and further energy is saved by the use of electrical demand water heating, which eliminates "standby energy" when water is not needed.

GreenLife buildings also feature arrays of solar photovoltaic (PV) panels that account for significant amounts of each project's annual operational energy. In instances where a building's required energy is greater than its on-site production, the balance is supplied to the grid by way of clean, renewable energy from wind and solar farms throughout Ontario.

For the most part, De Sylva describes the concept as a long-term vision of solutions that are "easily within reach," adding that Del Ridge looks to address real issues that other developers and governments tend to ignore.

Above all, De Sylva applies a GreenLife data management system that allows proprietors to continually assess and update energy use and to look for new efficiencies.

"Data is the other half of the experiment," De Sylva says. "Imagine the original science class: purpose/method/observations/conclusion. Can you imagine in school only starting at purpose and ending at method? If we don't monitor, we can't conclude. It's like repairing a car and not driving it again. We have to determine whether the choice we made helped to solve the problem we faced. The second part is to determine how effective the solution was, so that we can alter it one way or the other. Finally, as we continue to see results, this monitoring brings into focus the last remaining issues, which initially may have been seen as minor."

Information is clearly important to the Del Ridge/Greenlife team, and De Sylva lights on a key observation that engineers can no longer rely on outdated weather, climate and related data when looking to build sustainable buildings with a minimal or net zero impact on the environment.

"We can no longer rely on centuries-old weather patterns to grow the basic food for global survival," De Sylva says. "Why? Because the climate is changing–on land and in the air, and in oceans and water bodies everywhere. It all can be traced back to one common factor–indulgent use of yesterday's energy, kept stored in fossil fuels we consume today."

When asked if the Del Ridge approach qualifies as an engineering innovation, De Sylva had a ready answer: "When I graduated in 1973, I received a glass mug. On one side was painted 7T3 and the other side was painted SPS. Non-engineers always ask what SPS means, and I am delighted to inform them that it is what we were called in 1873–the School of Practical Science. That is what we are about. It defines an engineer. When we get caught up in process and confusion we lose sight. I recall someone saying once: 'Any intelligent fool can make something more complex, more difficult and harder to understand, but it takes a touch of genius and a bit of courage to move in the opposite direction.'"

FINDING THE CRACKS

OTTAWA STARTUP HELPS DETECT CRUMBLING INFRASTRUCTURE BEFORE DISASTER HAPPENS

By Jennifer Coombes

Crumbling bridges, dams, culverts and other concrete structures are a common sight and a common problem throughout much of the world. But one Ottawa-based engineering startup has a solution to detect potential deterioration of concrete before problems happen and before they become potentially life-threatening.

Giatec Scientific Inc. has developed and patented the first handheld device that allows the accurate, fast and non-invasive inspection of reinforced concrete structures to identify areas of potential deterioration before they happen. Called iCOR, the easy-to-use unit works by measuring several parameters from the surface of a concrete structure (to a depth of 10 cm) and, in less than 20 seconds, analyzing them using proprietary, advanced inverse-modeling algorithms.

Aali Alizadeh, PhD, P.Eng., Giatec's CEO, and Pouria Ghods, PhD, P.Eng., the company's president, have developed and patented iCOR and two other products for the industry based on more than 12 years of experience in concrete durability and corrosion analysis. Alizadeh's expertise lies in the properties of cement and concrete, while Ghods' is in the corrosion of steel in concrete.

"When iCOR comes into contact with the surface of concrete, it collects information, such as resistivity, corrosion potential in the rebar, temperature, humidity, and concrete cover thickness, and feeds it into the algorithms we've developed to quickly determine if the rebar is corroded and also calculate the rate of corrosion–how fast the corrosion is propagating," says Alizadeh. Corrosion is the main cause of deterioration in concrete structures and the most important parameter in estimating service life.

"A structure that's not cracked may get to the delamination [failure] stage faster than another structure that's already cracked because the rate of corrosion is different, depending on the quality of concrete, exposure conditions, and so on. iCOR can detect that," he says.

Pouria Ghods, PhD, P.Eng. (left) and Aali Alizadeh, PhD, P.Eng., demonstrate iCOR, the first hand-held device that allows the accurate, fast and non-invasive inspection of reinforced concrete.

Based on eight years of award-winning academic research, iCOR is a far cry from the older, much less accurate techniques that up until now have been used to evaluate the state of concrete. These include the widely used subjective method of hammering or chain dragging on suspected areas of damaged concrete, and polarization techniques, which are time consuming.

"Our key value proposition is that we give infrastructure owners a better and more accurate tool to prioritize their limited funding for the repair of infrastructure. Our technology is about enabling the owner or engineer to make decisions about maintenance and repair and direct those repairs more intelligently." Infrastructure owners can expect to realize cost savings for maintenance in the order of 20 to 40 per cent just by detecting corrosion early.

Although iCOR has not yet been released as a commercial product, Giatec is offering specialized consulting services to the construction industry using this technology. The company recently assisted the Ontario Provincial Police in the forensic analysis of the Algo Centre Mall collapse in Elliot Lake, to help investigators understand how future collapses of concrete structures can be prevented.

At the Elliot Lake Public Inquiry hearings on May 30, Ghods, who was invited to testify to the report of his findings in the forensic analysis of the mall's failure, explained how the company's non-destructive technology can improve the condition assessment and inspection of concrete structures.

Giatec's founders, in business since 2010, are already busy working on expanding their product line, increasing manufacturing capacity, developing worldwide distribution channels and establishing partnerships with world-class industry leaders like AMEC, Hatch, Golder and CBM, and such organizations as the Ready Mixed Concrete Association of Ontario and the American Concrete Institute.

"The upcoming revisions of the building code will include new standards for concrete durability assessment methods to improve the quality of new structures. But the problem with the deterioration of existing structures is so huge there is a lot of interest for our products right now from people who don't want to wait for the building code. They want to know now which area of their building is going to need repair and when," says Ghods.