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Canada's First Net Zero Energy Sixplex

BY ANDRÉ FAUTEUX

Like father, like sons. In 1982, René Voyer built Quebec's first-ever R-2000 home. It's thus only fitting that his sons Pascal and Jean-François are building Canada's first Net Zero Energy (NZE) sixplex.

When Construction Voyer, one of Quebec's best-known builders, decided it was time to offer homes fitted with grid-tied solar photovoltaic (PV) panels producing more energy annually than the homeowners will consume, it sent a strong signal in a province where three out of four houses are heated with cheap and relatively green electricity from renewable sources (essentially hydroelectric and a bit of wind power).

After building more than 500 houses certified Novoclimat (Quebec's R-2000-inspired program), the Voyers have taken their leadership role to new heights. "Energy-efficient homes are part of our company's DNA," said construction engineer **JEAN-FRANÇOIS VOYER**, the firm's Director of Development. "Our goal is to test the market to see if we can sell houses that are net-zero ready with off-the-shelf, cutting-edge technologies and prewiring to simplify future PV installation."

National NZE Demo

Construction Voyer has built some 7,000 houses since 1973, no small feat in Quebec where small builders are the norm, and the firm has won many awards of excellence in the process. Now owned by the two brothers, it was the only Quebec-based builder selected for the national Net Zero Energy demonstration project. The three-year, \$4.2 million project was launched in 2013 with \$1.96 million funding from Natural Resources Canada's (NRCan)

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ecoENERGY Innovation Initiative (ecoEII), with builders and suppliers sharing the balance with in-kind contributions.

The project's main sponsor, insulation manufacturer **Owens Corning Canada** (OCC), selected five leading builders to showcase 26 NZE homes across the country. The four others decided to build detached single-family homes in Halifax (Provident Developments), Ottawa (Minto Communities), Guelph (Reid's Heritage Homes opened it September 11) and Calgary (Mattamy Homes). Minto is also building four NZE town houses.

OCC is supplying all of the houses as well as its national partners: **Canadian Solar** (PV modules), **JELD-WEN** (triple-glazed, Low-E and argon filled windows), **Mitsubishi Electric** (Zuba-Central heat pump) and **Rheem** (with its new Prestige hybrid heat pump hot water heater). As does the Zuba-Central, the Rheem system produces up to three times more energy than it uses (an electric element meets peak demand) but better yet it actually provides free cooling while heating water. This because it uses the indoor air's heat generated by the heat pump, but its cooling effect won't be a major penalty in winter: the water tank will not only store internal heat gains (given off by appliances, people and pets) but also

passive-solar energy which otherwise could sometimes overheat the super-insulated building.

While green homes account for only 1.5% of consumer demand in Quebec (Écohabitation survey, 2014), Construction Voyer is targeting the growing number of buyers seeking sustainable homes. “Most people just want comfort and a good investment, but that also means housing that’s energy efficient and healthy,” said Jean-François Voyer. “It’s written in the stars that the *Régie du bâtiment* (Quebec’s building authority) will soon require ongoing energy efficiency training to keep a contractor’s license.”

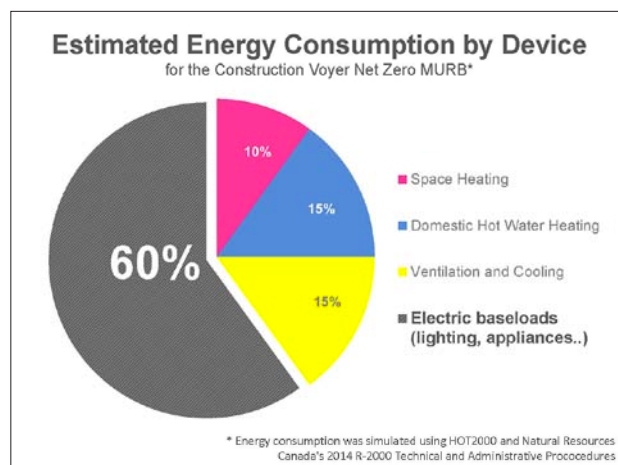
In addition, more affluent buyers are considering solar power: they want to reduce the environmental impact of centrally produced and distributed power, as well as a reliable and clean backup during outages. (The NZE homes will all be grid tied but nothing but limited space will prevent owners from adding batteries. PV production is marginal in Quebec, as grid-tied systems cost about 21 cents per kilowatt-hour compared to Hydro-Quebec’s low rates —5.6 ¢/kilowatt-hour (kWh) for the first 30 kWh consumed daily and 8.6 ¢/kWh for the balance. Since the utility has a huge surplus of renewable power, it only credits self-generated power that customers store on its grid, instead of buying it at an attractive price as some utilities do.)

“Our goal is to optimize concepts such as energy efficiency in order to develop a competitive advantage,” added Voyer. “The most important goal is to build affordable homes that are easily and cost-effectively reproducible. And it is clear that the market is increasingly going to multiple-unit housing.”

The Laval Project

The Voyers broke ground June 22 in the Duvernay East neighbourhood of Laval, a few minutes north of Montreal. Part of their 150-unit Val-des-Ruisseaux development, their NZE condos are slated for delivery by next March. The price of the 767 to 1,340 square-foot units is not yet established.

Besides 148 roof- and wall-mounted PV panels expected to produce 48,800 kWh annually, their main feature is hidden: a high-performance building envelope, with airtight R-39 walls as well as R-48 and R-60 flat and



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cathedral ceilings. The wall cavities are filled with high density FIBERGLAS EcoTouch PINK R-24 insulation. To counter thermal bridging and air leaks, the framing’s exterior is wrapped with 3 inches (R-15) of extruded polystyrene (XPS) using the CodeBord Air Barrier System. “It is comprised of our Foamular Codebord XPS board with JointSealR compressible sealing gaskets on the perimeter of the envelope, windows and doors, and all joints are sealed with our JointSealR tape to create an airtight and watertight seal,” explained OCC’s Technical Services Director, **SAL CIARLO**.

Ciarlo trained Voyer’s crews on a few of its regular houses and he said they quickly mastered the technique and loved its advantages. The main one is being able to easily achieve an R-2000-level airtightness (1.5 air change per hour or less at 50 Pascals) without having



to train subtrades to tape or caulk the interior vapour barrier they often puncture like Swiss cheese. “With this system, we always perform the blower-door test before installing the fiberglass and vapour barrier,” said Ciarlo. “A vapour barrier paint can even be applied on the drywall. Otherwise, the poly is left unsealed to allow quick drying of the wall cavity inward when it’s hot outside, as heat always drives moisture towards cooler spaces.”

A \$70 Annual Heating Bill

By connecting two triplexes and using the CodeBord System and high performance glazing, Construction Voyer shrank the building’s heating budget to peanuts: at about 850 kWh (or about \$70) annually, it should only account for 10% of electricity use, according to a simulation performed with NRCan’s HOT2000 software based on standard operating conditions and occupancy assumptions. In fact, lighting and appliances will represent 60% of energy consumption, the proportion heating typically uses in a Code-built house. “The lighting and appliances will certainly be of the highest efficiency,” said Voyer. “But these have not been fully specified yet as the homebuyers will have options to choose from.”

Construction Voyer’s biggest challenges so far arose working with local stakeholders. “It was very difficult getting the design approved,” said Voyer. “City of Laval officials had never seen PV panels on the roof of many houses and were not comfortable with having some installed on the north (street) side, so they will all be on the southern roof and wall, as well as a side wall. It also took many phone calls to find the right consultant and have all our questions answered on how to request permission to connect the PV array to Hydro-Quebec’s grid.”

In both cases, an important lesson was learned, concluded Voyer: “We probably should have engaged them really early...”

All in all, Jean-François Voyer is optimistic but realistic. His is a patient, baby-steps approach: “If in the end people ask us, ‘How much does a NZE home cost?’ I think that will mean we succeeded.”

A daily view of the Voyer worksite can be viewed here: workzonecam.com/projects/buildability/ocnetzero/workzonecam