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Software-Controlled Switched Reluctance Motors

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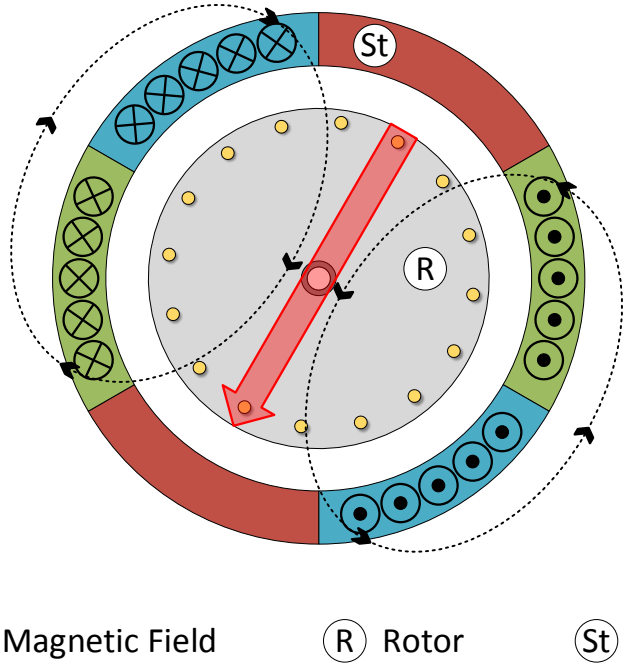
Background

- Power savings can be achieved by reducing the indoor fan speed when possible
- Induction motors are typically used to drive RTU indoor fan and are designed to operate at a fixed speed
- Variable frequency drives (VFDs) are used to provide variable speed fan operation
- Switched Reluctance Motors were tested as an alternative to induction motor + VFD system

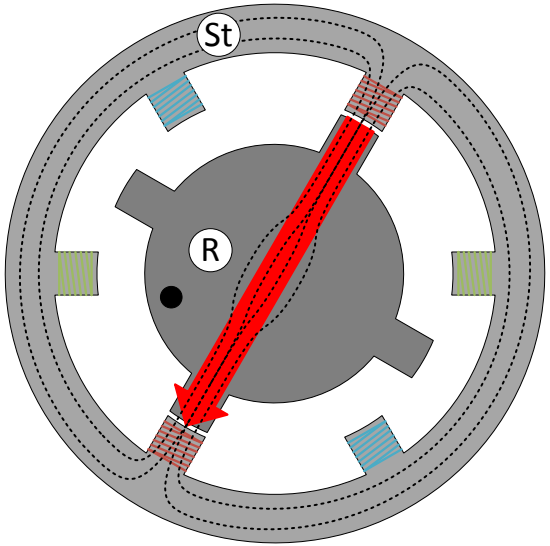
Induction Motors

- Primary components:
  - Stator (stationary part)
  - Rotor (rotational part)
  - Wire windings (create electromagnetic poles on stator and rotor)
- Speed passively controlled by AC power frequency
- VFD changes the AC power frequency, but adds losses to the VFD/motor system



Switched Reluctance Motors (SRM)

- Primary components:
  - Stator (stationary part)
  - Rotor (rotational part, stacks of ferrous laminate material)
  - Stator wire windings (create electromagnetic poles)
  - Software-controlled inverter
- Inverter actively controls stator coil commutation and current - inherently variable speed
- Less transistor losses

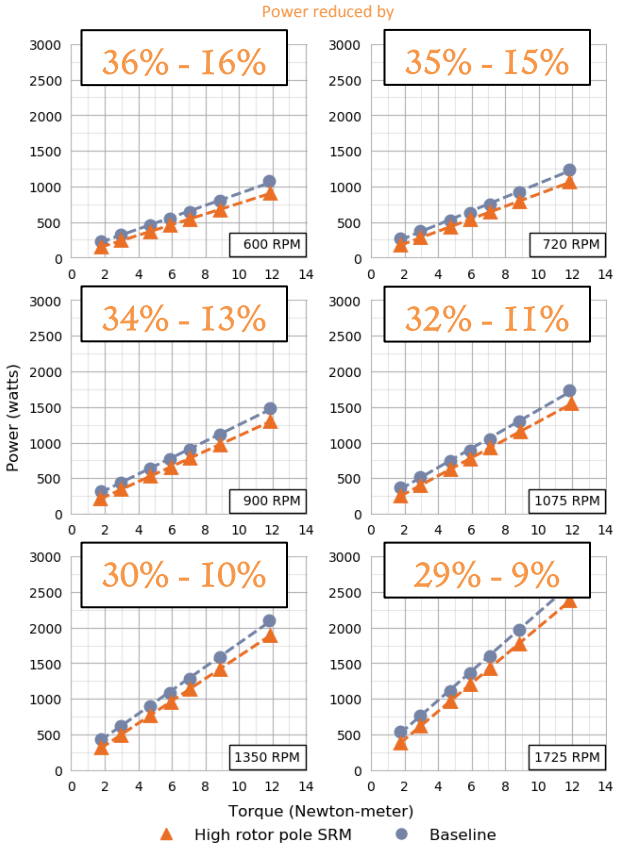


---- Magnetic Field (R) Rotor (St) Stator

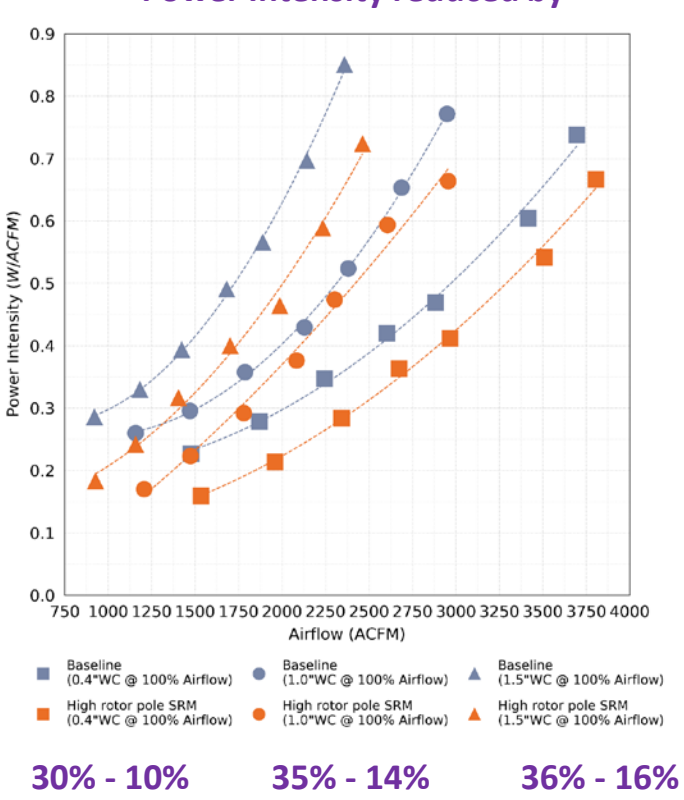
Testing Methodology

- **Laboratory testing**
  - 3HP high rotor pole SRM and 3HP induction motor + VFD
  - Each motor tested on a benchtop dynamometer at six different speeds and seven different loads
  - Each motor tested in laboratory RTU at seven different airflows and three different airflow resistances
- **Field testing**
  - 10-ton RTU on a big box retail store in Corona, CA between November 1, 2017 and August 31, 2018
  - 3HP high rotor pole SRM and 3HP induction motor
  - High rotor pole SRM performance was measured in two phases:
    - Fixed speed- matching the baseline induction motor RPM
    - Variable speed- using the manufacturer's recommended speeds

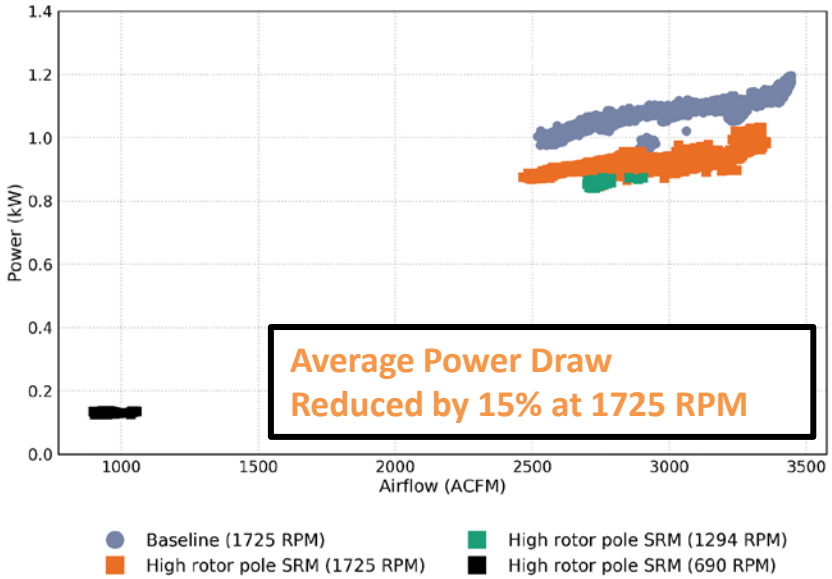
Benchtop Testing

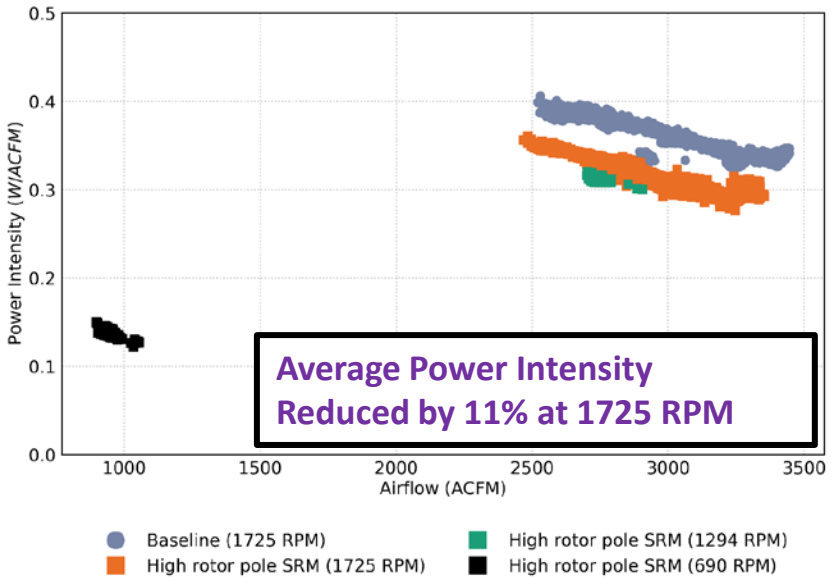


Lab RTU Testing



Field RTU Testing





Reducing the Fan Speed Provided Additional Savings

This project was funded by the California Emerging Technologies Program.

For more information, contact Dallen Coulter at dallen.coulter@sce.com

The project report can be found at:
https://www.etcc-ca.com/reports/software-controlled-switch-reluctance-motors

Questions?

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