

A scenic photograph of a sunset over a body of water. The sun is partially obscured by a cloud, creating a bright lens flare effect. The sky is filled with soft, golden light, and the water below reflects the sun's glow. The text is overlaid in a bold, yellow font.

**PWA Engineering, LLC
Presents
ECM Motors**

What's an ECM?

The highest efficiency motor there is! ... essentially a DC Motor

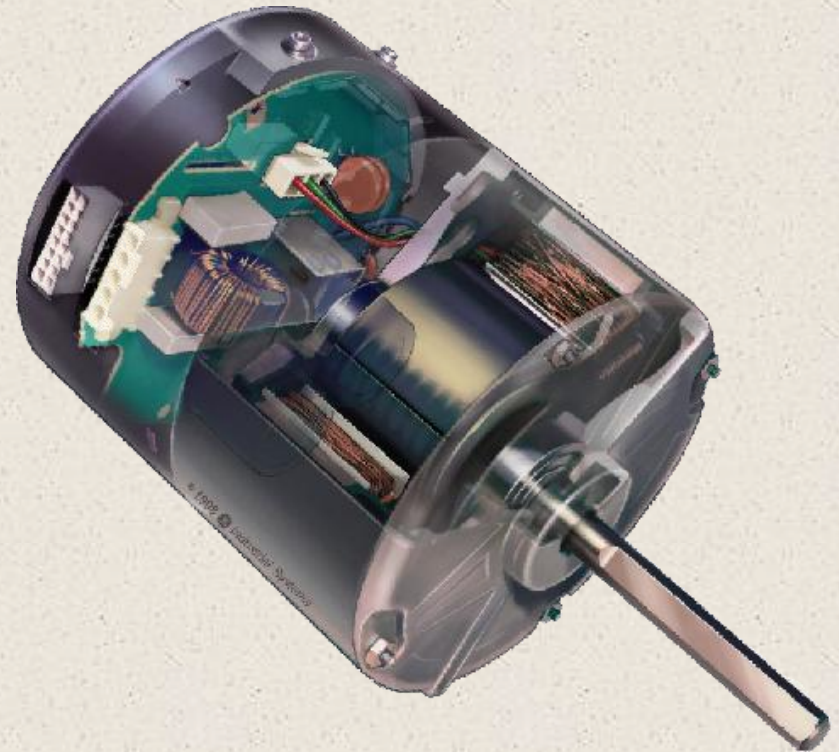
Without mechanical Brushes and Commutator—motor is electronically commutated

Permanent Magnet Rotor

Rotor losses are nearly zero

Motor has 3 windings and is powered from a single AC source

The “Electronic Inverter”
Speed and torque controlled



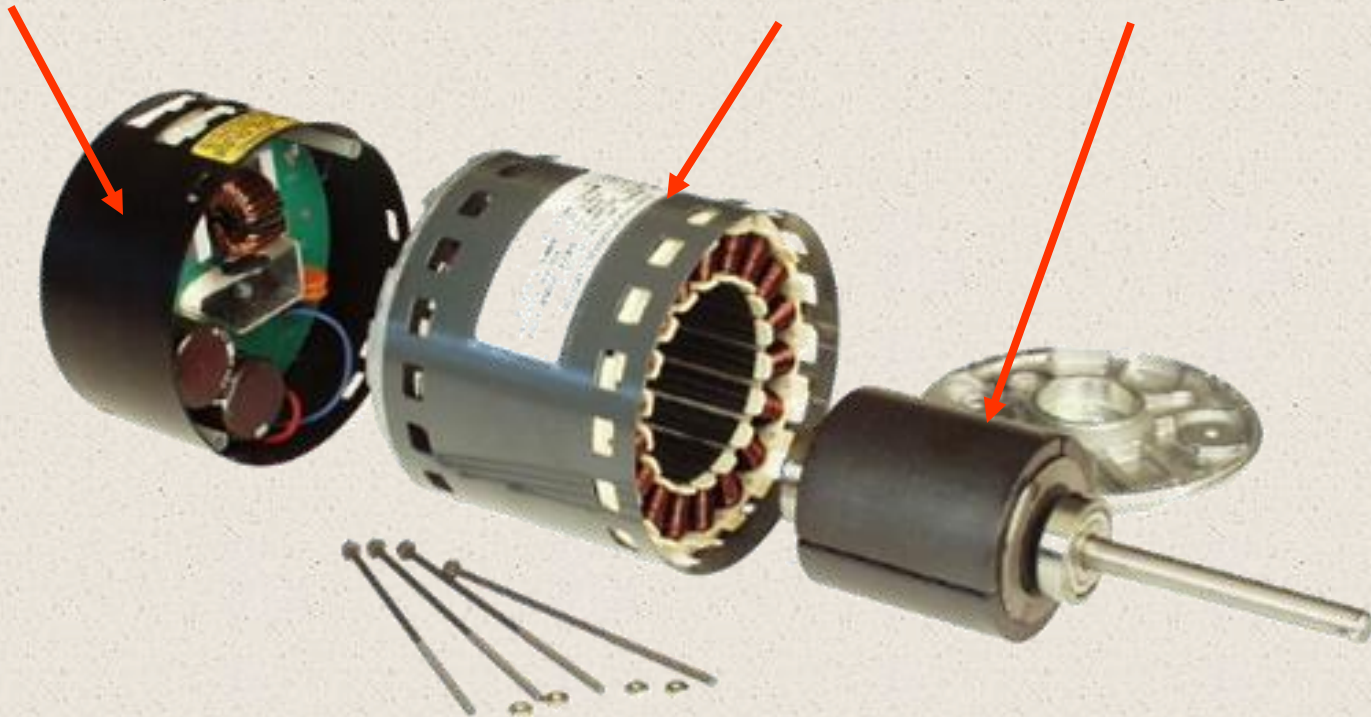
The ECM Motor

Simple construction minimizes the cost of the technology and takes advantage of the efficiency of DC motors

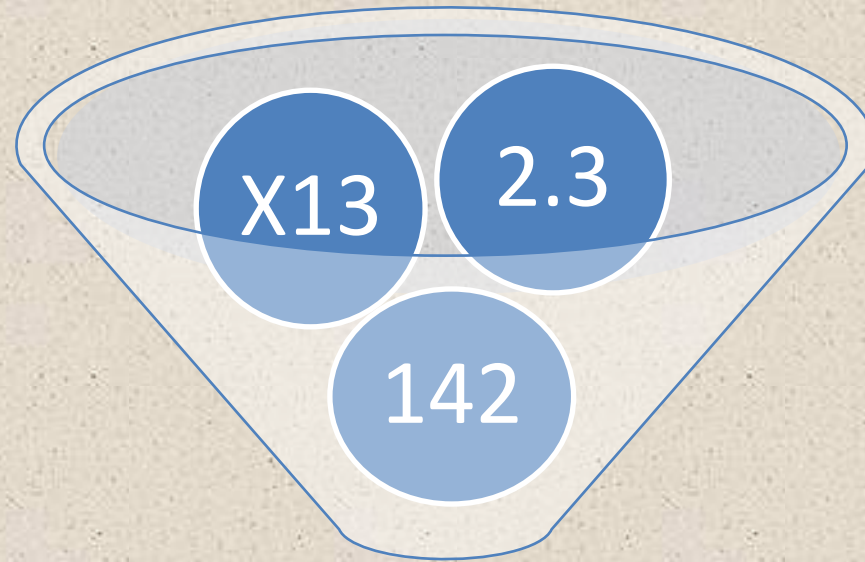
Hi reliability electronic drive

Salient pole stator

Ferrite magnets



Motor Specifications



Single Phase

48 Frame

1/15, 1/10, 1/5, 1/3, 1/2, 3/4, 1 HP

120, 208-230, 277, 460 volts

ECM 2.3

Easy Installation and Service

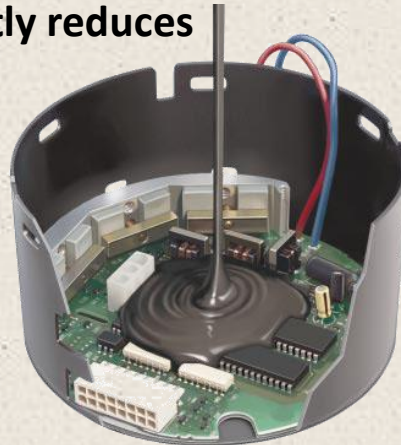
The ECM 2.3 is designed to be easy to install, troubleshoot and service. There is no need to go to the motor for set up. In fact, there are no dip switches or adjustment terminals on the ECM 2.3. The system manufacturer can locate all connections required for set up in any convenient location. When it comes to service, the 2.3 is designed so its electronic controller can be replaced without removing the motor from the blower mounting which greatly reduces service time and cost.

Moisture-Resistant Design

The ECM 2.3 addresses the most common problem today in forced-air systems—moisture. GE encapsulates the motor's sensitive controls in potting material to prevent water from reaching its electronic components. In fact, the ECM 2.3 stands up to more than 600 hours of ASTM-B117 salt-spray testing.

Ultra-High Efficiency

At full load the ECM 2.3 is 20% more efficient than a standard induction motor. In addition, its permanent-magnet, DC design and absence of rotor losses allow it to maintain its high efficiency over a wide speed range



ECM 2.3

Constant Airflow

The most important programmable feature is GE's patented sensor less, constant-airflow technology that allows the ECM 2.3 to maintain a programmed level of airflow over a wide range of external static pressure in an air-distribution system. It even holds airflow constant under less-than-optimum duct configurations and other conditions that produce high or varying static pressure. It does so by automatically adjusting its speed and torque to deliver the airflow we program into it. Constant airflow capability is critical to providing the greatest performance and comfort.

Resilient Electronics

Line transients from lightning strikes or corrupt utility power can cause damage or a temporary interruption of power to any electrical appliance. The ECM 2.3 Series comes standard with robust electronics that allow the motor to operate trouble-free in the event of power irregularities without spark gap. In addition, short power-line interruptions or under-voltage conditions do not affect the operation of the ECM 2.3.

ECM 2.3

Wide Range of Applications

- Single-stage, two-stage and variable-Capacity furnaces
- Air handlers
- Energy-recovery ventilators
- Powered filter units Unit ventilators
- Heat pump systems
- Rooftop exhaust fans
- Fan-powered terminal units

Proven Technology

Since 1985, ECM technology has been providing product designers and engineers an extremely versatile tool for improving HVAC-system performance. Now some 20 years later, ECM technology is becoming a standard product in residential and non-residential buildings. In fact, the 2005 California Building Energy Efficiency Standards now mandates that ECM technology be used in series terminal units for commercial and industrial buildings.

ECM 2.3

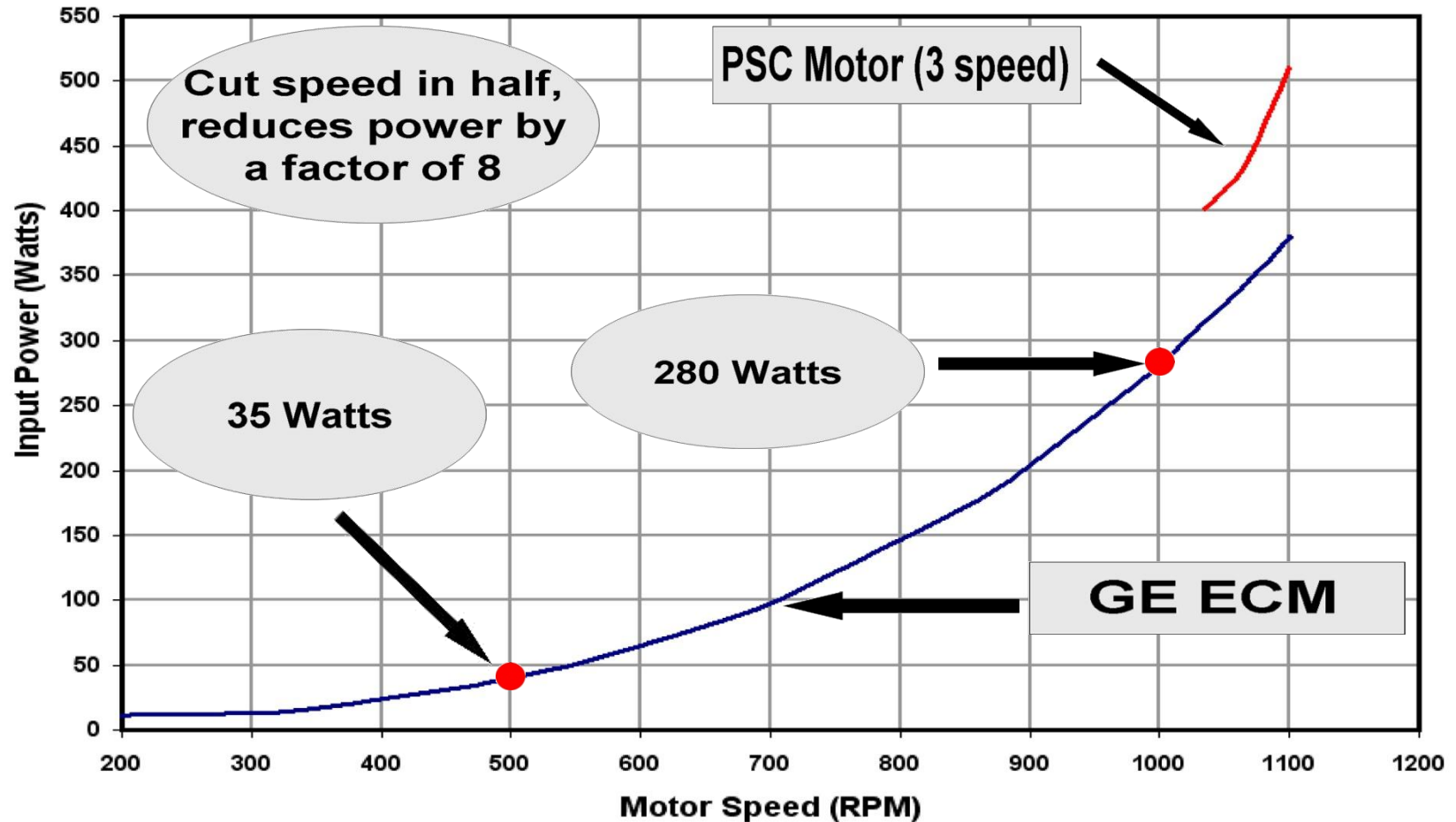
Create Better Products

- Better humidity control
- Constant airflow
- Lower set up and inventory cost
- Quieter operation
- Better indoor-air quality.

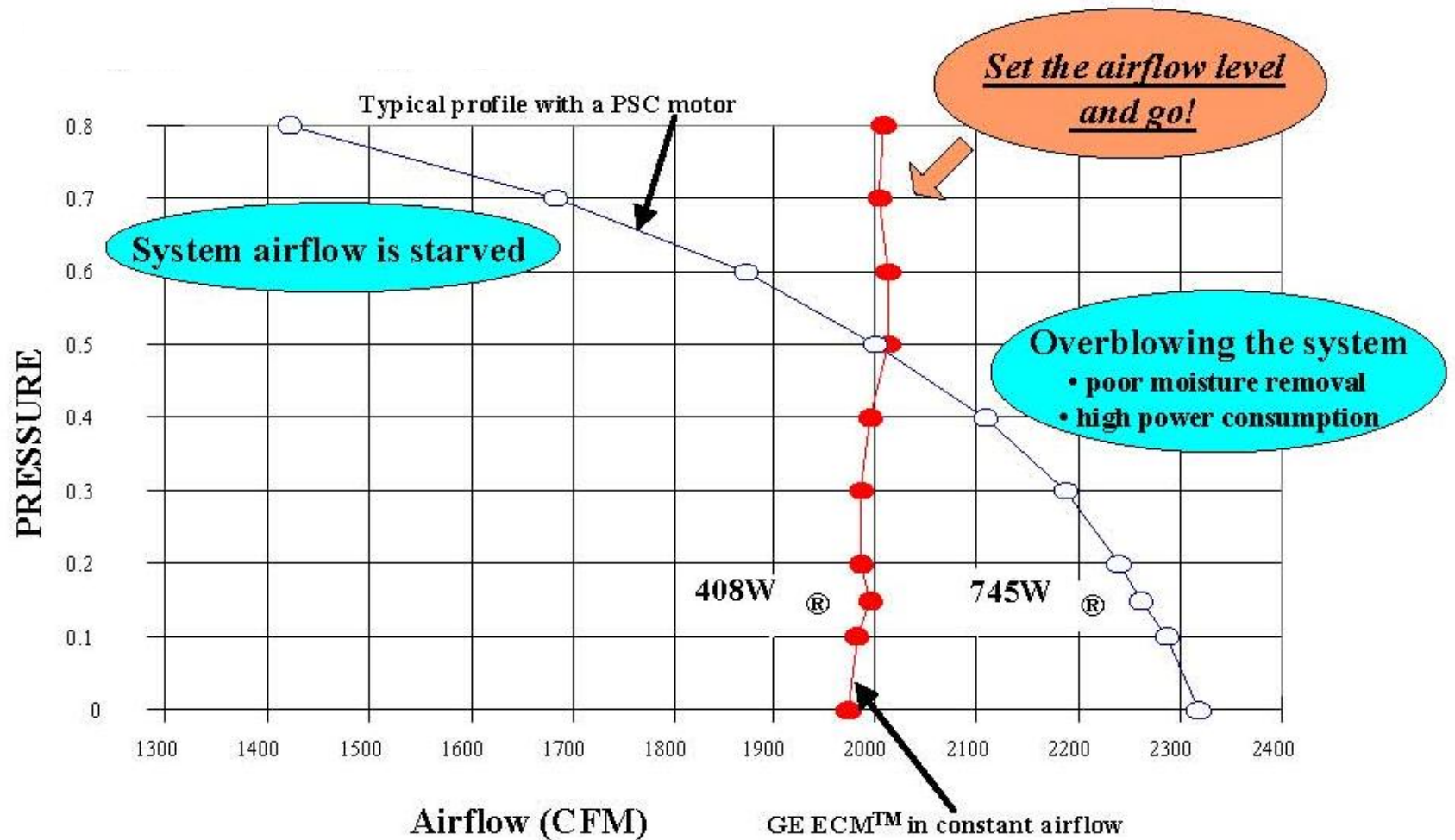
Programmable Controls

- Rotation direction,
- Start/ stop ramp rates
- On/off blower delays
- Climate Profiles
- Constant CFM

Power Consumption of An ECM 2.3 versus a PSC Motor

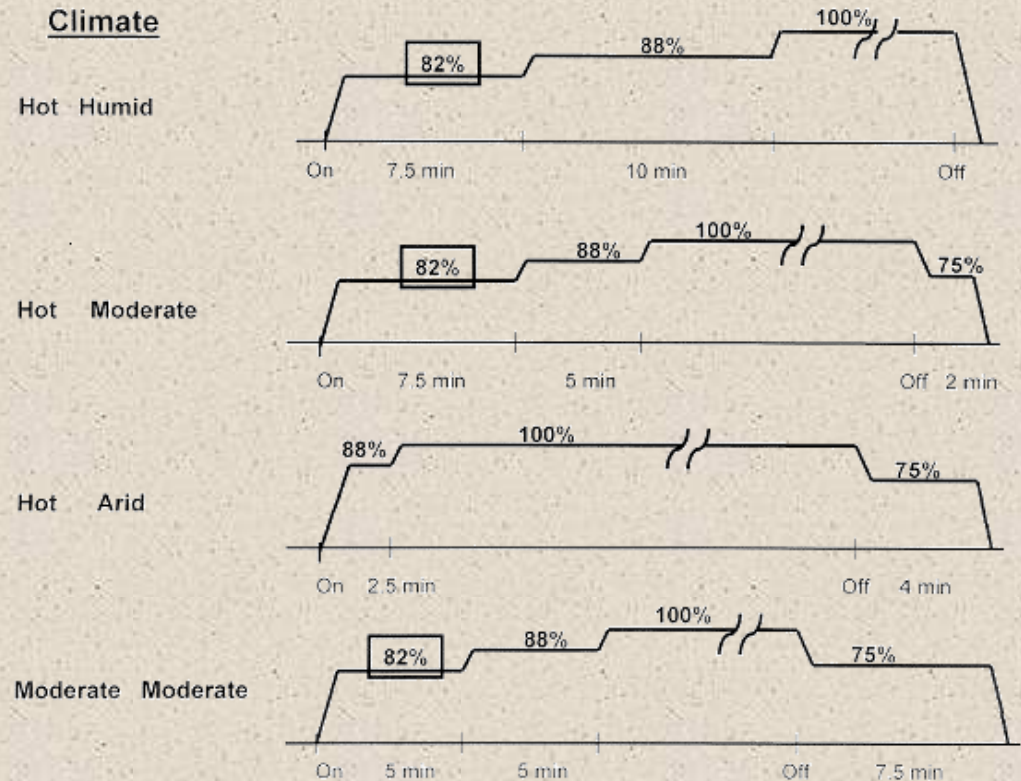


Airflow Characteristics of An ECM 2.3 versus a PSC Motor



Climate Profiles Increase Efficiency

- Regional climate profiles
- On-Delays allow for heat exchanger to heat up or cool down before fan start-up
- Off-Delays use stored energy in the heat exchanger
- Moisture removal

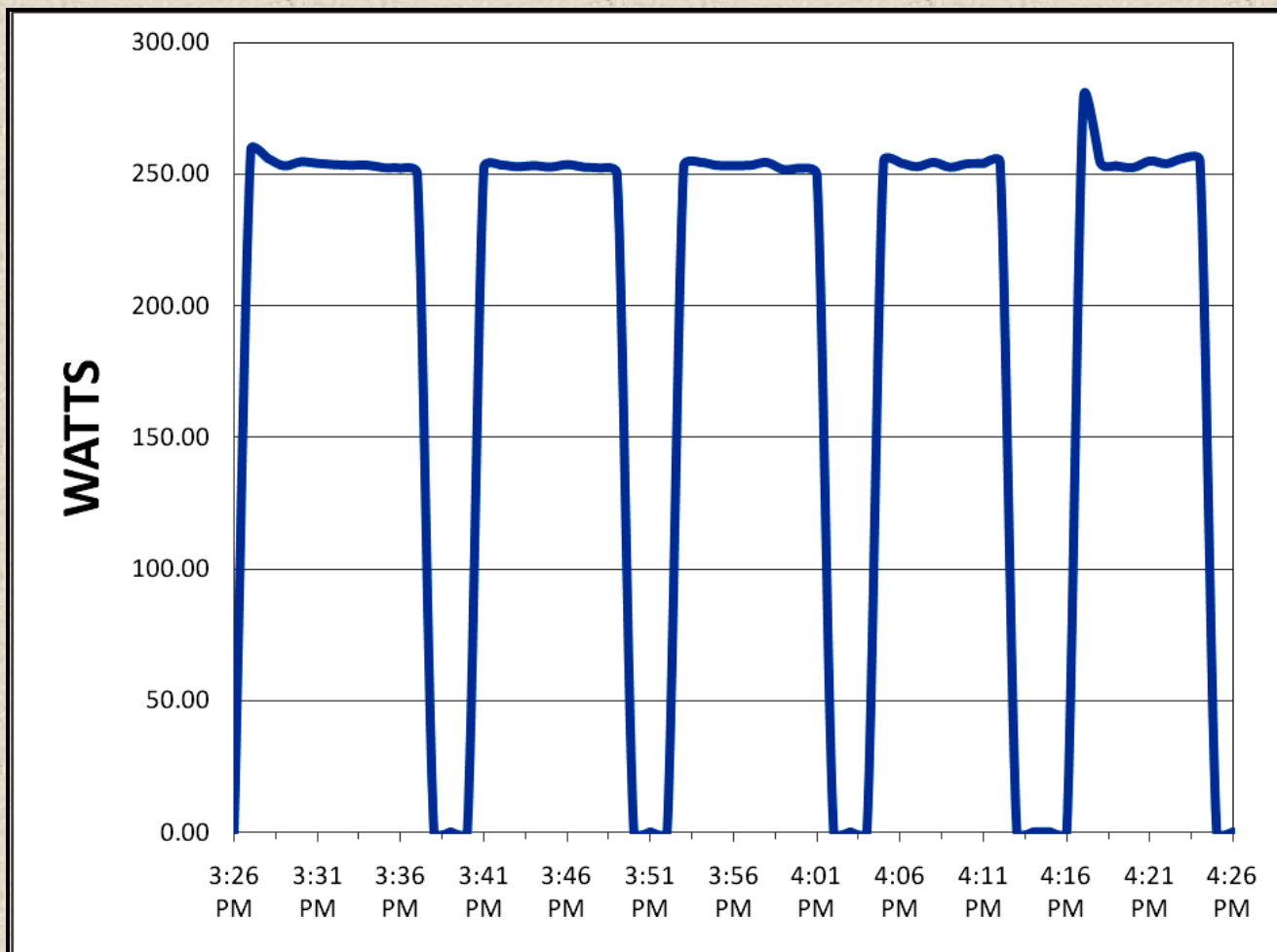


**An ECM 2.3 and X13
Can Save 20-86%
Over PSC Motors!!!**

Energy Consumption Study for a Permanently Split Capacitor Blower Motor versus an ECM 2.3 Contained In a Water Source Heat Pump

PSC Real Power Consumption at 1-Minute Intervals for a Period of One-Hour

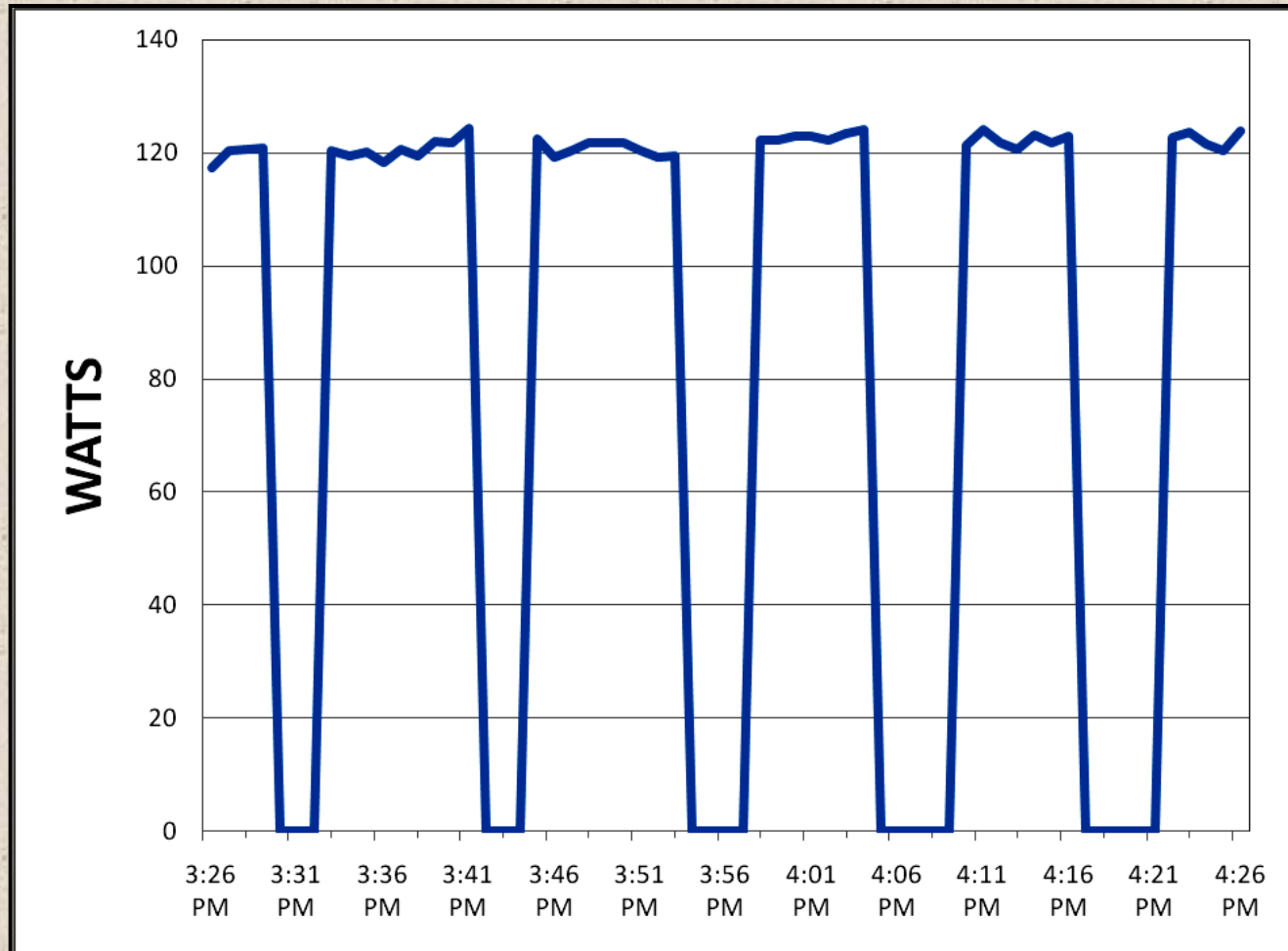
The existing PSC motor was operating at 700 RPM and consumed an average of 256 Watts.



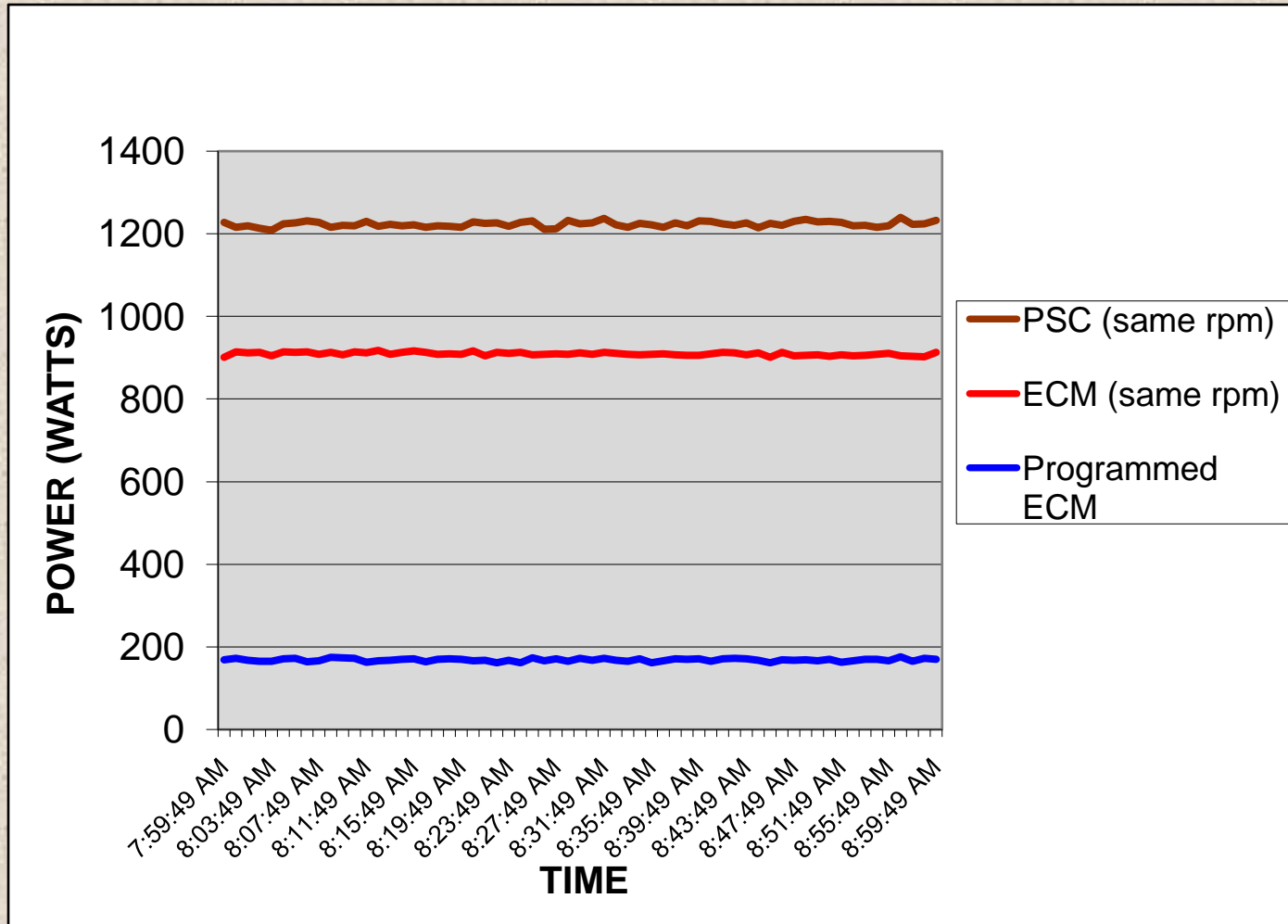
Energy Consumption Study for a Permanently Split Capacitor Blower Motor versus an ECM 2.3 Contained In a Water Source Heat Pump

ECM Real Power Consumption at 1-Minute Intervals for a Period of One-Hour

The existing PSC motor was replaced with an ECM that was also programmed to operate at 700 RPM. The ECM replacement showed an average power consumption of **121 Watts**, which is **52%** less energy consumption versus the PSC motor.

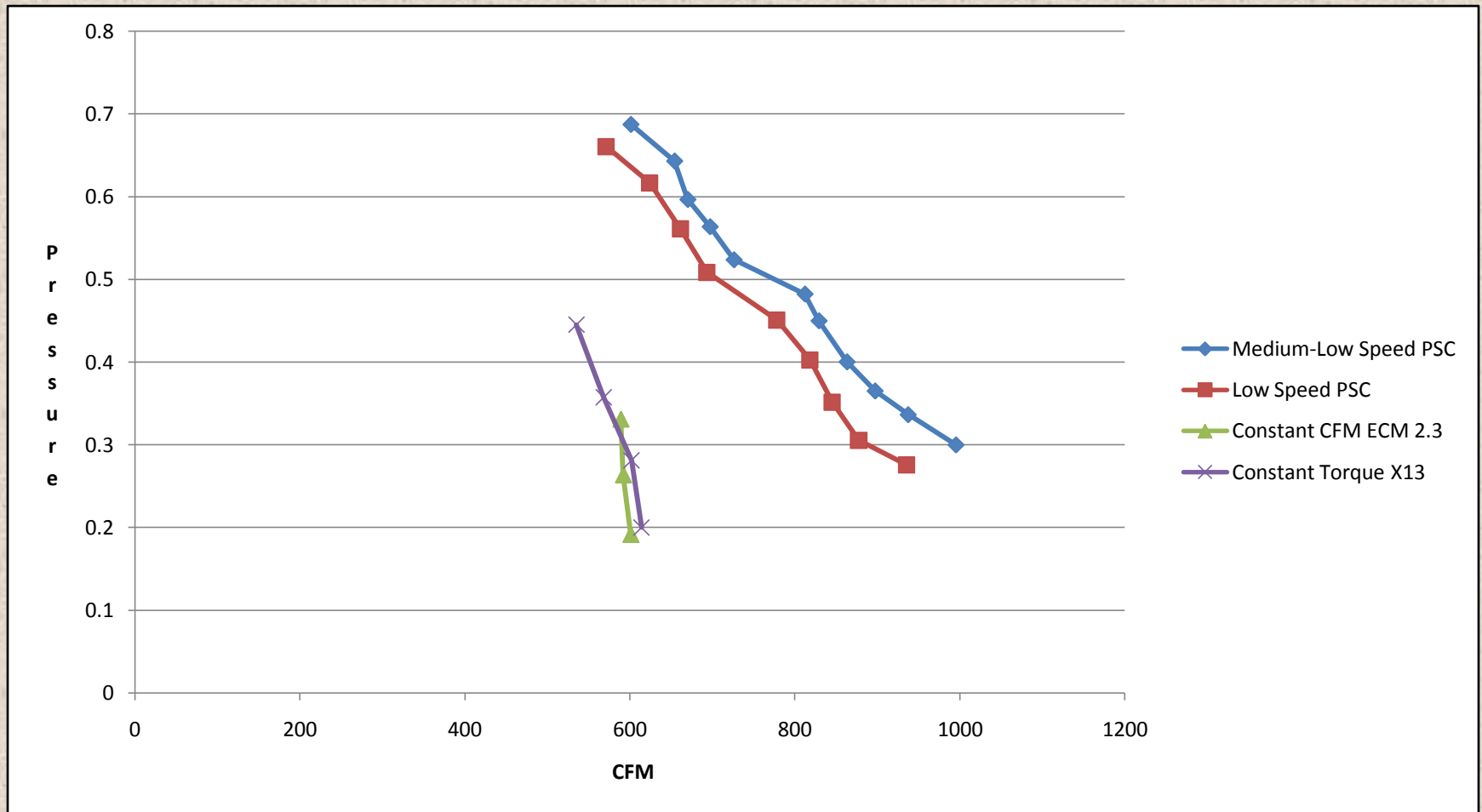


Energy Consumption Study for PSC Motors versus ECM 2.3 Motors In Four Series VAV Boxes

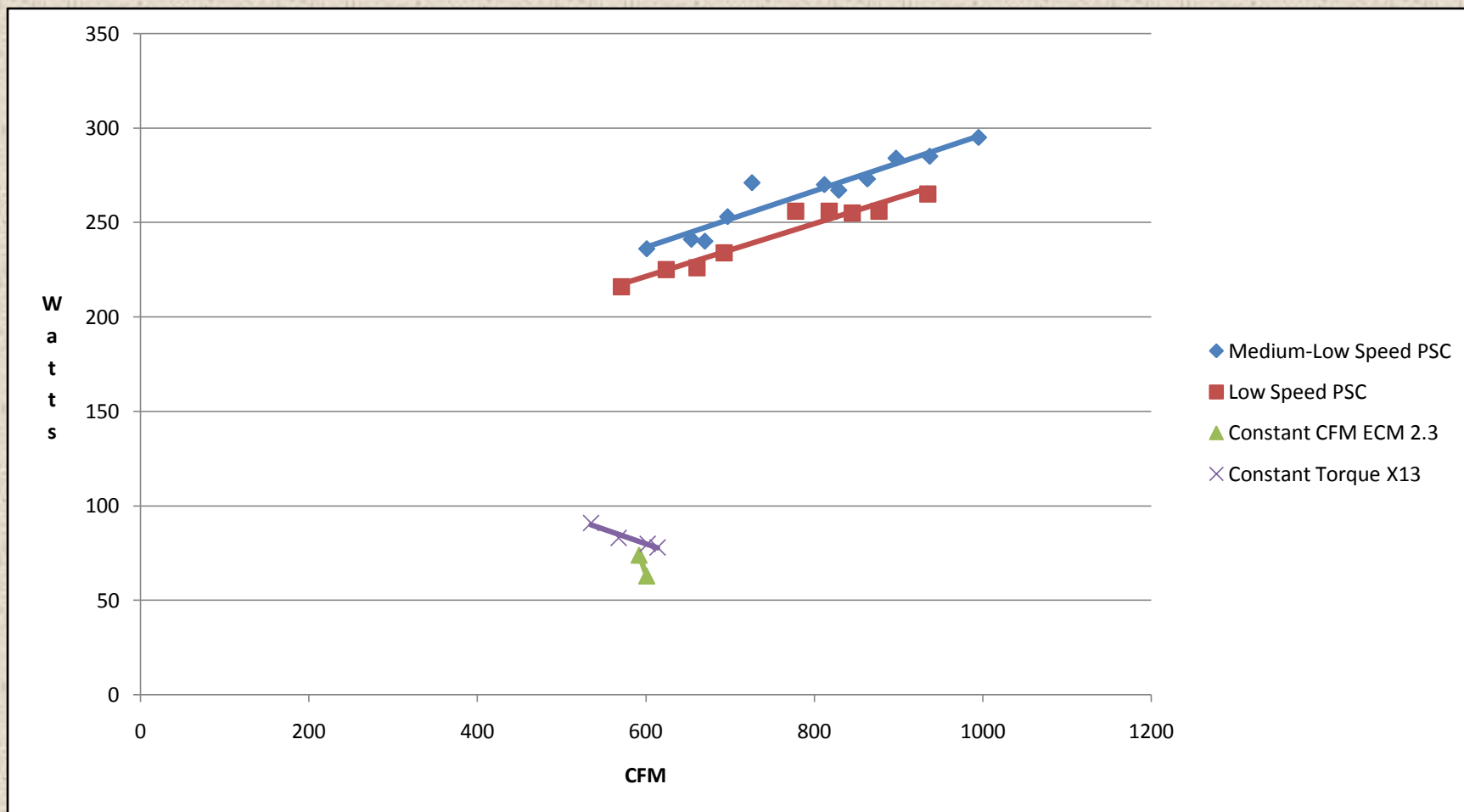


Test results proved that the ECM motor ran **25%** more efficient than the PSC motor when operated at the same revolutions per minute (RPM). Energy reduction was further increased to **86%** when we utilized the unique programmability of the ECM motor and reduced the operating speed to 500 RPM.

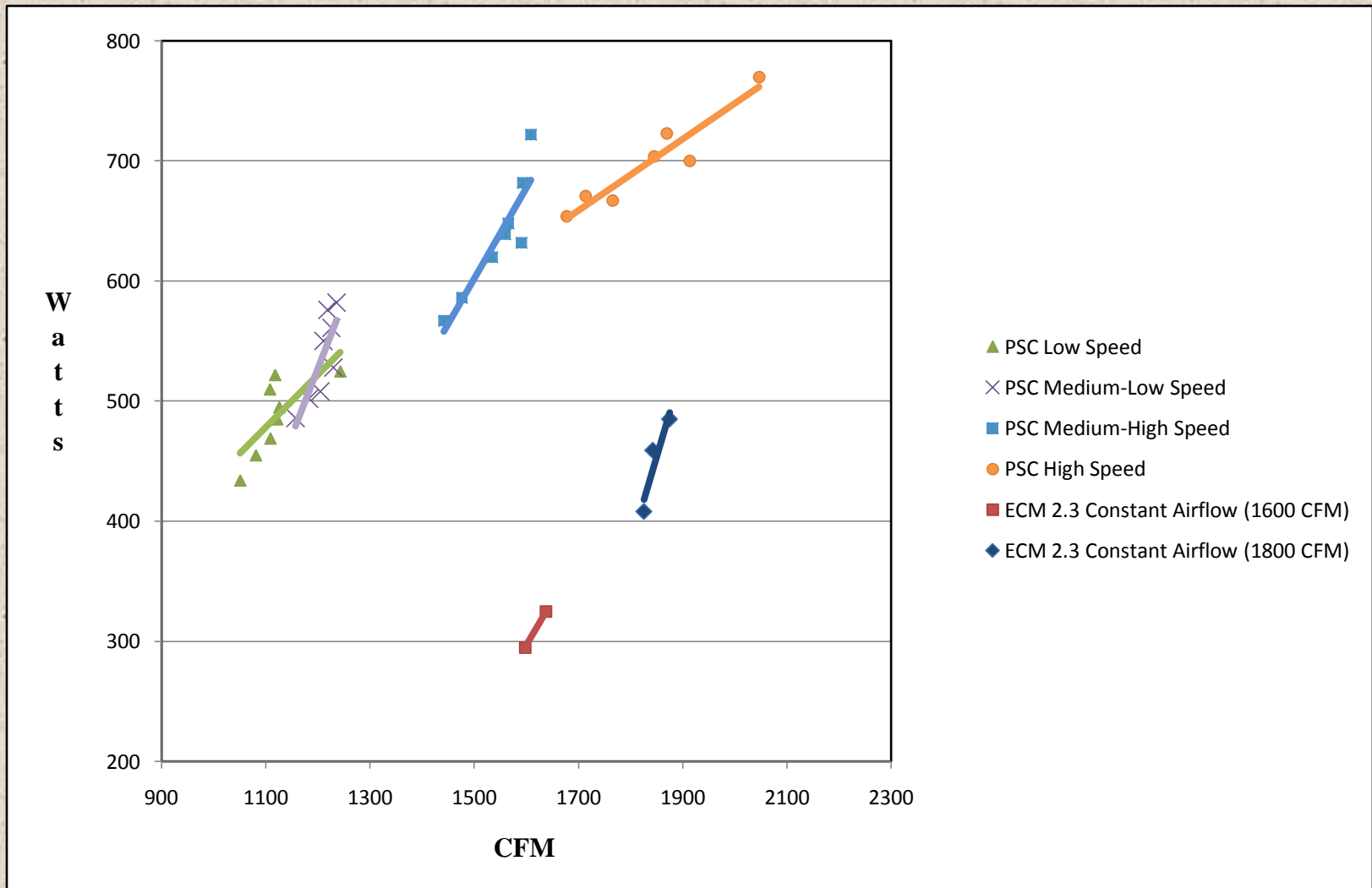
Is The Motor in The System Oversized???



Watts to CFM Comparison for a 1/3 HP PSC Motor Operating at Various Speeds To a 1/3 HP ECM 2.3 Operating in Constant Airflow and a 1/3 HP ECM X13 Operating Constant Torque In a 9X6 Blower



Watts to CFM Comparison for a ½ HP PSC Motor Operating at Various Speeds and a ½ HP ECM 2.3 Programmed For Constant Airflow In a 10X10 Blower



Energy Savings by Replacing a ½ HP PSC Motor With a ½ HP ECM 2.3 Programmed For Constant Airflow In a 10X10 Blower

CFM	Percentage Energy Savings
1600	58%
1800	35%

CFM	kWh Saved per Year	Utility Rate (\$/kWh)	Energy Savings per Year
At 1600 CFM	2490	0.10	\$249.00
		0.12	\$298.80
		0.17	\$423.30
At 1800 CFM	1470	0.10	\$147.00
		0.12	\$176.40
		0.17	\$249.90

Energy Savings per Year for a Motor Operating 6,000 Hours per Year

Carbon Dioxide Reductions

Why is it important to your company???

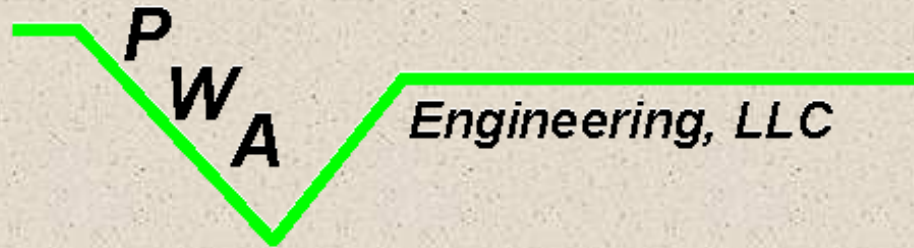
1. Replacing a PSC with an ECM reduces carbon dioxide levels
2. Decreased Greenhouse Gases
3. Governmental Taxation

Reductions in Carbon Dioxide for Four Series VAV Boxes With PSC Motors Consuming 1200 Watts Replaced by ECMs Consuming 170 Watts

PSC Replaced By ECM	1 Year Savings	10 Year Savings
Electricity (at national average**)	\$908.60	\$9,086.00
Lbs. of Carbon Dioxide	12,054.46	120,544.60
Number of Cars Removed	1.14	11.40
Planting X Acres of Trees	1.87	18.70

** National average is \$0.1007/kWh using utility rates provided by the Department of Energy
<http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html>

Please contact PWA Engineering, LLC for additional information.



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