



## How do the above figures translate in real life?

### **Residential applications (Window ACs & Non-ducted Splits):**

Rotary compressors are more energy-efficient. Rotary compressors are now used widely in our country for window and mini split airconditioners.

We recommend rotary air conditioners as a good energy saving option for this segment.

### **Light commercial applications (small to medium offices, showrooms, restaurants):**

Scroll compressor-driven ducted splits and packaged airconditioners are the clear choice. Scrolls are extremely energy-efficient by design. They are a quantum leap in technology.

In addition, they are far quieter and more reliable.

### **Heavy Commercial applications (large offices, commercial complexes):**

If water is available, scroll compressor-driven Packaged ACs or screw chillers clearly score.

If water is not available, and air-cooled equipment is to be chosen, scroll compressor-driven Packaged ACs are the best choice.





Large systems (hotels, hospitals, airports, industrial applications):

Water-cooled centrifugal or screw chillers are the best choice.

### Do electronic controls and electronic thermostats help in efficient operation, or are they just gimmicks?

Electronic controls are more reliable and long-lasting than conventional knobs and switches. Secondly, electronic controls tend to be more accurate in their settings, thus making your airconditioner more efficient.

Similarly, electronic thermostat is far more precise than a conventional thermostat. Hence cut-out and cut-in of the compressor occurs more precisely, thus increasing comfort levels while saving power at the same time, since your airconditioner consumes power only as long as necessary.

So, while electronic controls and thermostats may marginally increase the cost of your airconditioner, the expense is well worth it in the long run.

### How can I further increase power savings in a Central Plant?

A Central Plant is a complete airconditioning system, custom-made to suit your need. A detailed study of various

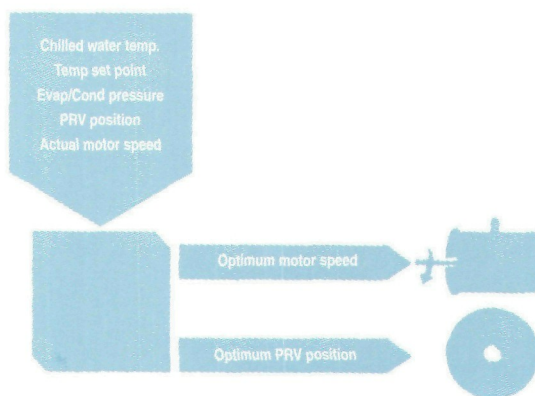


components and possibilities in a Central Plant is beyond the scope of this booklet. However, the following pages discuss some innovations — Variable Speed Drives, Open Drives, Sub-cooling and Compressor Head Reduction — which bring about major power savings to Central Plant users.

## Variable Speed Drives

One of the major advances in airconditioning technology that has contributed significantly to energy savings is the development of Variable Speed Drives for compressors.

A VSD converts standard 3-phase AC power input at 415V, 50Hz into an adjusted voltage and frequency output that controls the speed of an AC motor.

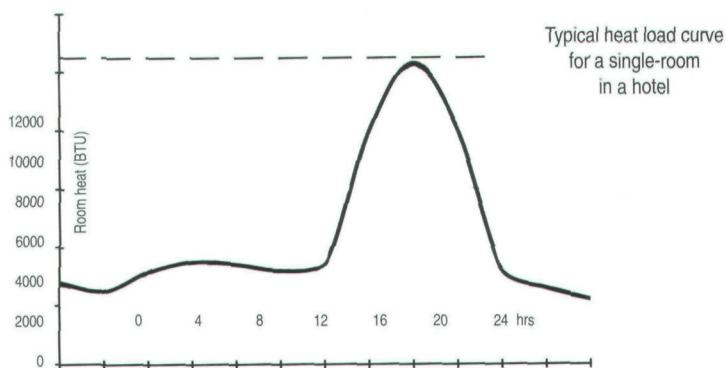


Airconditioning systems are generally designed to operate efficiently only at *peak-load* conditions. In practice, however, most systems actually operate at *part-load* conditions for a major part of their operating lives.





A centrifugal chiller in Delhi, for example, could spend upto 90% of its life in part-load conditions, working at peak-load conditions only for 10% of the time!



Under such practical conditions, machines with constant speed drives result in unnecessary exertion on the part of the compressor drive, and wasted energy. This is particularly true in the case of Central Plants.

Keeping this factor in mind, international standards now rate Chillers not just by their PLV (Peak Load Values) but, more importantly, by their IPLV (Integrated Part Load Values). The IPLV takes into consideration the efficiencies of the Chiller in part-load and off-load conditions as well, thus representing the efficiency of the Chiller more accurately.

**It is very important therefore that more attention is paid to part-load design of the system. The IPLV ratings are important indicators of overall efficiency of a Chiller.**

Variable Speed Drives (VSDs) were designed to ensure improvements in efficiency while operating under part-load conditions. With the use of VSDs, chiller power consumption can drop to such dramatic lows as 0.3kw/ton!



The classic way to explain a VSD is to relate fan laws to the centrifugal compressor :

- RPM      ~      CFM
- RPM<sup>2</sup>    ~      STATIC HEAD
- RPM<sup>3</sup>    ~      HP

Therefore, every single unit drop in RPM of the compressor reduces the HP of the motor by the cube root.

Based on tests conducted in the field, the savings are dramatic with centrifugal compressors (see table below).

Load	Power input
100%	100%
75%	42%
25%	15%

As you can see, at part load of 25%, a VSD helps drop power consumption to 15%.

The VSD needs a lot of input data to function effectively. Several operating conditions, such as chilled water temperature, set-point, refrigerant pressures, pre-rotation vane position and actual motor speed are constantly fed into the VSD. Microprocessors then work out the most efficient parameters of operation, and optimise the motor speed and vane position, thus saving power.

Effective utilisation of a VSD can result in huge savings in power, thus paying back for the investment on the VSD very quickly indeed. However, due to the precision



electronics involved, only a few manufacturers are able to put VSD technology to effective use.

	Investment cost per ton	Savings per annum per ton
VSD	Rs.5000 app.	Rs.1200 app.

Variable Speed Drives can also be retrofitted into constant speed centrifugal chillers. Savings in energy can pay back the investment very fast, sometimes as fast as 1 to 3 years.

A VSD retrofit also gives you the following additional advantages:

- ☛ It makes your chiller quieter!
- ☛ It lowers in-rush current and provides a smoother start.
- ☛ It protects against power surges.
- ☛ It provides a microcomputer-controlled Control Panel.

One of the outstanding features of this starter is that the starting current of the centrifugal compressor never exceeds full load current, unlike other types of starters where starting current would typically be 2 to 6 times the full load current.

This greatly reduces cable sizes and also in transformer / DG set sizing, resulting in initial cost savings.