

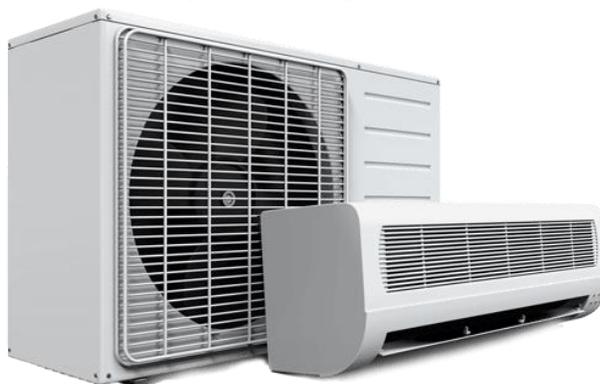


Energy Efficient Appliances

By Dr.Ramaratnam
Basil Energetics, Chennai



In the last blog, the advantages of replacing the existing single phase motors with PMSM (Permanent Magnet Synchronous Motors) was described. The techniques of energy efficient motor along with variable speed operation give rise to enormous energy savings in regular appliances like Room Air Conditioners, Refrigerators, Fans, Pumps, etc. The air conditioning load is the major energy guzzler mainly in the urban households. Compared to other appliances, the air con is both energy intensive and runs for long periods. This is true for homes, commercial establishments, offices (government & private) and industries. Apart from comfort cooling, the air con is used for cold storage applications also, when the room temperature is to be around $15 \sim 25^{\circ}$ C. This kind of cold storage is needed in food processing industry and storage of special materials. In chemical industries, materials like Chemicals, resins, etc., have to be stored at specific temperatures to ensure long shelf life.



Similarly refrigeration, which refers to near zero and sub-zero temperatures are required for storage of materials in food processing, industrial and healthcare segments. Milk chillers, Freezer Chest for Vaccines, storage of fish & meat, bottle cooling vending machines, ice cream storage freezers, etc., are examples of low temperature storage requirements. With organised retailing picking up along with establishment of cold storage chains, the commercial refrigeration segment is poised for a big leap and in all such equipments, energy plays a vital part. This is apart from the usual home refrigerator market which is already established and growing at a fast clip. It is also to be remembered that these equipments are to be operational on a 24 x 7 basis continuously.

For lower income groups who cannot afford air conditioners and a few offices, commercial establishments, schools, colleges and public places, Ceiling Fan is the main source of comfort cooling. The production of such simple equipments is around 3 Crore units per annum in India. The Air Con and Ceiling Fan are also long running appliances. It is not uncommon to see that these appliances run for 8 ~ 16 hours per day with little stops in between in both homes and commercial places.

Another major power guzzler is the ubiquitous water lifting pump, which are deployed in agriculture in a big way. Pumps are required for extraction of water, moving it from one place to another through pipes and for water purification purposes. These also operate for long hours and the Reverse Osmosis plants operate often on a continuous basis.

Enormous energy savings can be realised by making these appliances much more efficient. The country, along with the world, is seized of such proactive methods for power and energy savings. The demand side management of energy, i.e., deployment of energy efficient appliances, could be a big leap in the power infrastructure management. India needs to be much more proactive in this strategy to reduce the power & energy consumption. Particularly for a country like India which are constrained by resources, both monetary and fossil fuels such a strategy to manage the demand side better will yield quick and enormous benefits. Deployment of renewable energy would make much better sense if it in tandem with such demands side management techniques. This is true for the

country as a whole and efforts have commenced with the central power ministry establishing BEE (Bureau of Energy Efficiency) specifically to address the issues. But it should also be said here that more aggressive goals have to be set, particularly in view of the heavy commitments that India have agreed to by signing the COP21 agreement held in Paris earlier this year. India has committed to reducing the pollution in a large way in this treaty, along with China and USA, the three major polluting nations of the world.

Room Air Conditioners:

BEE has introduced star ratings for these appliances and consumers should increasingly pay attention to this. An air conditioner with a 5 star rating may be more expensive initially but the operational costs (the power bill) will come down drastically. Rather than looking at the first cost of purchase, the public should look at the life cycle costs of the appliances. Besides benefitting their own pockets, this habit would eventually help the country in reducing pollution levels in a big way.

The 1.5 Ton Split type air conditioner, perhaps the fastest moving model, used to consume about 2 kWh (Units) of energy per hour of operation. A BEE 5 Star rated model would bring this down to 1.2 units per hour. These figures are for the appliances with AC Single Phase motors. The recently introduced 'Inverter Air Conditioner', which is actually with a variable speed motor for the compressor (BLDC type motor brings this figure to 0.7 ~ 0.8). The lower number is achieved by some of the leading brands and companies. Thus one can see that compared to the past about 60 ~ 65% savings in energy can easily be realised by such calculated purchases. In fact our own Indian company has achieved even better results, with the energy consumption figure coming down to 0.35 units per hour. India consumes about 4 million units of room air conditioners annually and one can calculate the energy savings potential from this alone, if BEE insists and adopts even more aggressive standards.

Home Refrigerators:



Like air conditioners, the refrigerators can also be fixed with variable speed permanent magnet DC (BLDC) motors to obtain huge savings in energy. The popular domestic models are 170 & 300 Litre capacity models. From the present power rating of about 150 ~ 180 W for such units, the deployment of BLDC motors can bring down the figures to 30 ~ 45 W respectively for the two models. India consumes about 12 million refrigerators per year and the savings potential is again huge for this appliance. And due to the fact that the refrigerator is a practically a continuous running appliances, the energy savings will amount to substantial numbers. Extending the technology to commercial refrigeration segment, which is rapidly growing, tremendous energy reduction, is possible.

Establishment of cold storage chain across the country and deployment of such energy efficient technologies would be helpful for the country. It will also result in a drastic reduction of waste from 'Farm to Dining Table' in the food processing chain. It is said that about 30% wastage of food articles occur in the supply chain of the food industry, with neither the producer (the poor farmer) nor the consumer getting the benefit!

Ceiling Fans:

India is the world leader in production and consumption of fans, particularly ceiling fans. This appliance is simple and is produced in clusters like Hyderabad, Agra, Faridabad, Kolkata, etc., provides a simple and cost effective way of achieving cooling comfort for millions of middle, lower

middle and poor people. The most popular size is 48” (1200 mm) Sweep model and this alone accounts for about 30 Million units per annum. The cheaper price models freely available in the market consumes about 75 - 80 Watts power. The BEE 5 Star rated model is mandated to consume about 55 Watts power. Discussions are on to introduce a super efficient model at around 35 Watts. Some companies have in fact introduce such a model in the market at a higher price. A company in Chennai has gone even further and has introduced a 48” ceiling fan at only 20 Watt.

Summarising the above three appliances alone, the present and projected energy savings are given in the following table.

It is easily seen that the new Super Efficient appliances with PMSM motor and sophisticated electronic controls achieves magical figures in terms of energy savings. Appliances with roof top systems (PV modules) would bring down the power rating and the rooftop area of such renewable energy systems

Item	Existing 5 Star	New Super Efficient
1.5 Ton AC	1650 W	350 W
Refrigerator	150 W	40 W
Ceiling Fan	55 W	20 W

Possible Energy Savings:

The following table presents a tabulation of the consolidated effects of total deployment of such super efficient appliances. One may say that this is theoretical but such a thing is possible with focused and concentrated efforts of the authorities in both central and state governments.

Possible Power Savings

Appliance	Annual Consumption	Existing 5 Star	New Super Efficient	Total Saving in MW
Air conditioner	4000000	1650	350	5200
Refrigerator	12000000	150	40	1320
Ceiling Fan	30000000	55	20	1050
Total Savings				7570

The comparison is with the BEE 5 Star models and considering the fact that there are a large percentage of lower star rated models being sold in the country, the savings potential could be even higher. In particular for ‘Green Rameswaram’ mission, this approach is essential to make the island totally green in terms of energy. The deployment of solar energy would only make a meaningful impact once this is done.
