# CASE STUDY

## Foundry unit can replace inefficient air compressor with PMSM compressor, save 4 lakh rupees per year, and recover investment in less than 2 years

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## Background

Howrah, in West Bengal, is a prominent foundry cluster in India. Compressed air plays an important role in foundry operations. It is used for mould cleaning and powering various equipment such as pneumatic rammers, moulding machines, CNC machines, sand plants, pneumatic pusher cylinders, shot blasting machines, paint booths, bag filters, etc. Air compressors account for a significant share of the plant's total electricity consumption. In many cases, compressors operate with a high unloading percentage, leading to considerable energy loss. Also, poor maintenance and inefficient operating practices result in high specific energy consumption levels. Replacing old compressors with energy-efficient Permanent Magnet Synchronous Motor (PMSM) type compressors can address these issues and significantly reduce energy wastage.

## *Baseline*

A foundry in Howrah was operating a 55 kW reciprocating compressor with a capacity of 328 cubic feet per minute (CFM) delivering compressed air at 7 kg per $cm^2$. The compressor was operating with a loading and unloading power of around 61 kW and 18 kW respectively. The unloading duration is approximately 58% of its daily runtime. This resulted in a high specific energy consumption of 0.217 kW per CFM, indicating significant potential for improvements.

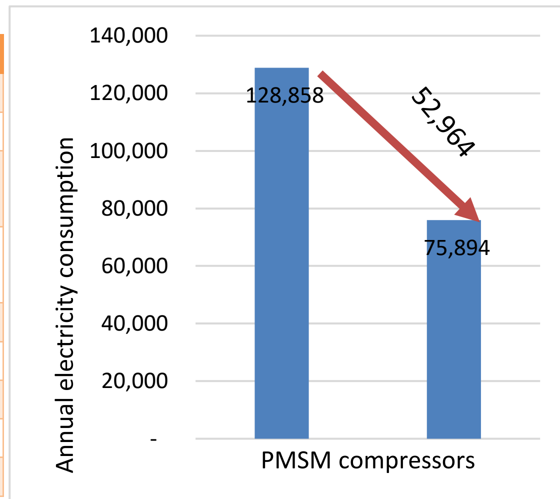
## Energy efficient compressor

PMSM type air compressor uses high-efficiency motors with minimum energy losses, delivering better performance than conventional induction motor-driven compressors. PMSM compressors are typically integrated with Variable Frequency Drives (VFD), which adjust motor speed based on actual air demand, minimizing unloading losses thereby reducing energy consumption. PMSM compressors integrated with VFDs ensure consistent efficiency across varying loads, making them more energy efficient.

## Energy saving

A study during 2024–25 indicated that replacement of the existing air compressor with a PMSM air compressor could save about 41% in electricity consumption for compressed air. The investment on the new compressor would be paid back in less than 2 years.

| Parameters | Unit | Existing | Proposed |
|---|---|---|---|
| Loading | % | 42% | 100% |
| Unloading | % | 58% | - |
| Total energy consumption per hour | kWh | 35.8 | 21.1 |
| Annual energy consumption (@3600 hr per year) | kWh | 128,858 | 75,894 |
| Annual energy saving potential | kWh | | 52,964 |
| Annual energy cost savings | Lakh INR | | 4 |
| Investment | Lakh INR | | 7 |
| Simple payback period | year | | 1.8 |
| Reduction in emission | (t-$CO_2$/year) | | 37.8 |





**For more details, please contact**
Industrial Energy Efficiency Division
TERI, Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi - 110 003, India
Tel: (+91 11) 2468 2100 | Fax: (+91 11) 2468 2144, 2468 2145 | Email: sameeeksha@teri.res.in | Website: http://sameeeksha.org