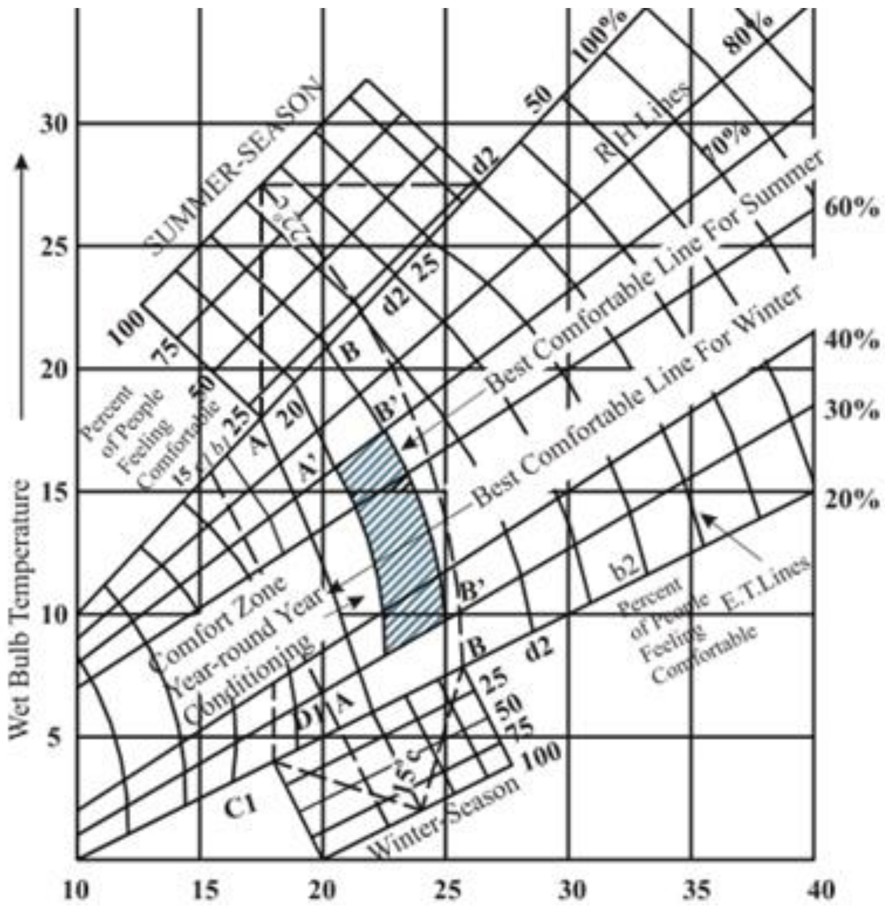
Where:

H_m is the metabolic heat produced by the body
W is the useful rate of working
$(H_m – W)$ is the heat to be dissipated from the body
H_e is the heat lost by evaporation
H_c is the heat lost or gained by convection
H_r is the heat lost or gained by radiation
H_s is the heat stored in the body

- The main purpose of comfort air-conditioning systems is to control the abovementioned factors of conditioned air in such a way that the sum of heat losses (Hc + Hr + He) must balance Hm (metabolic heat produced) thereby making Hs (stored heat) zero.
- The metabolic heat produced (Hm) depends upon the activity of the human being.
- The heat lost from the body by each mode depends on the atmospheric conditions.

Comfort and Comfort Chart

- In theory human comfort exists when the rate of heat production becomes equal to the rate of heat loss. This equilibrium condition is maintained when proper conditions of temperature, humidity, air velocity and purity are maintained in the air-conditioned space.
- The feeling of comfort experienced by an individual depends upon various factors such as; eating habits, type of clothing, duration of stay, age, sex, rate of activity etc.
- Since the feeling of comfort is controlled by a number of variables, there is no proper method to measure it.
- A proper control of dry bulb temperature and relative humidity can ensure reasonable closeness to a feeling of comfort.
- The American Society of Heating and Refrigeration Engineers (ASHRAE) have conducted exhaustive tests on various people subjected to wide variations of combinations of temperature, relative humidity and air motion.
- A **scientific method to measure comfort** feeling of human beings introduces the concept of '**Effective temperature**'.



Optimum Effective Temperature

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Factors Governing the Optimum Effective Temperature:

- The comfort chart shows roughly the percentage of people comfortable at various effective temperatures.
- In actual practice, conditions may vary depending on person-to-person, nation-to-nation, different food habits, climatic conditions and altitude.
- These factors are responsible for changing the optimum effective temperature.

Climatic and Seasonal Difference:

- People living in colder climatic conditions are comfortable at lower temperatures than people living in warmer regions.
- The comfort chart shows that optimum effective temperature in winter is 19°C and 22°C in summer.

Optimum Effective Temperature

Clothing:

- Clothing affects the effective temperature because the loss by convection and radiation depends on the body surface temperature. Light clothing requires less effective temperature compared with heavy clothing.
- Age and Gender:
- The metabolic rate of a women is less than that of a man; so a women requires greater effective temperature as compared to a man.

Air Velocity:

- Higher air velocities require less difference between outdoor effective temperature and inside effective temperature. The air velocity in the conditioned space should be low enough to avoid objectionable noise and draft. It should be high enough to carry (out) heat from human bodies.

Design Considerations

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Design conditions

- Outdoor and indoor air temperature, humidity, moisture content,
- Orientation of the building
- Dimensions of the space
- Construction materials
- Surrounding conditions
- Doors and windows
- Number of People
- Lighting loads
- Motors
- Appliances, business machines, electronic equipment
- Ventilation
- Continuous or intermittent operation

Heat Load Components

Internal Sensible and Latent Heat Load Components:

- Load components can be divided into two types:
- **Sensible Load** - results when heat entering the conditioned space that causes **dry bulb temperature** (DB) to increase.
- **Latent Load** - results when moisture entering the space causes the **humidity** to increase.
- A load component may be all sensible, all latent, or a combination of the two.
- The effective room total heat (Room Sensible Heat + Latent Heat) which determines the quantity and temperature-humidity condition of the supply air from Air Handling units.
- Grand Total heat (ERTH + the load due to fresh intake, chilled water system, pump’s hp etc.), which determines the capacity of the refrigeration plant. There are few terms and ratios which we often come across in heat load calculations.

Heat Load or Heat Gain

- **Step One:** Calculate the area in square feet of the space to be cooled, and multiply by 31.25
  Area BTU = length (ft.) x width (ft.) x 31.25

- **Step Two:** Calculate the heat gain through the windows. If the windows don't have shading multiply the result by 1.4
  North window BTU = Area of North facing windows (m. sq.) x 164
  If no shading, North window BTU = North window BTU x 1.4
  South window BTU = Area of South facing windows (m. sq.) x 868
  If no shading, South window BTU = South window BTU x 1.4 Add the results together.
  Total window BTU = North window + South window

- **Step Three:** Calculate the heat generated by occupants, allow 600 BTU per person.
  Occupant BTU = number of people x 600

Heat Load or Heat Gain

- **Step Four:** Calculate the heat generated by each item of machinery - copiers, computers, ovens etc. Find the power in watts for each item, add them together and multiply by 3.4
  Equipment BTU = total equipment watts x 3.4

- **Step Five:** Calculate the heat generated by lighting. Find the total wattage for all lighting & multiply by 4.25
  Lighting BTU = total lighting watts x 4.25

- **Step Six:** Add the above together to find the total heat load.
  Total heat load BTU = Area BTU + Total Window BTU + Occupant BTU + Equipment BTU + Lighting BTU

- **Step Seven:** Divide the heat load by the cooling capacity of the air conditioning unit in BTU, to determine how many air conditioners are needed.

- Number of a/c units required = Total heat load BTU / Cooling capacity BTU

HVAC Load: Manual J Calculation

- A proper HVAC design begins with an accurate load calculation. Performing a room-by-room loads analysis addresses the issue of room-to-room temperature differences and provides information that is critical to sizing your HVAC system. The HVAC load calculation process determines the amount of heating and cooling a house needs by analyzing the heat gain and heat loss for each room in a home.

- There are several different methods for performing an HVAC load calculation, but the most common and accurate method is the Manual J Load Calculation. The Manual J process takes into account a variety of factors such as the home's insulation values, window types and sizes, and the direction that the home faces.

- HVAC Load Calculator. Simple Manual J Calculation

- If you want to properly size an HVAC unit for a residential building, you should use the technique designed by the ACCA Association (Air Conditioning Contractors of America), the Manual J Residential Calculation..

Movement-Activated AirCon

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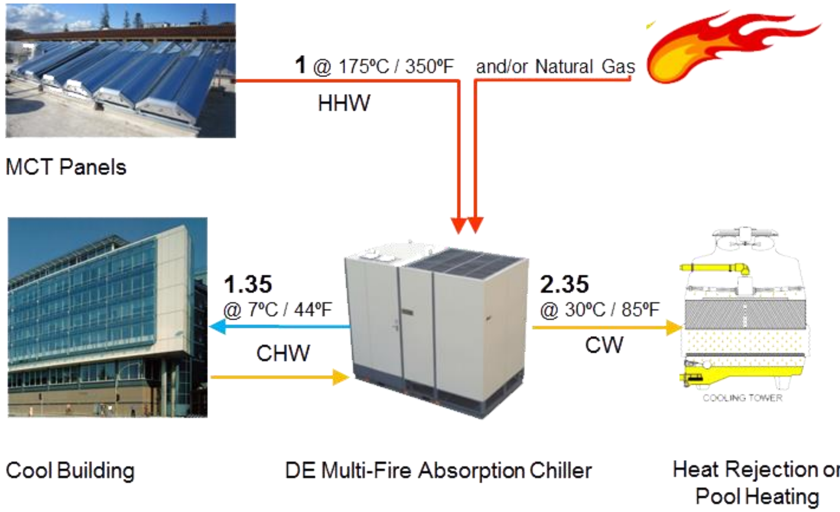
- Engineers at MIT have come up with a new air conditioning design that utilizes sensors along aluminium rods hung from the ceiling. Movement then activates these sensors. In other words, the air conditioner only kicks on when people are present.
- A motion-activated system seems like such a simple, ingenious idea that it’s almost baffling it hasn’t been tried before now. However, this kind of prototype is just one example of how future HVAC systems are going to be more compact and portable, helping to reduce both energy and utility costs.
- In the future, our air conditioners will look like giant clouds of mist — and they'll follow us around.
- When we last checked in with MIT's Senseable City Lab, they were debuting a prototype heater that targets the exact space where you're standing.
- Now, the lab has created a system that does the same thing—for cooling.
- Why waste the energy to heat or cool an entire building or room when you could micro-target the space of a human, instead? This week in Dubai, the Lab unveiled the inverse and opposite sister project to Local Warming. It's called Cloud Cast, and it's designed with desert climates in mind.

Thermally Driven Air Conditioning

- Another design that's recently been implemented is thermally driven air conditioning. An Australian company named Chromasun has produced a low-cost alternative to traditional A/C units. It isn't a widespread technology yet, and it will likely be several years before this kind of design becomes widely available in the United States.

- However, thermally driven air conditioning is a system that uses solar energy and is supplemented by natural gas, making it a highly efficient and effective system.

- In fact, the double-chiller design provides more cooling capabilities than any other system so far, and it eliminates electricity costs altogether.



On-Demand Hot Water Re-circulator

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- A U.S.-based company out of Rhode Island and other manufacturers offer “on command” pumps for a home’s water lines, which allows cool water to be circulated back into the water heater upon activation.
- This product was engineered to be a solution to a major problem to which all of us contribute: Each year, the average home wastes 12,000 gallons of water just waiting for that water to warm up.
- Recirculating this otherwise-wasted water back into the system is an eco-friendly solution that’s bound to play a huge part in future homes.
- TacoGenie ® delivers hot water to faucets and taps at your command, and can save the average family of four up to 12,000 gallons per year. The TacoGenie ® is a small, silent pump that attaches to the hot and cold water lines in the cabinet under the most remote kitchen or bath fixture in the home. When the TacoGenie ® is activated, the cool water you normally let run down the drain is recirculated back to the water heater through the cold water line. When the hot water arrives at the faucet, the TacoGenie heat sensor and control board shut off the pump to prevent pumping excess hot water into the cold water line.

Ice-Powered Air Conditioning

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- California-based company has created an ice-powered A/C system called the Ice Bear. The Ice Bear essentially works by freezing water in a tank overnight, so the ice can help cool a building the next day.

- So far, the design has been able to provide enough cooling for a building for up to six hours, after which, a conventional commercial air conditioner takes over.

- Although this type of technology has quite a way to go before it can be the sole cooling system for a home, six straight hours of cooling a commercial building is a solid step in the right direction.

Sensor-Enhanced Ventilation

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- An ingenious product unveiled in 2015 consists of sensor-driven vents that replace a home's existing ceiling, wall, or floor vents. The best part? A smartphone app can control the Ecovent, providing precise, room-by-room temperature control.

- Additionally, the system utilizes sensors to monitor a home's temperature, air pressure, and other indoor air quality factors. Even though this system design is new, it's been well tested and has already hit the market. Therefore, this is one piece of technology you can take advantage of today.

Dual-Fuel Heat Pumps

- Several U.S.-based companies offer products that rely on the dual-fuel heat pump concept. The argument is that heat pumps tend to be more efficient and provide the maximum amount of comfort when using a combination of fuel. In this case, the system is a combination of an electric heat pump and a gas furnace.

- At low temperatures, the pump draws on gas heat to maximize efficiency. When the temperature rises above 35 degrees, electricity takes over. The initial costs associated with a dual-fuel heat pump are more than a conventional system, but the amount of money you can potentially save over the next several years more than makes up for the costs.

Geothermal Heat Pumps

- Along those same lines, geothermal technology is a major investment that promises to save you much money over its lifetime. Geothermal heat pumps have been around since the 1940s, so they’re not exactly a new technology. Nevertheless, these products haven’t really caught on until recently.

- With more homeowners waking up to the importance of going green, geothermal heat pumps have grown in popularity. A geothermal heat pump gets its energy directly from the earth through an underground looped pipe that absorbs the heat and carries it into the home.

- When cooling is needed, the process occurs in reverse, with the pump removing warmth in the home. A major bonus of having a geothermal heat pump is the availability of free hot water. Therefore, if you’re considering having geothermal technology installed in your home, ask your technician about this valuable perk.
- Most closed-loop geothermal heat pumps circulate an antifreeze solution through a closed loop -- usually made of a high density plastic-type tubing -- that is buried in the ground or submerged in water. A heat exchanger transfers heat between the refrigerant in the heat pump and the antifreeze solution in the closed loop.

Smart & Fully Automated Homes

- Connected systems and phone apps now allow us to control our home's lighting, heating, cooling, security systems, surveillance, and entertainment at the push of a virtual button. It's a no-brainer that these "smart" technologies will continue to evolve and become integrated into our homes, allowing us to control a home's comfort levels down to the last detail.
- Since many of these innovations such as the Nest learning thermostat are already available on the market, this movement toward a smarter home has changed how HVAC engineers and designers approach the next big thing, which is good news for those of us who appreciate high-tech solutions.

Fully Automated Homes

- As if owning a smart home wasn't convenient enough, fully automated homes will soon become a reality.
- There are already technological solutions on the market that are allowing companies to experiment with automated appliances and other products.
- Therefore, it's only natural that HVAC systems will one day be directly tied into other systems in your home, making adjustments according to the status of the rest of the house.

Integration of smart technologies

- Smart Temperature Control:
- Advanced sensors and algorithms allow the device to automatically adjust based on indoor and outdoor temperatures to provide optimal comfort. This feature uses real-time data to optimize cooling performance.
- Remote operation and monitoring:
- Users can remotely control and monitor indoor temperature in real time through a smartphone application.
- Energy efficiency optimization:
- Smart devices can automatically adjust energy consumption by learning users' usage habits and environmental conditions to achieve energy saving and consumption reduction.
- Silent technology:
- Adopt efficient silent design to reduce operating noise and improve user experience.
- Integrated design:
- Intelligent refrigeration equipment is increasingly integrated with other home intelligent systems to realize the concept of smart home.
- Personalized settings: Users can set temperature, wind speed, etc. according to personal preferences to achieve a personalized comfortable experience.

3D Printed Air Conditioners

- It may seem a little far-fetched, but 3-D printing has advanced rapidly over the last few years, so expecting products like 3-D printed A/C systems could very well be a reality one day.
- In fact, a company called Emerging Objects has already created a 3-D printed "brick" that draws moisture out of an area to cool it.
- While this simple innovation can't be used in extreme temperatures, and we're still a far cry from 3-D printed air conditioners, it's just one example of the power of such a simple technology. We never know what tomorrow may bring.

Harnessing Heat From a Computer

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- If you own a laptop and have ever used it for several hours in one setting, you know how much heat it begins to generate. One innovator named Lawrence Orsini, founder of Project Exergy, has seen how efficient computers are at generating heat. This is why he’s theorized they can be used for powering heating systems.

- Harnessing heat from a product you already use every day is a smart idea. Why waste all that excess energy when you don’t have to?

- It’s fun to speculate about the future of HVAC technology, but only time will tell which systems will make the cut and catch on with most homeowners.

Key HVAC Industry Trends in 2024

- **Smart HVAC Systems**
- The Internet of Things is growing and allowing home appliances to communicate via smartphones.
- **Sustainable Building Design**
- Newly designed and constructed buildings are now being designed to be greener and focus on energy efficiency.
- **DeVAP HVAC**
- Billed as the 'Future of Air Conditioning,' DeVAP HVAC systems use an evaporative cooling system.
- **Solar HVAC Systems**
- Similar to heat pumps, solar HVAC systems draw energy from the sun to warm a fluid, which then heats the air.
- **Geothermal HVAC Systems**
- Geothermal HVAC systems use below-ground pipes (called an earth loop) to heat and cool a home or commercial building.

Related courses

This webinar/topic relates to our school of Mechanical Engineering and is particularly found in the following courses:

- Professional Certificate of Competency in Heating, Ventilation & Air-Conditioning
- 52884WA Advanced Diploma of Mechanical Engineering Technology
- Graduate Diploma of Engineering (Mechanical)
- Online – Bachelor of Science (Mechanical Engineering)
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