



Lots of buzz surrounding this company

Toronto firm's gadget imitates how bees solve problems without a central commander

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This could come back to sting me, literally, but for the record: bees are stupid.

No offense to our honey-making friends, which in an indirect way we depend on for our very survival, but bees don't live up to their buzz.

That said, get a thousand bees together and something remarkable happens. They communicate with each other using a simple language. They co-ordinate. They organize. They exhibit behaviour that suggests, well, that they're working through problems. Just as interesting is that there's no single bee giving orders from central command. Bees just miraculously figure things out from what appears to us as chaos.

The way the bees come together as part of a larger, seemingly more intelligent collective is an example of an emergent system – a controversial area of study that's sometimes called "swarm logic." We see it with crickets, with ants, with all kinds of animals, and now a Toronto-based company called Regen Energy is applying the concept of swarm logic to the area of energy management.

Regen has developed a wireless device that allows major electrical appliances in a building to communicate with each other at a very basic level, with the goal of minimizing how much power these appliances collectively use at a given point in time.

The devices are attached to power-intensive equipment that cycles on and off, such as air conditioners, compressors and pumps.

"If you get a lot of these things exchanging very simple messages with each other but on a very frequent basis, you can have each unit operating in a simple fashion but achieve overall system goals," explains Mark Kerbel, co-founder and chief executive officer of Regen.

In other words, you don't need somebody behind a central control flicking switches. It's all automated.

"The devices broadcast wirelessly to each other saying, 'Here's what's going on with me, what's going on with you?' and every 15 minutes they make decisions. They ask, should I be on or should I tell my load to back off and come on 15 minutes later?"

Now, the approach doesn't necessarily achieve energy conservation. After all, the appliances still need to operate for a certain number of minutes each hour to achieve their purpose, such as cooling or heating.

But they also don't need to be on at exactly same time. By making sure the fewest number of appliances are operating during a given minute, Regen's wireless devices help building owners

smooth out their electricity consumption.

Why is this important? First, some building owners get charged a higher rate if they exceed 50 kilowatts of power demand during certain times of the year, so there are financial benefits to always staying below that peak threshold. Regen claims that its system, on average, can reduce a building's peak load by 20 to 30 per cent.

Second, from the perspective of overall grid management, it's best for everybody if we try to lower our daytime peak. That's because there's a lot of generating capacity on the grid that's reserved for peak periods that only occur a few dozen hours a year. We collectively pay a lot for that electricity, and it tends to come from a mix of coal and natural gas, both big sources of greenhouse gases and other pollutants.

If we can trim or smooth out that peak, we can avoid using dirtier and more expensive sources of electricity, and we can also take price volatility out of the electricity market.

"Sometimes just over half a customer's bill is based on peak consumption, and we saw that as an opportunity," says Kerbel. "From the building owners' perspective that goes right to their bottom line."

Kerbel founded the company in 2005 with long-time business partner Roman Kulyk, currently the chief technology officer of Regen. Before that, the two were running a business that designed software for the electricity sector.

But pushing around bits and bytes wasn't exactly thrilling, and both Kerbel and Kulyk wanted to have a more meaningful impact on the way electricity is used.

"We wanted to take the bloat off the grid," says Kerbel. "So we bashed our heads around a little and came up with what we're doing now." Eventually they hooked up with electricity-sector veteran Chris Beaver, who took on the role of senior vice-president (though on the side he still manages the Ryerson men's volleyball team).

The circuit board for the initial device was etched out in the bathroom sink of Kulyk's home, with later versions made at the company's modest lab on Bay Street. Funding has come largely from angel investors, as well as \$55,000 through an Ontario Power Authority technology fund.

Regen has so far signed up five building customers – including a large convention centre in Mississauga and Toronto Hydro's headquarters. It has more than \$100,000 in revenues, which it plans to grow substantially through an innovative business model based on the rental, not sale, of devices.

The pitch is compelling: "Immediate payback with no multi-year financing required," according to the company's website. "We'll install our controllers in your facility for up to 90 days. If you're not satisfied with the resulting savings on your electricity bills, we'll remove our controllers."

Kerbel says there's no risk for potential customers, no worry about warranties, and that the monthly electricity savings will more than offset the cost of the rental. Regen is working with students at Centennial College to further validate the performance of the technology.

Momentum is building; interest is growing. "We're on a war path toward commercialization," says Kerbel, adding he's been getting more calls recently from venture capitalists and is in talks with what could be a strategic customer and investor. "We're now looking at a product that could be rolled out to thousands of buildings easily."

Just like bees, a single device has little impact. But get them together in a swarm and they're a force to be reckoned with.

David Chassin, a staff scientist in the energy and environmental technology division of Pacific Northwest National Laboratory, in Richland, Wash., is a recognized expert in emergent systems

who sees tremendous potential for managing the electricity system – whether it's designing self-healing grids or making the most efficient use of limited transmission capacity.

He points to a research project in Seattle where 250 homes were equipped with devices that are similar to those offered through Regen. The devices would not only talk to each other but would respond to market signals.

"The market would announce the price and the devices would throttle themselves based on the price," says Chassin. "It worked remarkably well."

He compares it to an airport, where an air traffic controller is required to guide planes one-by-one on to a single runway. Using swarm logic, the planes figure it out themselves without the need for a central controller.

Now, for obvious reasons, we're not about to trust this approach for landing planes. But for energy management, where occasional errors can be tolerated, there's a case to be made.

"If you let the devices figure it out for themselves, yes, some of them make mistakes, but on average the mistakes wash out. The larger number of participants, the more they get it right, and that's what this type of emergent system does."

He says when numbers are large – that is, hundreds of thousands of appliances operating on the grid – a central command system begins to break down. Still, engineers tend to assert that the top-down, central control model is superior.

"My response is that you can do it, but you're going to spend a lot of money and it will only work in the right conditions. It won't have the flexibility to work in the real world," explains Chassin.

"If there's a big change, if something dramatic happens, these engineered systems fail dramatically. Whereas these emergent systems tend to be much more robust in the long run, and tend to survive these big disturbances a lot better."