CHRA Green Housing

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INTRODUCTION

Affordable housing providers have been early adopters of measures that contribute to developing more sustainable communities. While some affordable housing providers have found novel ways to undertake or support environmental projects in the community, the most powerful and common contribution they make to shrinking a neighbourhood's environmental footprint is to employ green practices in the development and management of their housing portfolios. The results support housing affordability, and benefit tenants, communities and the environment.

CHRA, at its 2014 Annual Congress, presented three speakers on the panel, Greener Housing for More Affordable Housing, who shared lessons they have learned from working to support and develop green affordable housing. This brief presents those lessons.

THE SPEAKERS

Jennifer Sanguinetti is Director of Smart Buildings and Energy Management at BC Housing, a provincial crown agency that facilitates the development of affordable housing targeting the full spectrum of British Columbia's housing need. Working with numerous non-profit housing providers, municipalities and health authorities, over just the past three years the agency has supported the construction of nearly 5000 affordable and supportive housing units.

Arthur Mills is Vice President, Housing, at the YWCA Vancouver, a BC Housing partner responsible for developing and operating affordable and 2nd stage housing for women and their children. Some tenants simply need an affordable home, while others require a range of supports to help them escape abusive partners or reduce substance-related harms. One innovative project houses and supports pregnant women who are active substance abusers. In total, the YWCA Vancouver operates 136 housing units and 155 hotel and residence rooms over 9 properties, with more in development.

Nathalie Doyon is Advisor, Technical Expertise Department, at the Société d'habitation du Québec (SHQ). She initiated the SHQ sustainable development action plan which introduced to Québec environmentally-friendly construction standards for affordable housing units. The SHQ currently supports energy efficiency retrofit and upgrade projects in its 73,000 older social housing units, and mandates high energy efficiency standards in new affordable and cooperative housing. More than 30,000 units have been built in the last 5 years, and over 10,000 units are currently planned or under construction.

WHAT IS GREEN HOUSING?

What makes a building green is not defined by the efficiency of its heating system, the thickness of its insulation or the inclusion or absence of solar panels. Jennifer makes the point that it cannot be defined on a standard development pro-forma. Green projects are as different as the sites on which they're built, the communities they serve, the builders who construct them, the operators who maintain them and the tenants who live in them. All those factors and more inform a building's performance, and therefore its green profile.

Building green, Jennifer continues, is fundamentally defined by the owner/operator. It flows from their deciding what building and performance characteristics are most important to them and their tenants, what goals are achievable by the project team, and what the budget will accommodate. The goal, Jennifer sums up, is to balance people, planet and prosperity, the 3-legged stool of sustainability.

GREEN BUILDING STANDARDS

While one pro-forma may not define all green building, numerous helpful tools can guide project teams in identifying and evaluating green options that might address a project's needs. Green building standards have become among the most important of those tools. Perhaps the best known multi-unit residential green building standard used in North America today is Leadership in Energy and Environmental Design (LEED), and in 2008 the Province of British Columbia mandated that every development it supported had to build to the LEED Gold standard. Further, the buildings had to be formally certified as having met that standard. Approximately 40 projects have been built and certified LEED Gold since the policy was introduced. Projects that are not eligible for LEED certification, specifically smaller and scattered developments, must build to the aggressive EnerGuide 82 standard.

While over 450 affordable and cooperative housing units have achieved LEED certification in Québec, Nathalie stated that all new provincially-subsidized housing construction in the province is required to adhere to SHQ guidelines for green site design, material selection and handling of construction waste, and to, at minimum, achieve the Novoclimat energy efficiency standard. Following the Québec-only program should result in a structure that is at least 20% more efficient than one built to the standard building code. Projects that demonstrate innovation in exceeding the Novoclimat requirements may qualify for provincial grants. Novoclimat helps drive investment in better-performing building envelopes, a critical element of today's green design that improves the availability of innovative materials while bringing down their cost. In the last 5 years, 200 Novoclimat-certified affordable and cooperative housing projects have been completed.

Says Jennifer, green building standards like LEED are important tools not just for driving efficiency, but also for facilitating important development conversations that improve

projects in every way. They force design teams to communicate and collaborate, and create spaces for owners/operators and other stakeholders to contribute ideas and input that make the end result work better for people and the environment.

USING AND MANAGING TECHNOLOGY

Most green building today incorporates systems and technologies that are much more complex than they were even a few years ago. As Jennifer points out, computer chips are now found throughout building systems, and with computerization comes complexity and the need for technical skills to manage and get the most from it. The numerous building material options on the market today also adds to design and construction complexity. For those capable of effectively leveraging the technology, though, many benefits can be realized.

Nathalie described a number of projects that are actively pushing the boundaries of our understanding of green building methods and technologies. Québec City's 40-unit Cité Verte project is highlighting the benefits of optimizing building shape and envelope. The goal, based on Germany's "net-zero" Passivhaus model, is to produce an extremely simple and efficient structure that is compact, optimizes the distribution and dimensions of openings, increases the building envelope's thermal resistance and air tightness, and incorporates uninterrupted insulation (avoiding thermal bridges). Nathalie pointed out that a key development goal is to optimize the return on investment in energy efficiency, and in a region like Québec where the winters are cold but the hydro electricity is inexpensive, that return may drive different solutions than ones adopted in Vancouver or Winnipeg, for example. In the Cité Verte case, while the development is not yet complete, modeling suggests that a design that falls somewhere between the Novoclimat and Passivhaus approaches will optimize return on investment.

A second boundary-pushing construction research project underway in Québec City with SHQ support is testing the use of wood frame construction in larger developments. The 6-story building is designed using a light frame constructed of 2"x6" lumber on one side, and a cross-laminated timber frame on the other. The characteristics and properties of the two structure types on energy efficiency, acoustics, dimensional stability, vibration and speed of construction will be systematically compared. Reducing operating costs and environmental impacts are the project's primary goals, while encouraging the use of wood to create employment in the province is also of interest.

TENANTS

Buildings do not operate independently of the people who live in them. Jennifer points out that people live in a space in the way that is most comfortable for them, and so if, for example, realizing peak energy performance requires having windows closed when

temperatures drop below zero, the building's systems must ensure that good indoor air quality will be maintained when windows are closed. If not, tenants will open windows and building performance will suffer.

Sometimes green and energy-saving benefits can only be realized by modifying tenant behaviours. Turning off lights in unoccupied rooms, having shorter showers or recycling pop cans that would otherwise go to the trash can make a building's operation substantially greener, and tenant engagement programs have proven to be effective in promoting adoption of these positive behaviours.

BC Housing has developed a set of tenant engagement resources , and experience has shown that energy savings of up to 5% can be directly attributable to supporting green-positive tenant involvement. Arthur described applying some of these strategies, including tenant meetings and social events, and identifying and collaborating with tenant leaders who then educated and encouraged other tenants to adopt greener practices. There were successes, as exemplified by one of Arthur's tenants who designed, printed and distributed to other tenants a flyer that showed in great detail what waste could and could not be recycled.

In some cases implementing these engagement strategies can be challenging. One of the YWCA Vancouver's buildings houses a tenant population of low-income single mothers, some of whom face enormous challenges simply providing for their families and nurturing their development. Engaging them around green issues initially fell flat, but after taking the time to modify the strategy to address those tenants' specific needs and challenges, progress was made. Messages were refocused to emphasize the value the tenants might derive from changing their behaviours, including, for example, participating in a community garden to reduce food costs, and raising money through bottle and can returns to fund small social events. Arthur also found that focusing on kids' involvement in promoting green behaviours within the household was effective. The tenant engagement has paid dividends, albeit incremental, and will keep paying off in the long term.

COMMISSIONING

All three speakers emphasized the importance of good project management to that project's success, and essentially two management approaches were described. One option is for the project owner/operator to manage the project itself, and the other is to hire a commissioning agent as project manager. Within those two models there are many potential variations, but there was a consensus on the panel that whether and how a project engaged a commissioning agent was a pivotal decision with great potential to impact the project's success in a range of ways. There was also a consensus that hiring a commissioning agent is strongly recommended.

Commissioning is the integrated process of building design, oversight, inspection, testing and calibrating that together minimizes construction deficiencies, addresses problems as they arise, tests and monitors individual system functioning and the ways systems work together, and ensures that the building operates as it should. It can begin in the project conception phase and extend for a period beyond building delivery.

Fully realizing the performance potential of a building's design can be difficult under optimal conditions, but proper commissioning maximizes the likelihood of success. Keys to success include:

- Start early, end late- Arthur has learned the hard way that it pays to engage a commissioning agent at a project's conception phase to help develop the project requirements, coordinate the mechanical team, review mechanical and electrical specifications to ensure they are reflected in the design, verify installation quality, verify building performance post-construction, and coordinate building hand-over and critical staff training. Periodic post-handover checks by the design engineer and commissioning agent (every 3-4 months for at least one year, but ideally for two) is a minimal recommendation.

- Do not cede control- a commissioning agent can help the owner/operator identify and articulate building and operating requirements, including a description of the manageable level of complexity and the features they want or need. While architects and commissioning agents can be great resources in this process, owners/operators should not rely on them to make those decisions. Instead they should assertively ensure that their voice is heard in every phase of the project, and that their direction is followed. Employing LEED, or a similar standard, in a project helps to facilitate these important conversations because the answers they produce are needed to meet the standard's requirements.

- Simple works- Nathalie stated that the simpler the intervention, the better the return on invested capital. Tenant engagement to promote green-positive behaviours, properly calibrating mechanical systems and installing programmable thermostats are among the lowest-cost and highest-return investments in existing buildings.

- Model the project's total cost of ownership- maintenance and system replacement costs are factored into a total cost of ownership model, and without this analysis operators may not realize the long-term savings anticipated by a design. This modeling often more envelope-intensive design, with beefed-up wall insulation and high-performance windows. These buildings keep tenants happier because the units tend to be more comfortable, and they are also more manageable for architects, builders and maintenance people.

- Build commissioning costs into the pro-forma- depending on the project's complexity, Jennifer noted, commissioning costs can add an approximately 2.5% premium on mechanical systems and a 1.5% premium on electrical systems. Average total commissioning costs started at an approximately 7% premium, and have reduced to approximately 5% with more green building and LEED experience. It has also been demonstrated that the areas where the greatest commissioning investments are made (mechanical and electrical) are the same ones that generate the largest cost savings.

- Investing time and money up front in energy modeling that predicts the impacts of design options on efficiency helps to establish the design that will optimize return on green investment.

- Because even well designed and managed projects have issues, Arthur emphasized the importance of having a plan for resolving them. It is critical to act on issues early, bringing in outside help if necessary.

- Market maturity around green design and technology varies widely from region to region, and groundbreaking projects in a region will incur higher development costs. With more green projects a market matures and cost premiums diminish.

IS A 5% COMMISSIONING PREMIUM TOO COSTLY?

Several projects funded by BC Housing have demonstrated that not commissioning effectively can cost far more than the cost of commissioning, making commissioning an important element of an effective financial risk management strategy. One project in a smaller northern BC community was not professionally commissioned because the expertise would have had been especially expensive to bring in from a larger centre. After almost two years of operation with astronomical energy costs it was discovered that system controls were not working properly, resulting in the smoking room fan and the back-up propane boiler running constantly. The main water heating system featured a much more efficient heat pump, but it never cut in. Proper commissioning would have caught this problem right away, resulting in far lower operating costs.

The YWCA Vancouver opened a building two years ago featuring a relatively complex set of green technologies, including solar panels, two domestic hot water heat pumps, and air handling units to heat hallways and common areas, and air conditioning in offices and the amenity room. The system is computerized, and stemming in part from undisclosed changes made to the heating system during construction, it caused numerous problems. For example, when the external air temperature dropped below -5C the production of hot water stopped, and the heat pump tanks rusted after just 6 months of operation leading to very premature replacement. Making matters worse, there was no domestic hot water backup system.

When Arthur went to the system suppliers for assistance he was told that they were not obligated to do the post-installation system checks and recalibrations that would have caught the problems early, and getting them to act without contractual leverage proved extremely difficult. Eventually new technicians had to be brought in which slowed the repair process and added to the project and operating costs.

MANAGING COMPLEXITY

As stated earlier, the increasing complexity of modern building systems, particularly electrical and mechanical, presents a challenge to project teams, especially the owners/operators who must operate and maintain those systems in the long term. An essential aspect of commissioning, therefore, is to identify from the outset who will operate the building, and to assess their capacity to manage its technology. Will there be an operating engineer, highly trained and experienced staff, a contractor, or essentially a janitor with extended responsibilities? The design team then needs to spec a building that the operator can be trained to manage properly. Jennifer cautions that sometimes designers will tell a client during the design process that a building system's operation is too complex to explain, and suggests that that should be a major red flag suggesting that the designer either underestimate's the operator's technical capacity or is not designing a building tailored to the client's needs. In either scenario, there is a problem that the owner/operator, with the support of the commissioning agent, must assertively and immediately address. Building appropriate and thorough training into contractual arrangements, regardless of a building's complexity, is always essential .

Technology has introduced effective options with the potential to significantly improve a building's energy efficiency, but given that the complexity they add always increases the potential for operating problems, minimizing technology while realizing project goals can be a very effective development and risk management strategy.

HANDOVER

Handover, the point at which a builder finishes construction and the owner/operator takes possession and occupies the building, is a critical phase that is often not well managed. The goal is to ready the owner/operator to effectively manage and maintain the building at peak performance levels, and the process should be formally written into construction contracts to clarify training and support needs and expectations, and to ensure proper follow-through on those commitments . Contractors have been known to interpret training requirements as simply showing up at handover and asking the new operator what they want to know about the building systems. At this point the operator may not have the experience with the building and its systems to know what their training needs are, so contracts should specify the types of training required, the timeframe in which it should be

delivered, any contingencies for training follow-up or phased training, and any other potential requirements that the owner/operator, with the help of the commissioning agent, identifies. All training should include a review of building system operating manuals and any special tools required for proper system maintenance.

CONCLUSION

Affordable housing providers have proven to be strong green building advocates and innovators who are becoming more savvy with every new experience. Provincial governments, including those in BC and Québec whose work is presented here, are increasingly mandating green standards for publicly-funded construction. This is accelerating learning around maximizing return on green investment, and is raising the level of sophistication around the application of green technologies and approaches in the design and building sectors, which in turn is reducing the incremental cost of green projects. Based on this learning, the panelists are unanimous in recommending that green developers secure commissioning expertise early and leverage it throughout the project lifecycle (which extends beyond handover), and that they ensure that building designs meet the specific needs of the people who will operate and live in them.