

Inventor's motor aims to save millions in energy costs

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On the list of a million things Americans think about, electric motors are probably, oh, number a million and one.

But we're surrounded by them at home, at the office, in our cars, shopping for groceries - hundreds of millions of them just for heating and cooling. And every one of them could be more efficient.

But people like Kansas City inventor Joe Flynn and his two dozen coworkers at QM Power in suburban Kansas City think about motors every day - and now they have one for sale that federal researchers say could save half a billion dollars in <u>energy</u> costs every year.

It's called the Q-Sync Smart Synchronous Motor, and Flynn says it is "one of the coolest things" he's ever invented.

Its design came to him while he was pondering how a motor could be more efficient than the best ones on the market but also simpler than the cheapest ones, "to keep the costs low." In the end, said Flynn, the company's chief technology officer, his design for the Q-Sync was so stripped down "it was hard to believe it ran."

But run it did.

And now the Q-Sync, designated an "emerging energy-saving technology" by the Department of Energy, is ready for market. Specifically, the supermarket market, because it's just right for running



the evaporation fans that keep food cool.

That may seem like small potatoes, but it's really big lettuce. When you stroll the produce aisle or any cooled display space, you pass a fan-and-motor rig every 4 feet, hidden underneath. Refrigeration costs are one of the biggest expenses for grocers, where profits are just a few pennies on the dollar.

Getting grocers - and their fan makers, equipment buyers and electrical contractors - to make the switch is QM Power's next challenge, an effort led by president and CEO P.J. Piper, who founded the company with Flynn nine years ago.

Piper thinks he can quickly capture 30 to 40 percent of the food-cooling market.

At a recent demonstration at a Kansas City Price Chopper, where the Q-Sync was outperforming the store's current fan motors, Piper said:

"Our motor uses 50 to 80 percent less energy than current motors, and

98 percent of the total cost of an electric motor is in the energy it consumes."

And for Piper, whose background is in finance, the clincher is that Flynn's design "to keep the costs low" means that the Q-Sync, unlike most energy-saving technologies, will not cost buyers more. Piper didn't put a unit price on the Q-Sync, saying that would vary based on factors including the size of an order, but said it wouldn't cost more than the next-most-efficient motors available.

Some other numbers that explain why the little Q-Sync, about the size of two hockey pucks, is such a big deal to Flynn and Piper - and to the



departments of Energy and Defense, the National Science Foundation, NASA, utility companies and others interested in energy efficiency:

-The average grocery store has 225 evaporator fans, and every soda vending machine has one, too. Add in restaurants, bars, convenience stores and other food vendors, and the U.S. has nearly 16 million such fans.

-Nearly 80 percent of those fan motors use a design that dates to the late 1800s, invented by Nikola Tesla. The relatively simple design - using AC current to create magnetic fields that make a motor's rotor spin - has persisted because it's inexpensive and can last a decade. But it's so inefficient that any upfront savings evaporate quickly as its electricity use mounts.

In the side-by-side tests being run at the Price Chopper, Q-Sync motors are using only about 20 percent as much energy as the older motors. And the older motors' wasted energy is lost as heat, further hurting a refrigeration system's efficiency.

-The other grocery fan motors now in use are a more recent and efficient design, known as ECM motors, which use permanent magnets to reduce the amount of electricity they need, and convert AC current to DC. The motor was invented in 1962, came to market in the late 1980s and finally caught on in the past couple of years, after California ordered a phase-out of the old-style motors. But the Q-Sync is more efficient than them, using 70 percent as much electricity as the ECM motors, and in some conditions just half as much.

The Q-Sync's technology, called a synchronous AC motor, has permanent magnets like the ECM, so it keeps that advantage. But it also has advanced electronics - thanks to Flynn - that bring the motor quickly up to speed and synchronize it to the frequency of the current from the



power grid. When the motor speed and current frequency are in sync, the motor's electronics can be shut off, saving more energy. Not having to convert AC current to DC also saves some power.

In the past, such synchronizing technology has been too expensive for widespread use. But as Flynn said, "My specialty has always been how to make a dollar's worth of stuff for a nickel."

-Add it all up - as the Oak Ridge National Laboratory did in a recent report - and replacing all those fan motors with the Q-Sync could save businesses \$517 million a year. The energy savings also would reduce the demand on the power grid around 600 megawatts and cut annual carbon dioxide emissions 4 million tons.

For that report, Bryan R. Becker, a professor of mechanical engineering at the University of Missouri-Kansas City, collaborated with Brian Fricke of Oak Ridge's energy and transportation science division. Besides research into the cooling-fan market and motor efficiencies, they monitored and verified results from another side-by-side test of Q-Sync and ECM motors at a Hy-Vee in suburban Kansas City.

Piper expects more good results to roll in this year when, under another government grant, 10,000 Q-Syncs are installed in more than 50 grocery stores across the country. The people doing the installing are another group Piper hopes to win over, and a Kansas City, Kan., company that does that work, Design Mechanical, has already seen the results.

Mike Cash, a service sales engineer with Design Mechanical who installed the Q-Syncs at the Price Chopper, said: "Upgrading lighting can provide a 10 to 20 percent energy saving. But these evaporation motors can save 40 to 50 percent and provide a better payback."

Piper also is working with utilities to make sure their customers know



about rebates and other energy-conservation incentives that will help them pay for the Q-Sync. QM Power is even considering contracts that essentially give the fans and motors away and recoup the costs by splitting money from the energy savings with buyers.

Bobby Castaneda of CLEAResult, which contracts with Kansas City Power & Light to promote energy savings, said KCP&L was "always looking for new technologies that can reduce the load on the electric grid. QM has been assertive in demonstrating its technology works offering proof, and not just theory or sales talk."

QM Power, like other motor makers, is outsourcing production, so it won't create lots of manufacturing jobs locally. But staff and revenue have been growing by more than 50 percent a year recently, Piper said, and could grow faster the next couple of years.

Piper, 45, has seen such growth before. His previous company, Aspen Aerogels, a high-tech insulation company in Boston, quickly grew to

150 people and went public last year. Now Piper is scouting properties to triple QM Power's current 4,000 square feet of office and lab space.

There, the QM Power team has used everything from computers and a 3-D printer to laser cutters, a freezing chamber and arrays of fans to develop, prototype, test and refine the 12-watt Q-Sync. And with the help of another government grant, the team is working on using the technology in bigger motors, such as the half-horsepower ones common in heating and air-conditioning.

Becker and Fricke, in their Oak Ridge Laboratory report, also saw that possibility for QM Power's technology in the "hundreds of millions" of U.S. heating and refrigeration motors, which use nearly 30 times as much energy as the evaporation fans Q-Sync is going after first.



So Flynn, 65, doesn't think the initial Q-Sync will be his last breakthrough.

"No, it never stops," he said. "We'll keep inventing. That's what we do."

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