



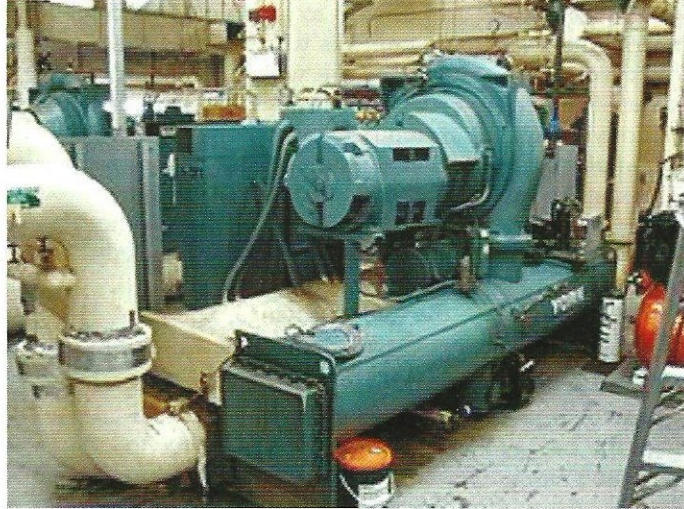
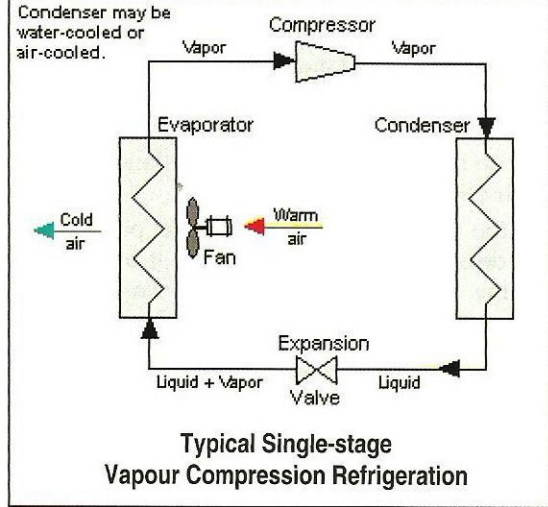
Green MEP Systems for Sustainable Design

The demand for environmentally responsible buildings is growing as owners and occupants realise it is not a cost, but a wise investment. They are designed using an integrated approach to energy efficiency, indoor air quality (IAQ) and sustainable materials leading to downsizing in MEP systems like HVAC, plumbing, transformers, cabling, lighting and backup power. These systems complemented with renewable energy systems lead to further optimisation.

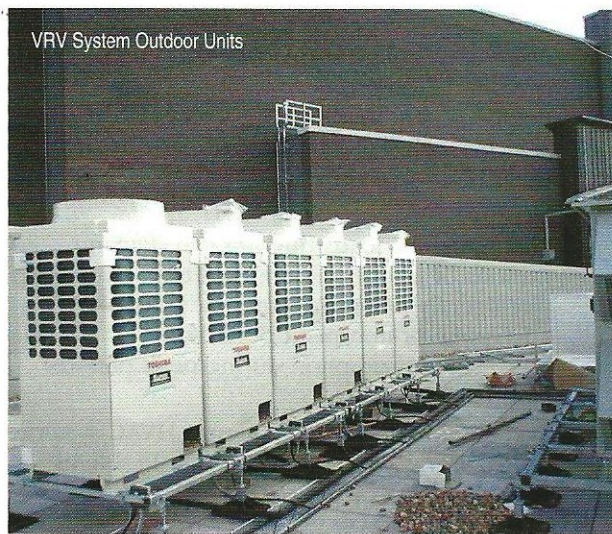
As part of energy efficient Green MEP systems, a few HVAC system design options are available today.

Conventional Systems

Vapour Compression Systems – VC systems is widely used in the industry based on VC Cycle. The four different types of compressors used in VC chillers are Screw, Reciprocating, Centrifugal and Scroll. VC chillers give a high coefficient of performance (COP) in the range of four and above. At the same time, they use expensive energy as compression is mostly electric motor driven.



Vapour compression cycle and central chiller plant



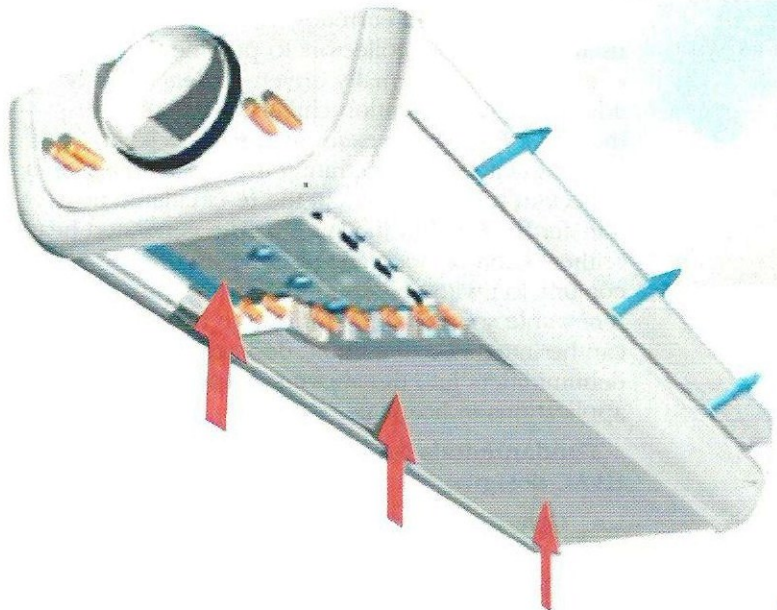
VRV System Outdoor Units

Thermal Energy Storage Systems – TES is the storage of ice/chilled water made during off peak hours when power is cheaper. This energy is used later when power is not available or is expensive. TES is required wherever dual tariffs/peak demand charges are applicable, when loads are cyclic in nature and of shorter duration like multiplexes and where uninterrupted requirement of space cooling in critical applications like hospitals, ICUs is important.

Alternative Systems

Radiant Cooling System – This refers to a temperature controlled surface that cools indoor temperatures by removing sensible heat and where more than half of heat transfer occurs through thermal radiation. Heat will flow from

Active Chilled Beams



Variable Refrigerant Volume VRV/VRF Systems – A VRV system provides considerable savings on energy, costs, and space requirements and is environment friendly. R410A refrigerant has low ozone depletion potential (ODP) and global warming potential (GWP). The VRV's innovative inverter technology ensures variable load applications. This adapts the speed of the variable-speed compressor to the varying thermal loads in a building. The pulse modulating valve (PMV) in each unit controls the exact amount of refrigerant to be injected into each indoor unit.

Conventional Hybrid Systems

Vapour Compression + VRV Systems – A hybrid air-conditioning application can be designed using both the systems which combines the advantages of both the systems and limits their disadvantages as well. The trend of using such hybrid systems is fast catching up in malls, multiplexes, hotels and hospitals.

space, occupants and objects to a cooled surface as long as their temperature is warmer than that of cooled surface and they are within the line of sight of the cooled surface. Through the process of convection, the air temperature will be lowered when air comes in contact with the cooled surface. The systems are usually hydronic using circulating water running in pipes in thermal contact with the surface. Typically, the circulating water only needs to be 2-4°C below the desired indoor air temperature, hence the energy savings. The two primary types are the Thermally Activated Building Systems and Active Chilled Beams.

Geothermal Cooling Systems – Geothermal uses the energy trapped in the earth’s surface to assist the air-conditioning process. The ground source heat pump - GSHP - pumps heat to the ground and uses the earth as a heat sink. The design takes advantage of the moderate temperatures in the ground to boost efficiency and reduce operational costs of cooling systems. The four main components of such a system are:

- An open or closed loop field on the property to transfer heat to and from the ground through HDPE pipes
- A liquid pump to send water through the loop field and heat pump
- A Geothermal Heat Pump – to capture heat at one temperature reservoir and transfer to it another
- Distribution System – standard air-conditioning ducting to distribute the cool air

Renewable Energy Assisted Hybrid Systems

Solar assisted vapour absorption and liquid desiccant systems are among the options which have been installed currently. Active solar cooling uses solar thermal collectors to provide thermal energy to drive thermally driven chillers (usually adsorption or absorption chillers). The solar thermal collector, for example, provides solar thermal heat by concentrating the sun’s energy on a collection tube and heating the re-circulated heat transfer fluid within the system. The generated heat (either steam or hot water) is then used in conjunction with absorption chillers to provide a renewable source of cooling. Some hybrid systems can be integrated like liquid desiccant systems and dehumidifiers into the above system for specialized applications in hospitals.

Fundamentals for energy efficient Green HVAC designs:

- Consider all aspects of the building simultaneously in designing heat loads: For example, the evaluation of a building envelope design must consider its effect on

cooling loads and daylighting. An energy-efficient building envelope, coupled with a state-of-the-art lighting system and efficient, properly-sized HVAC equipment will cost less to purchase and operate than a building whose systems are selected in isolation from each other.

- Decide on design goals as early as possible in the design process: A building that only meets energy code requirements will often have a different HVAC system than one that uses 40% less energy than the code. And the difference is likely to be not only component size, but also basic system type.
- Right size HVAC systems: Safety factors for HVAC systems allow for uncertainties in the final design, construction and use of the building, but should be used reasonably. Greatly oversized equipment operates less efficiently and costs more than properly-sized equipment.
- Consider part-load performance when selecting equipment-Part-load performance of equipment is a critical consideration for HVAC sizing.
- Shift electrical loads during peak demand periods: If utilities offer a dual tariff structure, intelligently select the equipment to take advantage of non peak periods so that electrical consumption during peak periods can be controlled.
- Commission the HVAC Systems: HVAC systems do not always work as expected. Problems can be caused by the design or because equipment and controls are improperly connected or installed. A part of commissioning involves testing the systems under all aspects of operation, revealing and correcting problems, and ensuring that everything works as intended. An enhanced commissioning programme will also ensure that O&M personnel are properly trained in the functioning of all systems.
- Operations & Maintenance programme: Proper performance and energy-efficient operation of HVAC systems can only be ensured through a successful O&M programme. The building design team should provide systems that will perform effectively at the level of maintenance that the owner is able to provide. In turn, the owner must understand that different components of the HVAC system will require different degrees of maintenance to perform properly.

Rakesh Bhatia, Vice President (MEP Services)
Ecofirst Services Private Limited