

PMSM - Environment Friendly and Reduction in Running Cost

- Anoop R. Menon (Techno Industries)

INTRODUCTION

Globally we have seen a shift towards environment friendly technologies, most of these new technologies struggle to gain acceptance in the market due to their high initial and running costs. However, PMSM technology is one of the few emerging technologies that has gained fast acceptance due to its cost saving & ecofriendly features

PMSM – Efficient, Quieter, Convenient & Reliable

In our routine lives we come across various applications of PMSM technology. This technology is used in wide range of applications ranging from a household fan to metro trains.

The major difference between Induction Motor and PM motor is in its rotor design. The rotor in PM motor consists of strong permanent magnets, these magnets create magnetic fields which aligns with the magnetic field of the stator, and thus creates torque on the motor shaft. The generated torque is directly proportional to the strength of the magnets in the rotor. The magnets in the rotor follows the magnetic field of the stator and thus results in synchronous operation.

In comparison with the induction motor this technology is more efficient because there is no slip losses. This is possible because there is no actual current flow in the rotor. For the operation of PM motor an inverter /controller is a must, the function of the controller is to match the revolving magnetic field with the rotor position.

Characteristics of PMSM

Efficient - Efficiency is 10%-15% higher to the induction motor. (Reduction in CO emission & Power Saving)

Convenient – 1/5th of the maintenance procedure required in comparison to induction.

Quieter – Low noise and no heat generation (No sparks – Can be installed in explosive environments)

Reliable – Eliminated the “3D Maintenance” (Dirty, Demanding & Dangerous). Therefore preferred in critical and precise applications.

Additional characteristics include **Compact size, less weight and high torque.**

Surface Mounted Permanent Magnet Motor & Interior Permanent

Magnet Motor–

In Surface mounted permanent magnet motors magnets are fixed on the rotor surface and if the magnets are fixed inside the rotor it becomes Interior permanent magnet motor.

Surface mounted permanent magnet motors are used in low speed applications like gearless motors in elevators, whereas Interior permanent magnet motors are used in High speed applications across various industries.

	SPM	IPM
RPM	90 to 375	500 to 3000
No. of Poles	16- 66	2-12

Techno Make IPM motor efficiency

Techno IPM motor is designed to meet the highest efficiency level that is approximately higher to *IE4 Super premium efficiency (IEC60034-30-1)*. Techno 18.5 kw-1000 rpm IPM motor tested in Electrical Research and Development Association (ERDA) Vadodara resulted in an efficiency of **95.12%**.

Currently we exceed both IE 4 and proposed IE5 efficiency criteria.

To quantify our efficiency claims, if we pit PMSM motor of 18.5 KW/1000 RPM against Induction Motor of same configuration in a month we can **save up to Rs. 72000/-per year per machine**(Total Operational Hours -24, Days -26, Electricity unit rate as per GEB standards) and will get the **money back in 10 Months**.

For a detailed Comparison please look at the chart below-

Comparison of (37 Kw/ 950 RPM) PMSM Motor v/s Standard efficiency (IE1) Induction Motor	
KW	37
Efficiency of PMSM Motor	96%
Unit Consumption of PMSM (KWH)	38.54
Standard IE1 Efficiency (Induction Motor)	90.80%
Unit Consumption of Standard IE1 Efficiency (Induction Motor) -(KWH)	40.75
Unit Saving of PMSM in a Month (KWH) – (24 Hours *26 Days)	1377
Saving unit Charge/Month(Rs.4.35/KWH)In Rs.	5991/-
Demand in KVA Saving of PMSM	2.65
Demand Charge in PMSM Rs.130/KVA	344/-
Connection and Installation Charge Rs.1500/KVA	3974/-
Fuel Charge Rs.1.6/-	2204/-
TOU Charges Rs.0.45	206/-
Total Saving of PMSM Motor per Month	8745/-
Purchase Price of IE1 Motor in Rs.	1,50,000/-
Purchase price of Capacitor (20 KVAR)	11,000/-
Purchase price of PMSM motor in Rs.	2,40,000/-
Price Difference	75026/-
PAY Back Period (PMSM)	8.6 Months Approx.

Note – Panel cost is not included in both the above scenarios.

Why Techno?

We got an early bird advantage in the Indian Market, we were the first Indian company to introduce the PMSM technology to the gearless motors used in the elevators dated back in 2007. Moreover we have also developed and introduced solar submersible pump using PMSM technology; which is a path breaking technology in line with our PM's vision of harnessing solar power. Currently we have developed a customized solution for Oil mills using PMSM technology which has been successfully implemented. We have received positive reviews from our customers claiming to have recovered the extra money spent from efficiency gains in less than a year.