Community-inspired housing in Canada
Learning from Montreal  By Mark Poddubiuk

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Learning from Montreal

By Mark Poddubiuk, L’OEUF founding partner and Professor of Environmental Design, UQAM (Université du Québec à Montréal)

Les Maisons traditionnelles: affordable housing for young mothers at Benny Farm.
We find ourselves in a period of global climate change and resource depletion on a planet that cannot support man’s current patterns of consumption. Many cities face the problem of aging physical infrastructure, and most communities lack a healthy balance between individual interests and communal needs, which leads to social conflict. The vast majority of our suburban neighborhoods have little publicly owned space, and two-thirds of this minimal non-privatized space is simply roads and narrow sidewalks. Twentieth century suburban city form offered a seemingly attractive rewriting of the social contract, skewed toward individual rights through car-bound mobility patterns, generous parking facilities, and minimized gardens with an absence of communal or commercial amenities. Today there is a push among those who want to maintain the suburban dream to individually correct the unbalanced “ecological footprint” by adding technological fixes in lieu of complex sociocultural changes, especially regarding housing and lifestyle.

As an architect I’ve always had an interest in housing, and I am a strong proponent of social housing, though the term “social housing” is somewhat of a misnomer in the North American context. I’ve always been interested in communities that take some responsibility and some initiative, kind of an intentional community, a group of people that decide to come together and develop a project and make something better. This mechanism is completely contrary to how the vast majority of North American cities are developed. The environments we grow up in are created by some city department or, more often than not, by private developers building for some anonymous client that some marketing consultant has imagined for them. What is commonly referred to as social housing might better be called community-based housing. Social housing is stereotyped as subsidized housing for poor people, but that is not the true essence.
It is more of a collective approach to developing a physical and social community instead of a top-down approach.

Built in 1947, Benny Farm is a landmark of classic social housing in Montreal. When the redevelopment of the site was announced in 1992, I saw it as a remarkable opportunity within a healthy and well-developed neighborhood to begin to redevelop a significant site to respond to the current needs of the community and to look at the idea of renovation. I got heavily involved with a series of community groups in trying to support them and work with them in terms of different alternatives for the development, because it had become clear that the federal government was looking at demolishing all the buildings and selling the site to a private developer. For me this would have been a missed opportunity. Through this involvement, the nature of the redevelopment gradually emerged over several years. The project was fascinating, the potential tremendous, but the complexities formidable.

L’OEUF and the Fonds foncier communautaire Benny Farm, the community organization driving the project, came very close to actually acquiring the site from the federal government in 2001. For a variety of reasons, that acquisition didn’t happen. The government pulled out and decided to carry out the project themselves. We lost the battle to acquire the site and realize a community-based project, but it later turned out that much of the redevelopment project was built very much as we had envisioned, in appearance at least.

The project took a turn. Instead of being built upon community needs, experimentation, innovation, and looking at different alternatives, it became an exercise about trying to find ways to realize the project within existing programs and existing funding, a little bit out of the ordinary but still within the strictures of funding and social housing programs. Benny Farm comprises 14 different projects, seven of which we were involved in. Over the years, we managed to markedly influence the overall development strategy for the complex. Even if 60 percent of the buildings on the site were eventually demolished, the approach that was taken was to ensure a certain degree of renovation of existing buildings and to respond to needs for affordable housing within the community. These were two of our major issues which were not part of the original concept of the project. As activists, we achieved some of the change we were fighting for, but we fell short of achieving the full potential that Benny Farm offered.

Our intentions were precisely in line with what has since become known as sustainable construction. We were striving to pioneer subsidized, affordable, green, community-driven housing with high social and urban quality, to preserve the spirit of place as a local cultural institution, and to implement a better way of development, learn through the process, and pass on the knowledge and insight we gained. We learned an immense amount through the project, and we wanted to apply this knowledge to a next large-scale project.

And we did. A group of people who knew us through the Benny Farm project approached us to help them develop a new collaborative residential development in Rosemont. A second cooperative joined the project, giving a workable size to the project. Unlike at Benny Farm, we were able to work with the actual owners and future residents of the planned development, so we could conduct a true integrated design process (IDP), shaping the project in close collaboration with the users. The users wanted green subsidized housing with high social and environmental quality. At Benny Farm there was a building for each type of user; at Rosemont there is a
varied and broad mix of users within each building, and all share the same communal courtyard. This courtyard is private property, but it is open to the public; anybody can walk through. Such semi-public or semi-private common space is not traditional in Montreal. In North America, open space is either completely public or completely private, and that hinders the social quality of our cities. The design promotes social cohesion; the community was more cohesive after a few months than in many neighborhoods that are much older. Putting people first and automobiles ast, Rosemont is a healthy urban building block. Recognized as an important model, it has become one of the most visited housing developments in Canada.

We try to document our projects so that others can learn from them, and this book is an important part of that, as it summarizes everything important about our two most progressive, and most influential projects completed to date, projects that exemplify our attempt to change the way communities are designed and built. This is not spectacular architecture, after all, it’s social housing, and the book is more a discussion of the challenges and the process than a snapshot of the final outcome. In these pages, we share insight into the complexities of new green technologies, subsidy programs, nonprofit utility co-ops, working with co-ops and government agencies, managing the challenges of building affordable green social housing, “future proofing,” provoking change in legislation and in the construction industry, and breaking away from standard procedures. Architects, co-ops, developers, builders, engineers, and government agencies can benefit from what we share in this book. There is a chance for changing the way we build only if every player along the chain is committed to a shared vision. The stories of these two projects will hopefully inspire many other such projects, even better ones, across North America and throughout the world.
Sustainable development and architecture are multifarious subjects intertwined with many other complex issues. To make sustainable construction easier to understand, assess, and practice, the Holcim Foundation for Sustainable Construction developed a five-point definition. These five “target issues” serve to measure the degree to which a building contributes to sustainable development.

Three of the five target issues align with the primary goals of the Rio Agenda: balanced environmental, social, and economic performance. A further target issue applies specifically to building – the creation of appropriate buildings, neighborhoods, towns, and cities. The final target issue recognizes the need for significant advancements that can be applied on a broad scale.

The five target issues are explained in detail and illustrated at www.holcimfoundation.org/target. The pages that follow summarize the five criteria and how Benny Farm and Rosemont meet them.
The redevelopment of Benny Farm was the world’s first government-subsidized, large-scale, community-driven neighborhood renewal project combining affordability, green building technologies, rehabilitation, and new construction. This urban, landscape, and architectural project is a pioneer of sustainable urban renewal.

As part of the project, the nonprofit utility corporation Green Energy Benny Farm was formed to develop, own, and manage a common energy-and-water infrastructure for several nonprofit housing organizations. The scale, diversity, and scope of the proposed environmental measures made Benny Farm the most advanced attempt of its kind in Canada when it was conducted.

Benny Farm and its successor project Rosemont respond to the full range of sustainability challenges: social, ethical, technical, environmental and economic. As innovative and highly transferable examples, these projects hold great potential for the sustainable upgrading of aging urban neighborhoods in most countries.

Benny Farm and Rosemont have made an important first step in Montreal toward a change in attitudes and wider adoption of sustainable approaches. The overall strategy and the technologies proposed have advanced the local construction industry, public policy, and general expectations toward affordable construction.

In both projects, the architects and stakeholders pressed hard to change current attitudes, rules, and ways of thinking and working – knowing that achieving sustainability requires new mindsets, behavior, and practices more than new technologies.

Innovation and transferability

Significant improvements in the construction and use of buildings of all types must be realized on a broad scale to achieve global sustainability. Practices and strategies that transfer best are those that are affordable, simple, and broadly applicable.

The multifunctional interior courtyard at Rosemont exemplifies an amenity rarely found in social housing projects.
Benny Farm was rehabilitated explicitly for less-privileged sectors of society, including seniors, physically challenged, single mothers, first-time homebuyers, and others. This project and Rosemont gave less-affluent segments of society a say in shaping their own housing and their future, a generally neglected precondition for sustainable urban development.

Preservation of the social mission – affordability, social quality, and green public spaces – of the original development, incorporation of many stakeholder groups throughout the design process, and establishment of a nonprofit, community-run utility company, Green Energy Benny Farm, were fundamental aspects of the Benny Farm project.

Green Energy Benny Farm had a secondary goal of supporting sustainable development within the broader community. This included an education program for residents and visitors on the purposes and means of GEBF as well as an outreach program to disseminate the development model.

Embracing a community-driven vision, Benny Farm and Rosemont were conceived to place long-term control of the housing development in the hands of the resident groups. At Benny Farm this was done by first empowering the residents during the construction phase and then by establishing GEBF. At Rosemont the long-term visioning from the residents started from the very first charrette and continues today, as the buildings are prepared for future green upgrades that the residents can decide themselves and implement over time.

Rosemont was developed through an integrated design process, a collaborative process through which the future residents decided on the communal character of their project. Consequently, from the first day of occupancy, Rosemont displayed neighborhood qualities and a social mix that usually take years to develop in conventional developments.

Ethical standards and social equity

The built environment significantly influences quality of life and social interaction. Sustainable construction requires fair and respectful treatment of everyone affected during the design, construction, use, and recycling of buildings and infrastructure.

With public and private areas, the Rosemont courtyard is an ideal setting for social interaction.
The renovation of buildings is essential to sustainability and was a prime objective at Benny Farm. Over a third of the original buildings were saved from demolition, and much of the original materials and equipment were reused, diverting waste, saving embodied energy, conserving resources, and resulting in lower greenhouse gas emissions.

The new construction and rehab projects at Benny Farm incorporate extensive green strategies: material reuse, waste minimization, durable and energy-efficient envelopes, passive preheating of fresh air, a geothermal heating system, hybrid glycol/solar water heating, radiant heating and partial cooling, air and water-based heat recovery, water conservation, and on-site stormwater retention.

Rosemont incorporates a full array of passive and active environmental strategies: cross ventilation, high-efficiency envelopes, waste-heat recuperation, a central geothermal system, stormwater retention, permeable outdoor surfaces, trees as buffers, clotheslines instead of electric dryers, and more. The water and energy savings are significantly higher than code and standard housing projects.

The infrastructure and construction protocols are at the ecological heart of both projects. The geothermal systems implemented in the projects have the lowest environmental impact of any option. The environmental impact of on-site renewable energy sources is drastically lower than that of transporting energy or burning fuel.

Rosemont was built to include the necessary provisions for additional environmental, infrastructural, and risk-management measures, which could ultimately approach the net-zero concept. The buildings are prepped for “deep greening” over time, the flexible and staged addition of photovoltaic systems, green roofs, solar hot water systems, photovoltaic systems, etc.

Environmental quality and resource efficiency

The way we build must preserve the planet, respecting land, air, water, and ecosystems as life-supporting resources. Buildings must spare finite resources, avoid carbon emissions, eliminate waste, control pollution, and provide environments that are healthful for all life forms.

Passive design elements are a recurring theme at Benny Farm.
The redevelopment of Benny Farm delivers multiple economic benefits at the municipal level. The project tripled the number of much-needed subsidized housing units on the site while requiring no expansion of the civic infrastructure.

In a new participative model for shared infrastructure, three nonprofit housing organizations joined to redevelop Benny Farm, and GEBF was pioneered as a new legal and economic model. This groundbreaking model unites all levels of social organization, from individuals to various government officials and agencies, to exploit the economies of on-site energy production and shared infrastructure.

Rosemont incorporates innovative partnerships and financing models by bringing together diverse stakeholders, government, finance, and energy agencies. The robust financing model incorporates risk-management principles and lifecycle costing. It will document the compatibility of ecological and economic performance within a socially equitable framework.

Rosemont is designed for immediate affordability as well as long-term economy. By prepping the infrastructure for later additions and improvements, the initial cost is held low while future improvements are made more affordable. These future improvements will significantly reduce long-term energy costs, providing greater financial security and flexibility.

Both projects apply the cooperative and non-profit organization as an ownership model, where community benefits above private interests are seen as an urban resource rather than a commodity. This approach builds long-term value for the community instead of yielding short-term gain for a few individuals.

Economic performance and compatibility

Buildings must be financially feasible to build, operate, maintain, adapt, and ultimately remove. They should support sustainable economic mechanisms, activities, and purposes. Construction projects can stimulate economies, lead to economic integration, establish and support livelihoods, and equitably distribute wealth.

The solar preheater for make-up air at Benny Farm is a one-time investment in free energy for the lifetime of the building.
The rehab of Benny Farm grew from its geographical, urban, and historical context. The refurbishment of the abandoned and dilapidated complex mended the urban fabric in an architecturally, environmentally, financially, and socially sensitive way, preserving and respecting the identity of the neighborhood.

The redevelopment masterplan proposed at Benny Farm was designed to reinforce the public domain. The project’s streets, squares, landscaping and interstices collectively enrich the urban experience and add cultural value. Given a much wider definition of the public domain, the city can become a collective work that is a subject of concern for a wider range of the population.

Benny Farm shows that the greening, renovating, and densifying of the urban fabric of aging gardencity developments from the twentieth century can safeguard public and third-sector housing from privatization while ensuring sufficient capacity and vibrancy for long-term economic independence and renewed infrastructure.

The spatial organization of the buildings at Rosemont treats street and landscape as unifying amenities and urban resources. Adopting traditional European typological form, the peripheral ring of buildings defines positive outdoor space in both the streets and the courtyard, which serves as a multi-use green commons.

Benny Farm and Rosemont both exemplify the essential mechanism of greening and densification of urban contexts. The correspondence between buildings and outdoor space is carefully planned to achieve optimal land-use density while providing well-proportioned private, semi-private, and public outdoor green spaces.

Sustainable architecture is appropriate, durable, and adaptable. It provides attractive, comfortable, and functional environments. It enhances its surroundings, fitting functionally and aesthetically into its context, providing culturally valuable indoor and outdoor spaces.

Rosemont comprises 155 affordable housing units, achieving ideal density on a central site.
The history of Benny Farm

By Daniël Pearl, L’ŒUF founding partner and Associate Professor at the School of Architecture at the University of Montréal (UdeM) and founding board member of the Canada Green Building Council.
among citizens who advocated an alternative plan: rehabilitation as public housing. A thirteen-year battle over the future of Benny Farm had begun.

In 1994 L’OEUF proposed a masterplan for the site that included a mix of new buildings, renovations, and additions. This plan retained Benny Farm’s garden city attributes and featured a marvelous central square. In 2001, a coalition of community activists and nonprofit groups by the name of Benny Farm Community Land Trust was given six months to raise CAD 5.7 million to purchase the entire site to realize this plan. When the coalition failed to raise the money in time, the dream was shattered for many.

Seeing it as the end of Benny Farm, many activists who had been engaged since 1992 capitulated in 2001 or 2002. Some new people joined, replacing those who had contributed so much, taught the others social activism, and burned out struggling with the endless frustrations of funding, deadlines, and politics. L’OEUF tenaciously stood in and fought for the project throughout its duration.

Preserving the buildings at Benny Farm was seen as a fundamental premise because the complex is socially, socioeconomically, historically, symbolically, urbanistically, and environmentally significant. Wholesale demolition and replacement of the buildings would have destroyed most of these important attributes. Benny Farm is an institution and a landmark in Montreal, albeit a
maintained and remained in serviceable condition. The buildings were not up to modern standards but they were fundamentally good buildings to renovate, which could be done at roughly the same cost as new construction. Discarding serviceable materials and replacing them with new ones is always a loss of material and energy resources. Resource efficiency was not the main force behind the rehab project, but it was a legitimate and tangible argument.

In 1999 the ownership of Benny Farm was transferred from CMHC to Canada Lands Company (CLC), which manages, redevelops, and/or sells modest one. As a very large sub-community for over 60 years, it is indelibly anchored in the minds of tens of thousands of community members. This once-proud place has a heritage to be respected and preserved. Places such as Benny Farm are what make cities unique and urbane.

The buildings themselves are not stylistically significant, but they are architecturally valuable at the urban scale. The undulating facades define well-scaled green spaces. As a garden city fragment, the overall complex has always been an urban amenity, a distinctive and special place within the city – one of the rare places where public-private and semi-public-semi-private spaces exist, promoting healthy social intercourse in the neighborhood. For instance, parents can keep an eye on their children in a collective fashion. These types of outdoor spaces are what make the garden city a valuable model: it can provide a perfect balance between green space and density. Benny Farm is also an icon of its social mission, affordable housing, as urgent today as it was in 1947.

Saving the old buildings would also have moderate but significant environmental advantages. Much of the substance had been adequately

strategic government properties across Canada that are no longer required for program purposes. CLC regional manager Jim Lynes saw an opportunity to seek a better solution than replacement. He set up a task force and initiated a design competition for rehabilitating Benny Farm in a socially responsible way. By that time, 20 percent of the buildings had been demolished and the seniors had been moved onto a quarter of the site. For the rest of the site, the ideas competition led to a new masterplan that called for renovating 35 percent of the old buildings. The density would be less than 1,200 units, and a good social mix would be provided, with 75 percent of the units being either affordable housing or social housing. This new plan was seen as an outstanding achievement in an affluent neighborhood, one that would have been impossible without the efforts of activist coalition. With a workable alternative plan in hand, the razing of Benny Farm as envisaged in 1992 was finally stopped in 2004.

The nonprofit community-housing organization Habitations Communautaires Notre Dame de Grâce (HCNDG) bid on the parts of the site that were offered to the private sector, intending to build and manage new units offered at sub-market rates. At the time HCNDG submitted its bid for three sites, over 80 people had signed statements of interest in the 74 proposed units. HCNDG was awarded the sites, prevailing over a number of private developers with conventional proposals. Thus the Affordable Home Ownership Initiative (AHOI) at Benny Farm was born.

What followed was an urban-scale pilot project (within the larger redevelopment), named Greening the Infrastructure of Benny Farm, combining neighborhood improvement, social preservation, green rehabilitation, and new affordable housing – the gradual renovation of 60 existing housing units and the construction of 127 new units on four properties, each linked to a common energy, water, and waste infrastructure, the ownership and management of which was to be handled by the nonprofit, community-run utility company Green Energy Benny Farm (GEBF). Technical merits of this original plan include a much smaller carbon footprint, low water consumption, wastewater management, and waste reduction through retrofitting, reuse, and waste diversion.

The masterplan that L'OEUF proposed in 1994 was not adopted but it strongly influenced the masterplan that was ultimately realized on the site – a total of 14 housing projects, four of which were handled directly by L'OEUF, and three of which L'OEUF collaborated on. Thus L'OEUF's proposal raised the bar, causing the chosen design to be as green as possible. The overall redevelopment of Benny Farm did manage to build approximately 570 units of affordable housing on the Benny Farm site in new and rehabilitated buildings – providing opportunities for rental and home ownership for those who could not afford normal local market prices: seniors, young mothers, low- and moderate-income families, co-ops and people with special needs. A land trust model was envisioned to keep the units affordable for future generations, but it proved too complex to apply under Quebec's civil code. Nevertheless, various measures were put in place to keep the housing affordable over time.

Benny Farmers demonstrate, want answers
By Michael Bourque
Residents of the Benny Farm housing development in NDG were backing up the call of Mayor Jean D. Tremblay to delay demolition to rework an alternative to the plan to raze the complex.

The group of about 60, most of them residents or welfare clients, demonstrated outside city hall in hopes of drawing the mayor's ear to answer their concerns about the delays in approving the construction of new units to replace the Wilfrid Laurier buildings. The seniors are senators and many of them have difficulty negotiating the stairs in the buildings, which have no elevators.

The CCA's Montreal Housing Corps, which owns Benny Farm, announced rehabilitation plans in March 1991, and dispatched a proposal for housing units to the City.
Providing housing for the less-affluent was the original mission of Benny Farm, and five decades later this was again an essential objective of the rehabilitation project. Instead of financing the project by privatization, as initially proposed by CMHC in 1991, an alternative form of investment and ownership was sought that would benefit the community. The project was to be economically feasible but not financially driven, like most private developments, and it sought a balance between community and individual needs. The old neighborhood was to be revitalized, affordable housing for a range of groups ensured for the long term, and the occupants provided with healthful and comfortable homes in a respectful surrounding. The social dynamic that Benny Farm was once known for was to be recaptured, and Benny Farm was to reassume its civic role as an attractive neighborhood, an icon of social equity in Montreal. Going a step further, environmental compatibility was added to the list of objectives. The garden city fragment was to be updated: greened and densified.

Greening and densifying urban contexts is what Daniel Pearl, founding partner of L'OEUF, is most passionate about as an architect. These principles lie at the heart of sustainability, and they drove the design at Benny Farm. Pearl says the trick is “to find the sweet spot between the ecological

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<td>B1: Seniors residence with elevator</td>
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Benny Farm: to renovate or to demolish?

PIETER SUKES
SPECIAL TO THE GAZETTE

In architecture as well as in constitutional debates, some issues that ought to be straightforward become so muddled that opinions are no longer based on actual facts, but on the hype surrounding the facts. The debate over Benny Farm housing complex does not, of course, compare in importance with the referendum, but the muddle about the issues surrounding its future is of capital proportions. So for a start, let's spell out the verifiable facts.

Located in the west end of Montreal, the Benny Farm housing project consists of 384 two-, three- and four-bedroom apartments, distributed over 64 three-storey buildings. These buildings occupy a generous site of about 18 acres. Erected after the footprint, which looks for the highest density possible, and the carrying capacity of the site, which says we don't want so much density that it takes away the greenness, the light, the air that we need. New garden city fragments like Benny Farm were built at a density that is inconsistent with a good ecological footprint today. In the 1940s the global population was three billion, and cars were relatively few. Today we have a crisis, and we must ask: What is regeneration, requalification, rehabilitation? Pearl says "It's not renewal in the sense of demolish and rebuild. In the broad context of global unsustainability, the question we must ask is: How do we green and densify what we have? Whether it's suburbia or urban context or third-world countries, holistic urban fabric is the multiplicity of scales, the community, the block, the building, and how it all works together technically, socially, and economically. This is the essential thought behind the redevelopment of Benny Farm -- to renovate the old buildings and densify the site by adding building typologies that the old structures cannot easily accommodate."

The overarching vision for the redevelopment project was to find a new and better prototype for sustainable housing. Today there are thousands of social housing projects around the world and thousands of green buildings, but in the early 1990s this was the first large-scale project that sought to combine both. The apparent contradiction is that social housing is low-budget whereas emerging and green technologies are expensive -- but the two actually go hand in hand because, in the long term, buildings that are environmentally sound and energy efficient are more economical for everyone: the tenants, the owner, and the city. L'OEUF took on the challenge of attempting the untested combination.

The new model directly addresses social, environmental, and financial targets -- the "triple bottom line of sustainable development" -- a phrase that would be coined several years later. The goals for the redevelopment project were as diversified and ambitious as sustainability is complex. The scope and scale of intentions ranged from technical systems within buildings to neighborhood quality, city infrastructure, regional biodiversity, provincial policy, and the development of templates for global solutions. The most tangible and immediate goal of the project was to save the existing buildings, explains L'OEUF founding partner Mark Poddubuk: "It's a question of
principle. Insisting on the renovation of the existing buildings created rigor in terms of the development of the site – you can’t just do anything. There are certain restrictions – infrastructure, scale, and so forth – and that discipline forces you to do certain things. And with that we also inherit a certain modesty about the site, about the architecture. The buildings of Benny Farm, even the new buildings, are very ordinary. And that’s the great strength, housing should be ordinary. Keeping the existing buildings meant that we framed the project completely differently – a project with a certain affordability, modesty, economy of means, in the character that was part of the whole history of the development going back to postwar veteran housing.

This design diminishes the economic value of the site. The site was worth more with no buildings on it than it was with the existing buildings, from a real estate point of view. So what we proposed was not speculation, but responding to needs of the community. Keeping the buildings on the site is an incredibly useful tool; it’s a mechanism to diminish the speculative value of the property and it makes you move to talking about more fundamental issues about making cities, making environments, making neighborhoods.”

The decision to renovate the existing buildings was economically, ecologically, and socially motivated. While reuse exploits existing material value and diverts waste headed to landfill, it also promotes a sense of community continuity and takes value in the established social patterns of the neighborhood. L’OEUF partner Sudhir Suri expounds: “Even when the site seemed dead, the social memory of what was there was remarkably strong. I think it’s important to look for this kind of incipient memory in communities. What is it that the community holds dear? It often points to real architectural and urban design opportunity. That is something that is conventionally left out of planning and development proposals. We too infrequently talk to the community to find out what’s really of import to the community. There’s tremendous potential there, and it’s not part of the regular way development works. Wherever you have once had strong communities you will have this kind of resilience of memory around which you can build very powerful projects. It’s not always best to change the face of the city – in fact, it’s often inappropriate.”

L’OEUF’s studies showed that, in general, the old buildings at Benny Farm could be upgraded and rehabilitated for energy efficiency and to meet modern standards at the same cost as demolition and replacement. Daniel Pearl sees the potential for wider use of this approach: “We really tried to focus on things that anybody else can apply, such as the reuse of existing materials. Of course, the old buildings lacked good fire resistance, which we had to deal with. So, even though these buildings were built in the 40s, we had many of the same building types that were used everywhere in Montreal in the building stock that’s now 100 years old. Most if not all of the things we’ve done here can be applied to basically any of these buildings in Montreal.”

Given that the global building stock is massive, growing, and continually aging, and that housing is the commonest of all building types, preserving and upgrading residential structures is a key to achieving sustainability. Renovation conserves resources, makes use of the embodied energy already invested in buildings, uses materials more efficiently, reduces waste, and significantly reduces greenhouse gas emissions. Sudhir Suri sees renovation also as a cultural issue; it should be a natural consequence of the way society should care about stewardship and consumption: “I dislike the
idea of using things and then throwing them out. Why throw something out if you don’t have to? If you’ve got a pile of bricks, why not reuse them? There are some things that are harder to reuse — like using radiators with geothermal systems — but with some thought you can usually figure out a way to make it work. And we did.”

L’OEUF’s early studies in 1992 to 1994 looked at hybrid redevelopment strategies, tells Pearl: “We wanted to add new barrier-free buildings because modifying the existing buildings to make them barrier free would be cost prohibitive. But where and how to infill was not simply a technical issue; we had to understand and respect the original masterplan and landscape principles, going back to the roots of garden city planning.”

The environmental goals of Benny Farm included resource conservation, waste diversion, pollution control, energy efficiency, on-site green energy production and water management, and support of biodiversity. Suri says that architects tend not to connect with biodiversity although the financial advantages of having parks and bio-rich areas in cities are significant: “It’s very important that we learn to have the water that we otherwise pollute and flush out of our city become part of our parks network and part of the natural corridors through the city. But there are so many tendrils and cities are so big and so siloed that it’s actually very difficult to get all the different parts talking to each other.”

A micro-environmental goal of the project, but nonetheless an essential one, was to ensure a healthy indoor environment within the buildings. Airtightness is required for energy efficiency in cold climates such as Canada, and toxic emissions from processed building materials can accumulate inside tightly sealed buildings if air changes are not ensured, causing so-called sick building syndrome. The approach chosen for Benny Farm was to upgrade all building envelopes and install adequate ventilation systems incorporating passive and active energy recovery. Materials with potentially toxic gas emissions were to be eliminated or replaced, and inefficient mechanical ventilation systems would be upgraded to improve effectiveness and minimize energy consumption.

The CMHC is told to come up with a new proposal involving the renovation of a veterans’ housing project in N.D.G.
Developed by and for the local community, Green Energy Benny Farm (GEBF) was formed in 2005 as a nonprofit community-run utility company to oversee the ownership, management, and reinvestment in the common energy, water, and waste infrastructure serving the three nonprofit housing organizations Chez Soi, ZOO (Zone of Opportunity), and HCNDG, built in the first phase of the redevelopment of Benny Farm. This company was made possible with a grant from the Canadian Green Municipal Fund (GMF), which supports investment in innovative municipal infrastructure projects. Itself a demonstration project, GEBF aimed to prove the feasibility of its economic model and its applicability to a variety of situations.

GEBF’s mandate was to manage the infrastructure, including maintenance, monitoring, and expansion, according to a 30-year business plan that would balance energy revenues, operating costs, and the costs of maintenance and management. The savings generated by capturing renewable energy on site was to provide for continual reinvestment in the system, one of the primary economic innovations that made the project possible. Developed by grassroots stakeholders and designed to expand in phases, GEBF provided a protocol for construction for wastewater management and the reduction of greenhouse gas emissions, water consumption, and solid waste generation, through retrofitting, reuse, and waste diversion. The mission of Green Energy Benny Farm furthermore included a commitment to sustainable development within the community, specifically through an education program for residents and visitors on the purposes and means of GEBF as well as an outreach and development plan intended to disseminate the model GEBF developed.

Green Energy Benny Farm emphasized the use of locally appropriate technologies over technical sophistication as a goal in itself. The model proposed that distributed and local energy production and water management can be more efficient, more reliable, more economical, and more environmentally compatible than conventional large-scale long-distance
networks. The infrastructure and construction protocols are the ecological heart of the Benny Farm project. On-site renewable energy sources create only a fraction of the environmental impact of transporting energy or burning fuel. The geothermal system installed at Benny Farm has the lowest life-cycle cost and the lowest environmental impact of any option. It is coupled to water-based radiant systems to efficiently heat the buildings.

GEBF was envisaged to sell heat from the thermal exchangers to its members as well as maintain and operate all of the energy and environmental-quality equipment on the site. Proper maintenance of these systems is the key to ensuring that the energy savings are sustainable, and GEBF was to develop and apply the necessary expertise to ensure that the residents reap significant energy savings for decades. Operational energy costs of the system were designed to be 65 percent lower than the costs of conventional systems. The projected real income from energy savings over the first 15 years of operation was CAD 640,000.

Technology-related decisions were made considering local know-how in the construction industry and specific possibilities present on site at Benny Farm. Through GEBF support, the project integrated many building materials and much equipment salvaged from the old buildings. In addition to having a positive impact on waste diversion and saving embodied energy, reusing materials also contributed to developing necessary skills in the local construction industry. Although most of the techniques used are well known, they are usually ruled out because of the complexity they appear to entail. Standard construction materials and methods are generally preferred, even though these can result in a product of lower quality. This is especially common in larger projects, due to time constraints and quality-control concerns. This is an acute problem locally but is symptomatic of
chronic problems in the construction industry worldwide. GEBF demonstrated that the environmental and fiscal benefits involved in planning, building, and managing in this way outweigh the risks, and the project proved to the local industry that this is a valid strategy.

Most electricity in Quebec is generated in hydroelectric power plants far away from the population centers. This has three drawbacks: Dams disrupt and destroy ecosystems, power transmission over long distances is inefficient, and the decentralized system is potentially fragile. Ice storms in Montreal can take down power lines and cause extensive blackouts for weeks. Power in Canada is significantly cheaper than many other countries; for instance, seven times cheaper than in France. Cheap energy provides no incentive to invest in efficiency improvements or innovative solutions, which thwarts potential progress.

Sudhir Suri is inspired by the challenges and the potential of developing better energy solutions in this context of so-called “green” cheap energy: “What keeps me going when fighting those fights and trying to figure out those solutions? Solutions that we create in this kind of environment, a low-cost energy environment, can inspire change in countries where countless coal-fired plants are being built to support expanding populations. If lightening our footprint is one of our goals, we need to take on the idea that it’s important nevertheless to solve energy problems where energy is cheap. And we have to redefine “cheap,” globally. In some countries where energy doesn’t cost much, they just build another coal-fired plant and off they go, they’ve got all the “cheap” energy they need. The damage to the environment may be obvious to us, but the monetary imperative is very important in those places. And so if we come up with solutions here in Quebec, a low-cost energy environment, those other jurisdictions might actually pay some attention. And that could have a huge impact. That’s what keeps me going.”

The goals of GEBF were very ambitious, especially the financial goals, continues Suri: “In a way, this project was ahead of its time because we tried very hard to deal with water – and there is very little financial feedback from water. In the future there will be a financial incentive. But the goals that were set for Benny Farm were too far in front of the way they could be sustained financially. That was always a potential risk. As it turned out, some of the things we wanted to do with water we couldn’t do because we couldn’t find that financial justification. The decision-making criteria revolve around finances.”

Water management is an environmental and financial concern with ramifications that extend far beyond the site, explains L’ŒUF partner Bernard Olivier: “Since Benny Farm, we’ve been involved in a study to look at how rainwater can be managed more effectively on the site of individual buildings instead of being carried to the municipal infrastructure. The city of Montreal has a rainwater problem. The combined sewers of the city are obsolete and undersized. They regularly overflow, there is regular flooding of private property, there is regular wastewater discharge into the St. Lawrence River, and there’s no money for fixing it up. So they’re looking at how we could fix some of these problems upstream.

At Benny Farm, with the assistance of civil engineers at Vinci consultants and consultant/client representative Alex Hill, we tried to deal with that in another way. The problem now is that the individual owners of the property have no incentive to implement any of this. It’s too convenient to be connected to the infrastructure and see the wastewater disappear. So
the city is looking at whether there will be subsidies, or regulations, and so on, and they are looking at ways of reproducing some of the ideas that were implemented here.”

L’OEUF aimed to demonstrate the long-term financial viability of green infrastructure through GEBF. Careful economic consideration played a role in both the design of the project and its long-term feasibility. The benefits of GEBF were expected to extend beyond the site to the greater community. Daniel Pearl explains: “There are huge capital costs to this green infrastructure that we never could afford within social housing budgets. The goal was to guarantee that you have significant savings over time. Some of it goes into maintenance, some into rebuilding the infrastructure over the long term, some goes right to the residents, some goes to the benefit of the larger site of the GEBF, and some goes to the larger community.”

**From theory to practice: The operation of GEBF**

Although L’OEUF was responsible for the application for the GMF grant that made GEBF possible, once the grant was in hand it had to distance itself from the GEBF board because of the potential conflict of interest. Laura Blackader, operations manager of the project for the government agency FCM (Federation of Canadian Municipalities) in Ottawa, who reviewed and administered the dossier, appreciated the critical social issues being addressed through the Benny Farm project. Up to 2004, most grants were technically rather than socially oriented, and she was determined to assist this community-led endeavor.

As a nonprofit organization, GEBF had a board of directors from the beginning. Five of the nine board members came from the three Benny Farm projects that were to benefit directly from the GMF grant: Chez Soi, ZOO, and AHOI II (a project overseen by HCNDG). The other four board members represented the community at large and brought along experience to guide the less-seasoned board members.

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force, which was that GEBF should be a community organization.” The
green technologies were planned during the design phase of the project, but
they could not be included in the contract documents of ZOO or Chez Soi
because the grant had not yet been awarded. The project consultants did not
have the luxury of doing a truly “loose-fit design” because there would be no
leeway within the conventional social housing budgets to do so if the grant
were not to come through. The addition of numerous green measures during
the construction phase added a whole new layer of complexity.

Daniel Pearl explains that timing remained an ever-present issue: “The
GMF grant came in just a little late – just after the construction startup of
Chez Soi and ZOO, so some of the design and construction of the sustain-
able construction aspects ended up being retrofitted, not in the sense of
major changes, but there was some redesigning on the fly. That’s always
challenging, and it involves change orders. This construction process
remained a challenge right up to the end of construction. We never really
had the cash flow to make it to the next step, and the geothermal system

board remained the same since day one. Alex Hill, environmental program
manager and civil engineer, was hired as project manager for GEBF to
oversee the work of the volunteer board for most of the duration of their
work. The board worked as a team with L’OEUF.

Nancy Dunton, an architect and journalist who had followed the project
from the early 90s, played a critical role in ensuring continuity from theory
to practice. She collaborated effectively with the GEBF board members
from Chez Soi, and this project’s experienced board members Bob Butler
and Jeanne Mayo were constantly available to lend a helping hand, since
they were retired volunteers. Nancy Dunton explains the evolution of GEBF:
“Chez Soi, the seniors housing tract at Benny Farm, had been in service for
six years, and somebody had to be trustee of the GMF grant. That’s how
GEBF came into being. It started out being an energy services company to
provide heat for the buildings, but due to the complexities of coordinating
the development’s various building projects, with timelines years apart, the
concept had to be redefined. But we always adhered to the initial driving
and the solar hot water systems required more robust cash flow and operational resilience.” “The grant payment model that the municipal government uses for such projects is basically based on a whole wrong set of assumptions,” adds Nancy Dunton. “As a nonprofit, you haven’t got a bank account. As a nonprofit board, we actually went and negotiated bridging loans – which is unheard of – but it worked because the bank believed in the project. Also, many of the contractors gave us more time than normal to pay because they understood our situation. That helped too.”

Although Chez Soi was eventually completed quite successfully with many of the renewable systems incorporated in its basement and on its roofs (geothermal and solar thermal as the two largest ones), the second and furthest building of the three, ZOO, had its own challenges, as its base renovation and new construction were not completed by the same general contractor. Confronted with an extremely long list of deficiencies from the base construction, the board members of ZOO decided to dismiss the general contractor and sought to complete the work with government assistance. The coordination of both the base specifications and construction details and the additional renewable technologies added after the awarding the GMF grant progressed slowly, encumbered by legal complexities. The engineering of the heating systems for both ZOO’s base systems (gas boilers) and the renewable energy systems (geothermal and solar hot water) was not simple, especially as two thirds of the units were renovated housing units and one third was new construction. Also, the introduction of a second, separate construction team correcting deficiencies exacerbated the difficulties.

Dunton says the board remained dedicated to its ideals despite the hardship: “We ended up spending more time than anyone had imagined for commissioning. But we were driven to do it right, and we were fairly obsessed with the notion of letting other people know what our experiences had been in the project, and also with public education at every possible level, e.g. workshops and Access energy, which facilitated the purchase of domestic hot water solar panels for people in adjacent Montreal neighborhoods – so we were trying to take some of what we learned outside.”

There were plenty of setbacks that tempted people to give up, but the board remained resilient. “We recast the entire grant at a certain point,” tells Dunton. “We got to the point where we could see that with what we were going to be given for the rest of the grant we couldn’t do everything that we said we wanted to do in the first place. So we made a counter proposal; we said...
this is what we are going to be doing over the long term, and they realized that we were operating in good faith and will do it if we can.” Restructuring the loan became necessary because one building was dropped from the project and so much had been spent on retrofitting the energy systems that the cost of the water-management systems had to be cut back. Peeling off the systems and placing them under the grant allowed them to be realized and gave the team a certain discretion that never would have existed had these project elements been overseen directly by the government.

Summing up, board member Bob Butler puts the problems into perspective: “The bottom line is that we’ve got a really good project here – it’s affordable seniors housing, it’s open to the street, open to the community, and it will maintain its affordability because we have energy savings. As energy costs go up, the affordability will remain intact.”
L’OEUF’s 1994 proposal for renovation and infill rather than wholesale replacement was the least expensive method of providing quality affordable housing on the site. The proposed masterplan assured harmony with the scale and texture of the neighborhood and the least disturbance of both the residents and neighbors during construction. Within its economic and environmental context, it was the most effective method of creating employment and the most effective use of material resources. Modification of the existing complex would provide the opportunity to respond to current needs while assuring the commemoration and clarification of the sociocultural vision of the initial project. It is a process that enriches the development qualitatively and quantitatively.

In order to better integrate the existing housing fabric of Benny Farm into the neighborhood, L’OEUF proposed adding a wide range of new buildings of a similar but not identical scale to the existing buildings. Discrete small-scale blocks, about three stories in height along the perimeter street edge would mediate the relationship between the project and its neighborhood. Most of the new buildings would be located on the interior of the two city blocks, and additional buildings would infill the gaps in the courtyards facing the central garden. These additions would range in height from three to six stories. L’OEUF’s redevelopment concept was similar to making a quilt, tells Pearl: “It suggests something of beauty, of value, and of utility made from remnants of fabric otherwise headed for the rubbish. Like a quilt, an intense pattern of housing will cover the site, each part having its own distinct character. Like a quilt, every inch is important and useful to the overall pattern. And like a quilt, it is an evolving work, based upon an overall pattern but developing as new parts are added.”

The masterplan for Benny Farm required no radical new vision. History had shown that the environment was good. In 2002, Canada Lands Company (CLC) launched a one-stage ideas competition for a new masterplan to be elaborated through a participative approach. L’OEUF was one of four teams invited to compete, and proposed a progressive strategy: refurbishment of 88 percent of the remaining buildings. CLC chose a different masterplan proposed by Saïa Barbaresque Topouzanov Architectes (SBTA), which envisaged retention of a third of the original buildings. Compared with SBTA’s
its own character as each is landscaped differently, belonging to different individual building projects. A main road bisects the site, and access roads wind through. These narrow streets automatically reduce the speed of vehicles. These site elements and the central garden serve to articulate and differentiate the outdoor space, giving order to the site and making for easy orientation. Parking remains along the streets, in a few parking lots, and in underground parking garages where significant new construction was added. The landscaping was designed by Claude Cormier and Associates with Le Groupe Séguin Lacasse Inc. The team received a National Merit Award in 2001 for their outstanding design.

All the trees on the site were saved, although saving certain ones proved to be a very complicated exercise. Pearl and Poddubiuk feel that the notion of having to take down trees is just laziness. Much of the site exhibits park-like greenery, a mix of mature trees and new planting, creating a lush, attractive atmosphere. The outdoor spaces are usable and used — as park, playground, garden, and place to meet neighbors. Walks interconnect all the courtyards, and many new benches have been installed. Children-friendly and senior-friendly, this “horizontal condominium,” as L’ŒUF calls the shared outdoor space, supports neighborly cohesion. The green spaces on both sides of each building give parents a sense that their children are safe while they play outside. These semi-enclosed, semi-public courtyards between the buildings are defensible space, overseen by many windows and neighbors. In this sense, the shared courtyards function much like the private gardens of detached single-family dwellings, representing an uncommon amenity in social housing and an important element of the social contract. The centerpiece of the landscape design is the large central...
the Benny Farm. It’s really difficult to support a social ideal when it’s not supported in building form, in urban form, and in the form of the legal agreements. We ended up with enough of this at Benny Farm that it works. It keeps a sense of the community alive, and people are proud of it.”

Notre Dame de Grâce is a neighborhood of brick buildings, and walkups define this part of city. Although the old walkups of Benny Farm were not restored as examples of historic architecture, and many new buildings have been added, the character of Benny Farm is nonetheless historic, expressing a continuity of local tradition and lifestyle. Benny Farm is a sub-neighborhood with a singular identity that has been recognized in Montreal for over 60 years. Today it is once again a place where people, regardless of income level or socioeconomic class, live with decency and respectability in a simple but dignified and attractive neighborhood.

Reflecting upon the redevelopment masterplan of Benny Farm provokes contemplation of urban design and the public domain. Given a much wider definition of the public domain, the city can become a collective work that is a subject of concern for a wider range of the population. The public domain – the streets, squares, landscape and interstices of the city – is collectively given cultural value. Given the modesty of most built fabric, community-conscious treatment of the urban landscape can enrich the urban experience.

garden, which is and always has been an important part of life at Benny Farm, although today it is no longer in its original location. This garden for vegetables, fruit, herbs, and flowers is a natural social condenser, a meeting place with a purpose, not a “square designed for social interaction.” Even if three quarters of the residents don’t actively use it, they all walk by it and see each other, and many people talk over the fence that encloses it. Seniors, veterans, tenants, singles, rental homeowners, first-time homeowners, and residents of standard market housing all use this garden, which grows from the garden city roots of Benny Farm.

The buildings on the site provide a mix of typologies: units for purchase or rental, housing for a mix of residents, including the elderly, single mothers, first-home buyers, handicapped, and others. The casual eye can neither discern that the various buildings on the site have different owners nor distinguish which buildings might be rental units or condominiums. Even distinguishing between new and renovated buildings is difficult. Each building is different, with a distinctive identity, yet everything blends into a harmonious whole. This harmony and the flow of space unify the overall complex, a place that is and always has been identifiable as Benny Farm.

Sudhir Suri sees this as one of the social achievements: “One thing I really enjoy in this plan is that there is still a horizontal condominium. A vestige of community memory remains in the architecture, in the urban plan, and in the legal structure; it has influenced the central garden and it allows for pathways between all the properties. You can walk around freely in the Benny Farm. It’s really difficult to support a social ideal when it’s not supported in building form, in urban form, and in the form of the legal agreements. We ended up with enough of this at Benny Farm that it works. It keeps a sense of the community alive, and people are proud of it.”

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L’OEUF was the architect of record for four building projects at Benny Farm, which comprise a total of 190 residential units: Chez Soi, short for “O.B.N.L. Chez-soi Notre-Dame-de-Grâce,” seniors’ housing (new construction of 91 units), Coopérative d’habitation ZOO, affordable housing (new construction of 16 units and renovation of 30 units), CHBF (Coopérative d’habitation Benny Farm), affordable housing (renovation of 24 units), and Maisons Transit-ionnelles, affordable housing for young mothers (new construction of 29 units). L’OEUF provided the preliminary design of two further projects: AHOI 1 (renovation of 24 units) and AHOI II (new construction of 20 units and renovation of 30 units), both affordable housing for ownership. With approximately 800 residential units on the site, many in old buildings in which introducing barrier-free accessibility would be impractical, accessibility was a challenge. L’OEUF’s solution was to provide a reasonable number of new accessible units. About 100 units are fully barrier free, as is the entire seniors tract, Chez Soi.

Coopérative d’habitation ZOO
ZOO is a nonprofit subsidized rental housing cooperative that was created with the assistance of the local community organization Head and Hands to meet the rising need for adequate affordable housing for families in the neighborhood. ZOO’s mandate is to provide affordable housing for families with children in a safe and stable environment. The renovation project at Benny Farm was similar to many conventional residential rehab projects, except that ZOO is connected to a district geothermal heating system and that a number of other green technologies and strategies were integrated. The envelope was upgraded to meet stringent energy standards, interior finishes refurbished, kitchens and dining areas enlarged, bathrooms updated, and electrical and plumbing systems replaced.
A major aspect of the sustainable construction strategy at Benny Farm was to recuperate existing buildings and materials wherever practicable, thereby salvaging the energy embodied within the materials and reducing waste. Attempts were made to include new products with significant recycled content in the construction to further reduce the environmental impact of the various projects. High-efficiency buildings envelopes were designed, with the emphasis placed on ensuring airtightness, strategic installation of vapor barriers, and “effective R insulation values,” which take thermal bridging into account. Particular attention was paid to performance and longevity of the envelope (through on-site airtightness blower door testing and infrared thermography), thereby reducing the risk of premature envelope degradation.

The proposed building envelope section was modeled using EE4 software and compared with a design of similar R value but with the insulation applied on the inside. The analysis showed that externally sprayed-on polyurethane would provide superior performance. This can be attributed to better airtightness and reduced thermal bridging at wall-to-wall, wall-to-floor, and wall-to-roof intersections, which would be difficult to match with interior application of batt insulation. The condensation point of the wall section was determined to be on the outer surface of the polyurethane insulation, thus preventing moisture penetration into the walls and avoiding the unpredictable effects of moisture buildup within the building envelope.

The old brick at Benny Farm had remained in good condition but the mortar and ties had deteriorated. The brick veneer was carefully removed from the facades, the sheathing was inspected and found to be in good condition, a vapor control layer applied, and 1.5” of soya-based polyurethane thermal insulation sprayed on. The brick from many of the demolished buildings on the site was salvaged for reuse in both the renovation and construction of new buildings. A group of local teenagers and a few retired masons sorted the bricks, removed the mortar, and cleaned them. Samples were laboratory tested for water resistance and compressive strength, and the results showed higher performance than brick being produced today. Nevertheless, the contractor hesitated to provide a guarantee for masonry using salvaged brick, a practice which is not generally recognized by building codes. A total of 1,350 m² of recuperated bricks was used. Glass block from the original stairwells was also recuperated and used in the new wing entrances of ZOO.

New brick was also used. In fact, some of the renovated buildings use new brick and some of the new buildings use salvaged brick. The overall effect is a blurring between old and new buildings on the site. The color palette of the buildings is controlled, primarily brick red, gray, silver, and a splash of green. Reddish mortar was used in the rehab projects. Combined with the brick, it gives warmness and uniformity.

All the buildings were fitted with new high-efficiency fiberglass windows with operable sashes for natural ventilation. Daniel Pearl expounds: “Social housing doesn’t allow you to have too much fenestration because it is expensive, so illumination in social housing is sometimes meager. At Benny Farm we were lucky because the buildings are narrow and we were allowed to make window changes, so we enlarged windows in some key areas that were too dark, as in the kitchens and dinettes. We were able to achieve some amazing natural daylighting.” In both the new construction and renovated sections, windows and doors specified meet NovoClimat standards. All double-hung windows and sliding doors utilize low-e coated.
Because the renovated and new buildings are walkups, not double-loaded corridor type, cross ventilation is possible, providing greater indoor comfort and efficient early morning and overnight breezes during the hot summers. In winter, mechanical units ensure ample air exchange. The mechanical ventilation strategy for ZOO begins with roof-mounted make-up air units with preheating coils and high-efficiency energy recovery ventilators (ERVs) that maintain humidity levels and recuperate heat energy from exhaust from bathrooms and interior return vents. Make-up air is delivered through a series of shafts and ducts that serve multiple apartments. Exhaust is collected in common shafts. Exhaust from kitchen hoods and dryers is vented directly to the exterior without passing through the ERV units. The solar domestic hot water system is designed exclusively to preheat domestic hot water. The system comprises 36 collectors of 20 evacuated tubes each for a total area of 81 m², delivering a hot water storage capacity of 3,300 liters. A supplementary reservoir in the basement mechanical room stores the water heated by the solar water heating systems. The conventional DHW reservoirs are fed from the solar DHW reservoirs when hot water demand rises. Top-up DHW heating, when needed, is provided from the natural gas boilers, ensuring an adequate supply of DHW at all times.

Drain water heat recovery (DWHR) is a relatively straightforward technology whereby a heat exchanger is placed on shower drains. This recuperates heat in the waste water to preheat cold water being fed into the domestic hot water system. DWHR units are connected to the combined drains located in the basement below each set of apartments. Preheated cold water is fed to the domestic hot water inlet in the mechanical room.

Drain water heat recovery (DWHR) heat exchanger placed around shower drain.
Salvaged cast iron radiators were refurbished and reused.
Reusable floor boards from 1947 were salvaged and reused on site.
New piping for radiant heating in ZOO.
Blower door installed for testing of airtightness in renovated buildings at Benny Farm.
Chez Soi
Chez Soi provides affordable subsidized rental housing and services for seniors. This nonprofit, flexible-support housing complex with 91 apartments maintains the autonomy of its residents by providing fully equipped apartments as well as a range of collective services, including prepared meals in the common dining room.

The newly constructed concrete post-and-slab building with a four- and a six-story wing benefits from a solar domestic hot water system, a ground source space heating and cooling system, and a wide range of green measures incorporated into the construction. The design features a modest degree of glazing per unit. Balconies are strategically located above the larger openings to maximize solar gain in winter and minimize it in summer. Insulation is placed outside the steel-framed curtain wall and air barrier. Air tightness measures 1.5 AC/H at 50 pascals. Indoor air quality is enhanced by the use of low-VOC emitting materials. 40 percent of the waste generated on site during construction was separated and recycled. Using straightforward solutions for space planning, a tight building envelope, and green technologies, the architects provided a high-quality affordable design. Sudhir Suri summarizes the concept as “very simple design gestures, good building envelopes, better-than-code mechanical systems... We kept it simple and clear. That’s why this works.”

The ground source space heating system for Chez Soi is similar to that of ZOO. It includes nine wells and over 1,650 linear meters of heat-transfer contact, delivering 40 tons of capacity. These were the first GSHP systems installed under Montreal’s subsidized housing program. The water-to-water GSHP units transfer the heat from the ground loop to a header system that feeds the radiant floor heating system. It covers peak heating demands with moderately heated water at 48°C, a perfect match for GSHP systems, which typically have a maximum output temperature of 48°C. During the coldest periods, a mix of higher temperature water from the gas boilers increases the overall heating capacity to meet peak demand.

The GSHP also provides cooling through two pre-conditioning coils in the make-up air units as well as through the radiant floors. Humidity and temperature sensors placed in strategic locations throughout the building allow automatic monitoring of the dew point, ensuring that no condensation forms on the floors or feed pipes in cooling mode. The cooling strategy aims to temper peak temperatures rather than to provide fully conditioned air, as with a conventional air-conditioning system. The radiant floor cooling helps to ensure that the building’s concrete structure, which represents significant thermal ballast, does not overheat during prolonged periods of hot weather.

A 58 m² solar wall, in two sections, was installed by GEBF at Chez Soi. It is a simple installation that cannot break down, made of perforated pre-painted steel cladding installed 10 to 15 cm from the building section’s external surface, allowing air to flow behind it. As the sun’s rays hit the wall, the dark aluminum surface is heated, and air passing in front of and behind the wall and through the perforations is preheated as make-up fresh air. Air flow through the solar wall is controlled by a series of dampers in the 6th floor make-up air unit ductwork. The outside fresh air then passes in close contact with the exhaust ducts, reclaiming additional waste heat. The next step of preheating is via the ERV. Exhaust air heat recovery is provided by ERVs and fan coils linked to the geothermal network. Intake air during the summer is dehumidified by fan coils, providing some relief from the summer heat. This integrated high-efficiency fresh air system
portable self-watering vegetable and herb growers were installed. Workshops were held by urban agriculture groups to teach the residents how to use them. Moreover, the growers were available for residents to purchase and install on their own balconies. To date, the residents have installed thirty additional growers. Workshops and external coordination was supported for two years by GEBF, after which the residents took over management of the garden. The rooftop garden is not expected to provide much benefit through cooling or insulating the building; rather, it fulfills a social need within the project. It offers a chance for the residents with limited mobility to engage in gardening, which has many physical and psychological benefits. Moreover, it encourages discussion of the importance of healthy foods and the education about organic growing techniques.

A gray water/rainwater treatment and recycling system was installed at Chez Soi. The system collected gray water from the showers and bathroom sinks throughout the building. A second input collected the rainwater from the roof. Each input was passed through a coarse bucket strainer to remove larger debris before arriving into a primary reservoir which acts as a lift station. Two ½-hp submersible pumps in each lift station sent pressurized water through two 100-micron filters, which is then delivered to two 3,400 liter storage reservoirs. The control system monitored the amount of water arriving to the system and circulated an appropriate volume of water.
through the chlorine treatment tower to maintain chlorine concentration in the stored gray water. Supply to the toilets was pressurized to 50-65 psi using a 5-hp pump. Two 200-liter expansion tanks provided a buffer volume and maintained pressure in the toilet feed pipes, allowing the feed pump to operate after every 10 to 15 flushes. Based on an average of eight flushes per day per resident, it is estimated that the combined gray water and rainwater recycling system reduced water consumption at Chez Soi by over 2,000 m³ per year. The system was based on the Brac Systems CGW-6600 gray water treatment and recycling system, modified to combine rainwater and gray water in the same system. This was accomplished by adding an extra lift station and pair of 100 um filters to collect and filter the rainwater from Chez Soi’s 1,400 m² roof. The system controls were modified to accommodate the dual-feed system. Brac Systems cooperated with GEBF to monitor the system’s performance over the first years. Due to the demanding maintenance of the system and challenges that the Brac Systems did not foresee, the experiment was stopped. The system has great potential, but it was too complex for a modest senior’s residence building to take over.

As LOEUF had anticipated at the start of this complex and ambitious pioneering project, the lessons learned, effects seen, and questions, issues, and ideas raised were manifold, and the implications extend well beyond the local context. Bernard Olivier tells that one of LOEUF’s initial intentions was to approach the project as a challenge and to learn from it: “The number of difficulties we encountered made the project more of a lesson than we bargained for, but it highlighted the necessity to plan for that, because many of the difficulties had relatively simple solutions in the end.” A summary of the main lessons learned follows.

**Build in functional resilience**

The main technical problems encountered involved the heating system, which broke down and left the seniors in Chez Soi without heat for several days the first winter of operation. Although a degree of redundancy was incorporated into the initial design (geothermal energy coupled with hydroelectricity and high-efficiency gas boilers), both systems were quite innovative and it was hard to count on a straightforward reliable back-up during the first year when repairing one system or optimizing the other. Problems that arise in nonstandard systems are more time-consuming to troubleshoot and fix. Simple conventional backup systems should be provided to ensure that users will experience no discomfort in case of a breakdown. Systems selected should not exceed the industry’s capacity to manage and service them.

Ian Ball, engineer at TST Energy Systems, the commissioning agent hired by GEBF to help test, troubleshoot, and eventually correct some design and technical installation issues, outlines the learning experience: “The Benny Farm project was ahead of its time in regards to various factors, especially the overall knowledge of that type of mechanical system. The engineering
knowledge in the province is still developing. These are existing high-technology systems, and there was good practice with them as individuals systems, but here they were being combined and applied in unprecedented ways. Combining a geothermal system with a solar collector system with solar walls with a central control system with ERVs into affordable housing makes for an ambitious project. In retrospect, one can say that the overall budget for this type of project perhaps failed to address this level of complexity, which affects every step of the process.”

Keep technical systems simple
"In the old days, your heater goes out you call the plumber. At Benny Farm, you can forget that – the system is much more complex,” tells Mark Poddubiuk in retrospect. “We tried some things at Benny Farm that our subcontractors in the social housing field were not ready for,” adds Daniel Pearl: “They were required to install some equipment and use technologies that are traditionally in the realm of institutional construction. Some found that they could not meet specs without losing money, so they opted to be sued rather than trying to solve problems in the field. So the lesson here is to simplify technologies, and choose ones that are appropriate to the local industry.” Bernard Olivier agrees: “The diagnostics, finding the problem, ended up in many cases being quite a trial. So there’s something to be said about making these special mechanical systems not so opaque and building in the instruments and monitoring tools to ascertain whether they are working properly and how well they perform.”

Advance in small steps
Daniel Pearl warns against too large steps in applying advanced technologies: "We started to get into an area of problems that we didn’t really fully know. Our mechanical designer at the beginning of Benny Farm understood the theory very well, but there was a gap between the theory and the knowledge on how to build it very resiliently. Another gap was that the industry couldn’t respond to the design criteria within a reasonable cost. So the gaps were on many levels: on a political level, a technical level, on an industry readiness level, on a client being able to handle the uniqueness level – so the potential for error was large. The reason we pressed forward is that we need to start pilot projects and learn something. And we need to gather those lessons and document them too.” Mark Poddubiuk confirms: “At Benny Farm we were moving from a housing industry in Quebec and Montreal that is incredibly crude in terms of environmental systems and energy efficiency and performance, and we were trying to make a huge leap to something that it is much more sophisticated. There needed to be a few more small steps that happened in between.”

Design projects to grow in complexity over time
Projects should be designed to economically accommodate retrofit installations, to allow sustainable measures to be added over the years. This holds down the initial construction cost and it gives the residents time to learn about the systems and options and to decide themselves which additional measures they want to realize next. Since there is a significant turnover of residents and volunteer board members over the long term, one must ensure that knowledge will be passed on, such as maintenance and operation information and design information. The boards of the housing organizations play an important role in ensuring client management capacity; however, the members are all volunteers and they will eventually change, so the operational budgets or the energy savings pro forma must provide the long-term foundation.
Every player in the project is critical

Changing the way projects are developed is an enormous challenge that requires strong support by and a shared vision among broad groups of stakeholders. If only one key player in a project is not committed to the vision, the project will likely repeat the status quo and fall short of its potential. The players include land owners, project owners, investors, financing institutions, designers, relevant government officials and agencies, clients, users, and operators.

Fighting for change takes a toll on the people and organizations who invest themselves in the shared vision and strive to achieve aspiring goals. It is a time-consuming and stressful process that inevitably involves bureaucratic hurdles, technical challenges, and social resistance. It can also carry high financial risk. Delays, setbacks, disappointments, frustrations, and losses are to be expected. For this reason, large projects must be carried by a group of players who possess optimism and endurance in addition to technical competencies. The group must be broad-based because individual members, whether volunteers on a citizen board or employees of a contracted company, may suffer burnout and need to be replaced, as happened in this project. Unfortunately, we live in a society that puts those who try to effect change under tremendous pressure.

The integrated design process keeps clients, users, and the management team at the center of the design and construction process

The specific players in the Benny Farm project included the community groups, the GEBF board, the City of Montreal, Canada Lands, CMHC, the consultants, the political partnership, and the community partnership. Each player must maintain a voice throughout a project, otherwise interest will be lost and support withdrawn. Project leaders should use a structured process to integrate all the individual concerns into a holistic project as the process advances. The integrated design process (IDP) is a proven tool for this, keeping the client at the center of the process. Mark Poddubui elucidates: “In terms of the kind of systems and the environmental performance of buildings, we are still struggling with matching what we feel is important to do, what we feel is necessary to do to save the planet and to make something more sustainable, and what is appropriate to the context and the clientele living there. I think there needs to be more engagement on the part of the client, that they really step in and make decisions and engage themselves in terms of what they find appropriate and what they feel comfortable with.” Daniel Pearl concurs: “In the end, the clients are the agents of change. They must supply the vision, or at least buy into one, from the start. What made Benny Farm special is that we were able to, in the early absence of an involved client, still advance a vision that allowed flexibility.”

Government must adapt to fulfill its role

By setting a framework through regulations, policy, and funding decisions, government’s role in urban development is decisive. To finally curb car-based suburban sprawl, government must take more responsibility to control what developers may build and where. Unfortunately, government has often been a weak link in social housing projects due to immediate targets having to be met, bureaucratic complexity and rigidity, and limited resources. Daniel Pearl explains the Canadian situation: “To get anything significant done, you need to align three levels of government: the municipal, provincial, and federal government. The monies for all these programs are intertwined; we needed to wait for the right alignment, where all three were talking to each other, to invest into this project. We needed to massage the politics for so long – that’s one of the reasons it took 15 years to get off the ground. Whose job is it to envision the future?
Each of the three levels of government thinks it’s the other one’s responsibility – so there’s no one actually taking the bull by the horns. And that alignment is probably more fundamental than any other change. When it is finally achieved, the depth of the thought in sustainable projects, whether they are communities or buildings, is going to change totally.

Financing became a vexing problem at Benny Farm due to timing. Pearl recounts: “The money for greening the project came in late in the process. It took about a year to 16 months until the government agency actually confirmed funding, and during the waiting time the projects had to go ahead because this was a very long battle and once we got the go ahead we couldn’t slow down. Social housing is a little like private development in that you wait years and years to get a chance, and when you get the chance they want the drawings done yesterday.” Path-breaking projects do not fit into standard patterns and procedures and can require non-standard models of financing, contracts, and approvals. “Many of the great disappointments we had with the GEBF project were due to the fact that we had to insert the additional green measures into existing contracts. This is certainly not an ideal situation, and that warped the way the project got built. Had all the contracts been lined up in the right place, we would have seen how far we could really get. If there’s a major takeaway here, it’s this: Don’t try to hot rod a project into an existing contract because then not only are you renovating existing buildings, you are renovating contracts, and that’s a nightmare. This applies especially to low-cost bid jobs, in which general contractors typically count on finding extras when clients and professionals have little choice but to work with them.”

To achieve lasting change in urban building and development practice, government needs to fund not only the construction of projects but also the operation, maintenance, and management for the first couple of years, until a degree of stability and efficiency is attained. In 2006, the final mortgages for ZOO and Chez Soi were locked in by government officials and the technical resource group. By lowering each of the long-term project mortgages as much as possible (to potentially immediately lower the rents of the residents), critical financing was indirectly withdrawn from GEBF during its nascent trial-and-error period. Daniel Pearl explains: “When they saw how amazing the savings were projected to be, they created a lower loan, saying we don’t need any budget for energy because things are so efficient. So all the future savings that would have enabled GEBF to have a degree of robustness to address start-up operation challenges and then to become a community developer as set out in the charter of GEBF were compromised, threatening the ability of GEBF to survive for the long term, meeting its management and operational costs.

What would have been a CAD 80,000 income (when all of the renewable energy systems were running smoothly) was reduced to 20,000. Even the CAD 20,000 savings were not initially realized because of technical problems with the initial startups of the solar and geothermal systems. The ultimate consequence was that GEBF had to be closed down in August 2011.” Regrettably, a pioneering sustainable local energy organization with a promising future was prevented from ever achieving stable operation and reaching maturity.

14 In Canada, technical resource groups (TRGs) offer their clients (often start-up nonprofits and coops) training and technical and administrative support to develop, build, and operate community housing projects.
Performance

The performance of Benny Farm can be assessed in terms of economics, environmental footprint, social benefits, urban improvement, and broad influence. The overall technical performance of each building is hardly quantifiable because no money has been made available for full monitoring. Daniel Pearl says the biggest success of Benny Farm is that the social vocation was never lost, that the battle against privatizing three quarters of the site was won: “Maybe one quarter has been redeveloped to the equivalent of privatized, but that means three quarters has been really left in the affordable, social realm, which was the first mission – the garden city. The majority of the city’s affordable social housing projects are in inopportune locations, run-down streets in struggling neighborhoods. So to be able to have such mixture, such richness in a central location such as Notre-Dame-de-Grâce is such a respectful thing to do. And it’s created an incredible dynamic. It has not become a ghetto the way some people had predicted.”

L’OEUF’s initial projects in the first phase of redevelopment had an impact on the subsequent projects on the site done by others, explains Pearl: “Once the green standards and the award-winning design became known, we were able to leverage the competition between developers for building the other projects to be as green as possible. That would have never been the case had we not brought up the whole debate with the ideas competition. They didn’t simply give the land to the highest bidder. They had a competition as well, to know what standards you were going to bring to the project. In terms of both design and influencing change, the L’OEUF projects had an immediate influence on most if not all of the other projects in the Benny Farm complex.”

After thorough study, renovation and reuse of the existing buildings proved to be an economically feasible alternative to new construction. Careful engineering of the sustainable systems has resulted in a better quality of life for the residents at a lower life-cycle cost than conventional systems. For example, increased ventilation coupled with efficient energy-recovery systems does not increase energy costs. This high level of quality is unprecedented in the affordable housing sector. Benny Farm also delivers economic benefits at the municipal level. The project’s self sufficiency means that there is increased land-use efficiency with no need to increase external infrastructure. 183 units were built where 76 units previously stood, providing much-needed affordable housing in the center of a vibrant community. Despite this, there is no significant burden on the city’s water treatment facilities, and the on-site water infrastructure reduces conventional consumption significantly.

Benny Farm has very strong urban design credentials. Whereas hundreds of housing complexes throughout North America built in the 40s and 50s have been razed and replaced with conventional (and unsustainable) construction, Benny Farm has been preserved and renewed and remains an identifiable and attractive sub-neighborhood. The degree of densification has been optimized, making for more efficient land use while retaining green space. The rehabilitated site is gaining in public significance and growing in complexity beyond residential use; a new sports and cultural center with auditorium has opened across the street and soon a library and clinic will open too. This vital and walkable neighborhood, connected to the city center, is a germ of healthy urban growth.
Rosemont

Applying the lessons learned at Benny Farm, “adjusting and retooling,” and monitoring building performance

Rosemont is an affordable housing development very closely related to Benny Farm. It was L’OEUF’s second large social housing project in Montreal. Both projects carry forward the same overall intention: to prove different and better ways of creating urban housing, and furthermore to learn through the process, apply the knowledge gained, and document the process for others to use. The main differences between the two are that Benny Farm was an urban fringe rehab project for unidentified future tenants (the specific projects by L’OEUF totaled about CAD 25 million), whereas Rosemont was a CAD 19 million brownfield social housing development close to the orange subway line, being inserted as a new element into existing fabric, and that at Rosemont the resident group was highly present and fully represented from the beginning of the project in the very first charrette, which allowed L’OEUF to conduct a comprehensive integrated design process.
At the time the Benny Farm project was conducted, a major constraint in building sustainable housing was the level of knowledge, openness, and capacity of the construction industry in affordable housing. Since then, this has improved substantially in Montreal. L’OEUF applied at Rosemont almost all of the lessons learned from Benny Farm. Daniel Pearl: “Looking at Benny Farm as a new model, understanding it as a pilot project, understanding that the theory of the project and the reality didn’t line up, and how the theory changed practice in Montreal, and how from there, even if we didn’t build what we wanted, we designed and learned so much, we started to transfer those ideas to other projects, including Rosemont.”

New goals were set for Rosemont. The players in the project would be selected and coordinated with more rigor. Technical systems would be simplified. The residents would be able to take over the project and add green measures over time at their own pace. Technical resilience of environmental systems would be provided through simple backup measures. The way the lessons learned were applied at Rosemont elevates the project to a highly instructive example of sustainable development.

Daniel Pearl recounts the project origins: “While we were learning from Benny Farm, two different co-op groups came to see us. Mark Poddubiuk had helped secure a modest government grant from CMHC to look into affordable social housing for the co-op Coteau Vert (CV), that wanted 95 units. A second group, Un Toit pour Tous (UTPT), a nonprofit, followed shortly thereafter, and they wanted 60 units, so the two client groups got together and we had 155 units total. So Rosemont is actually two projects on one site. The combined group brought along a strong vision to create one sustainable collective community with a persuasive sustainable mission, and the original board of 18 members set the green standards very high.” Pearl sees such a vision as the essential germ of any project that seeks to swim against the mainstream: “We do this in all of our projects now. If the vision statement is strong enough, you will have the trust and determination that can keep you afloat through all the growing pains. The architect’s task is to take up the vision of a group of clients, carry it along throughout the development of the project, and in the end help faithfully translate it into reality.”

The site chosen for the project lies in a densely developed and popular neighborhood adjacent to Rosemont Metro station in the central part of Montreal. The plot of land had most recently been used as a parking area for municipal snow removal vehicles. A cycle path and train track run tangent to the site. At the same time that the project was being developed, a new small park and municipal library were to be designed to the north-west of the site, and a new eight-story private housing development was to be designed and built across the street.

One of the first decisions for CV and UTPT was to determine the appropriate density for the proposed development. Originally, the city had plans for 110 residential units on the site. L’OEUF determined that the density should be much higher and that the envisaged 155 units would be nearly ideal. Pearl recounts: “They needed persuasion. Mark Poddubiuk took on the task of proving to them that our proposal was not too dense; we had to convince them politically that it was the right thing.” L’OEUF proposed building not higher than 3½ stories, so that residents in the top-floor units would still enjoy a healthy relationship to the outdoor surroundings and so that wood-frame construction could be used, keeping the units affordable for large families.
In the integrated design process (IDP), all players in a project sit around the table from the beginning, first setting goals, and then proposing schemes, discussing options, and agreeing on approaches and solutions. Such workshops, or charrettes, held at varying scales and degrees of participation several times during a project, ensure the participation of stakeholders throughout the design and construction process. Daniel Pearl describes the initial charrette for Rosemont: “We got three government grants to help launch the design of the project: CAD 25,000 from the Green Municipal Fund to do a pre-design analysis study, a second grant from the City of Montreal, and a third from CMHC under the Equilibrium program. Other partners were also invited to participate in the initial charrette and follow the studies and grants, including Gaz Métropolitain, Hydro-Québec, and SHQ (Société d’habitation du Québec). This allowed us to better prepare a more comprehensive visioning exercise, which is critical to the success of any project.

The six-month process started in 2007 when we launched a large-scale charrette with client reps, engineers, and various government agencies, including the technical resource group Batir Son Quartier (BSQ). That charrette allowed us to look at what we were designing as a system for the entire block, versus just our own site, for water retention, for landscaping, for geothermal—and some great ideas came out of it. We did shading and shadow studies to try to prove we could do a denser project than the city had envisioned. We did a pre-study energy profile showing where we could save money. Ventilation and space heating played a big role in this. We used geothermal energy to preheat ventilation air, reducing the need for space heating. Initial calculations showed that we were headed toward energy savings of about 40 percent over the standard energy code on day one. We studied maximum envelope efficiency, heat recovery from water and air, geothermal, solar, equipment, and lighting. And we proposed it all with geothermal and solar air and solar hot water.”
Through IDP, holistic concepts that satisfy all stakeholder groups can be generated from the start and consistently developed. Even commissioning is considered from the very beginning. This process is the opposite of traditional practice – doing a design, knowing that it lacks potential, bringing in an engineer who tries to correct it, and so on, in effect working backwards. Pearl uses IDP in nearly every project: “Saying we want to involve the client and really involving the client are two different things. The problem with IDP is that not many people really understand it and have done it. So you have people who don’t know how to truly lead charrettes. Do the initial charrette right and you have already built a team with trust and commitment to a shared vision. The charrette is not just a technical exercise; it’s a team-building exercise of different people going through a process, one in which you establish a certain level of trust.”

IDP takes unilateral power away from the architects and engineers and puts it in the hands of many, including the clients. At Rosemont, the engineers provided very good information, the architects made recommendations, and the owners made the decisions. This form of client participation is changing the industry, changing the contractors, changing the government agencies, changing the process.

Rosemont had the good fortune to have a very strong stakeholder group for the IDP, says Pearl: “We had some of Montreal’s most dedicated local activists right from the outset; Pascoal Gomes, Charles Mercier, and Anne-Marie Pelletier from CV and Dyane Courchesne, Touimi Safae, and Jocelyne Moretti from UTPT on the founding board of the coop and the nonprofit. We also had one of the strongest environmental activists in the city, Steven Guilbeault, bring his highly respected profile to the client team. There was also an exceptional degree of seriousness and devotion provided by the technical resource group BSQ and City of Montreal officials from day one as well. The well-represented client group worked together for three or four years before the first foundation was ever poured. We started with fundraising, especially for the geothermal system. We went through so many meetings that by the time construction started no one ever felt they hadn’t been asked. We were very lucky to have that kind of dedication. All those people didn’t get paid for all those hours, and that can happen only when you have a really motivated client/user board.”

Frank Suerich-Gulick, then a civil engineering graduate student, was a motivated core member of the founding board of CV who specialized in technical matters. He is still playing a key role in the one-year post-occupancy monitoring project currently underway at Coteau Vert. He tells that many shades of green were represented on the co-op board: “A surprise for us was that we all agreed from the start that we wanted green social housing, but everybody had a different idea about what that was. And everybody was really passionate about it, so there was a lot of negotiation. It was a long process from wanting to build the project to actually moving in – and there were a lot of pitfalls. By the time we moved in, we were all fairly exhausted, but we had learned a lot about working together, and we had some muscles that we built on these challenges, so maybe we were more likely to have the project work.”

Technical resource groups (TRGs) play a fundamental role in social housing projects in Montreal. They manage housing projects for the province and the city, working with client groups and mediating between consultants and users. The TRG for Rosemont was a great asset, whereas at Benny Farm the TRG had less experience in working on green projects at the time. Often, two different TRG agents are assigned to a project, one for
the project development phase and the other for the construction and post-construction phase. For Rosemont, Jean-Pascal Beaudoin was the first agent and Yann Omer-Kassin the second. Daniel Pearl explains how the city controls program spending through the TRG: “The process is that we sign the contract, the client gets the money, and the client eventually signs the checks prepared by the TRG and the selected notary, but the client can’t sign any check until the TRG gets the city to sign off on every decision related to monies, whether for change orders, or anything else – so even though the client has total control on paper, in reality the city is holding the purse strings. And that’s not just during the project tendering and construction phase, it also holds true for how the future maintenance budget and operations will be allocated and set up.”

Yann Omer-Kassin explains that arranging the funding was a difficult challenge: “The TRG has a defined structure from the provincial subsidy program called “Acces logis” for social housing projects. The program subsidizes nothing other than raw square footage. There’s not even a penny for collective spaces or administrating a cooperative. So we had to think beyond the program to try to structure a financial arrangement with different partners, and we had ups and downs. We found a group of partners for financing. It took a lot of engagement and perseverance. We had to go beyond the notion that this would just be another pilot project or an improvement upon Benny Farm in some ways.”

As the project progressed, steered by the architects, the co-op and nonprofit boards, and the TRG, making the decisions on behalf of the entire client group, the meetings and the transfer of information were much more involved than in typical private projects. Suerich kept the client group continually informed and attended many meetings, always requesting suf-ficient information in order to make informed decisions from a long-term point of view: “The project has now been built, but that’s just the beginning. If you don’t plan and train really carefully and inform people for the operating part, you can have some major problems.” It was a demanding project for everybody involved, becoming more than a job for many people. Many clients and consultants invested untold unpaid hours into the project. Unfortunately, there were burnouts, as at Benny Farm, but a small core team of people remained on the co-op board through the whole project. Anne-Marie Pelletier was one of them: “It’s important that the co-op is big enough because boards have constant change. Consequently, in the end, only some of the people know why certain design decisions were made.”

The number of required parking spaces was reduced from 78 to 12. Most of the spaces are reserved for car sharing and persons with reduced mobility.

Un toit pour tous/
Coteau Vert

Playground/Parking

Community park

Common and family gardens

Circulation path

Un toit pour tous/ Coteau Vert

Coteau Vert

Community park

Common and family gardens
The design of Rosemont celebrates the common values of the project in its central garden, while the facades express a rhythmic play of solids and voids on the street, echoing passive solar design principles. The energy and water systems blend seamlessly with the cityscape and neighboring urban fabric. In regards to the planning of the units, in order to improve the interior air quality and comfort, most of the units benefit from a double orientation, with particular attention paid to the layout and fenestration in order to benefit the fullest from natural lighting and natural ventilation. The proposed balconies, mostly on the south of the buildings, allow for good sun exposure and at the same time act as sun screens to minimize thermal gain.

The major design themes were elaborated in charrettes: reduction of the urban heat-island effect, green energy strategies, water management strategies, envelope amelioration, risk management, affordability, and a high share of larger residential units. Various building forms were considered by the IDP team. Ultimately, the clients chose a series of almost contiguous perimeter buildings enclosing a central courtyard, similar to many of the most attractive garden city experiments in both Europe and North America. The central rectangular void forms a well-defined positive outdoor space linked to the city outside through portes cochères\textsuperscript{15}, a typological urban design element in Montreal. Coteau Vert is a U-shaped building group in which all units are cross ventilated. Un Toit pour Tous is a row of three buildings that close the “U,” in which the units are arranged along a central corridor, although many of the units have two exterior exposures.

The charrette process addressed more than surpassing energy requirements and dependencies. An important component of the IDP was to enhance the dialog between the various members of the design team,

\textsuperscript{15} Porte cochère: Vehicle entrance from the street into the courtyard.
So, the viability of the project, which still has to guarantee rents at least five percent below median rental rates in Montreal, was put in peril by the insistence on large units.

The courtyard, or the “yard,” as it is fondly referred to by many residents, serves many uses for everyone. It is a park, an entrance and service court, a semi-private leisure space, a place to plant, talk, meet, sit, and hang up laundry. It is a safe green place in the city for children to play. It is big enough for a block party or an open-air music event or an informal soccer game. It accommodates a small community center above the underground mechanical room, ample bicycle parking, and central waste separation and collection. “Architecturally, the buildings are interesting, but they are only a framework to support the heart of Rosemont, the courtyard,” tells Mark Poddubiuk: “It is a social space, an outdoor living room shared by all the residents. It is a strong, unifying factor – all about creating community.”

The courtyard includes twelve parking spaces for the 155 housing units, four of which are for car sharing. The architects applied for a zoning variance to reduce the parking requirement from 78, a process that took over six months. The variance was granted because Rosemont is adjacent to a subway station and a cycle path. Limiting parking had more to do with the philosophy of the group than with the building itself, explains Pearl: “The people you want to attract here are not the ones who own cars. People who own cars can park on the street. It’s not a problem because in the tenant profile they went after people who preferred to use other means of transportation than the car, people who care about their eco-footprint. It was made clear to everyone that they would have to park on the street, where few spaces are available. This is considered a great victory for Rosemont. Private parking would have ruined the courtyard. For once, here is a place
designed for people, not cars.” Rosemont exemplifies how densification and greening should go hand in hand in urban design.

**Passive and active strategies — a hybrid approach**

Mark Poddubiuk says many of the project goals were achieved through passive design: “The buildings are ten meters deep. Conventionally, we have 18- to 20-meter deep buildings with double-loaded corridors. A ten-meter building with southern orientation solves 80 percent of our environmental design. This is low-hanging fruit – big gains at no cost through clever design. The degree of fenestration is also an issue. The standard limits solar gain to 30 percent maximum. Southern orientation is the easiest way to save 10 to 20 percent of your energy costs. So the project uses passive design, including careful control of orientation, fenestration, depth of the building, natural ventilation, and shading.”

Southeast and southwest balconies are designed to shade the doors and windows below in the summer. Windows facing the railroad tracks could not be counted on for ventilation, due to noise, tells Pearl, “so we built in equivalency by providing more tempered cool air to those rooms than anywhere else. The government accepted that these rooms may need to have some form of air conditioning, although air conditioning is not part of the affordable housing standard in Quebec, as it is in Ontario. That’s why the government is very interested in us monitoring the efficiency of the cool air system. It’s going to help them determine whether this amount of air conditioning will be sufficiently efficient.”

A lyrical passive measure in the landscape design by NIP Paysage is the series of steel poles within the central courtyard. These multi-story clothes-line masts are carefully placed to demark the public domain within the courtyard.

This central public area is planted with local species that require minimal watering. Around it is a ring of private spaces with terraces and gardens.

The exterior envelope of the buildings meets all the current energy design standards for NovoClimat. Blower door tests verified airtightness at 1.5 air changes per hour (AC/H) when tested at 50 pascals. Pearl says efforts were made to reduce thermal bridging and to further improve exterior envelope airtightness, but the affordable housing industry was not aware of passive house standards: “We determined that there was probably no cost certainty or guaranteed performance results possible if we tried to get builders to construct to a higher standard of care/performance required to meet the demanding passive house airtightness standard of 0.6 (AC/H). Most importantly, the exterior envelope was built in wood with a continuous layer of soy-based polyurethane insulation sprayed outside of the wood stud walls to ensure that the dew point in the wall section was safely outside of the internal wood stud cavity. This also meant that thermal bridging was not as problematic since wood has decent properties in slowing down thermal bridging.”

**Energy**

Heating buildings in winter accounts for an enormous energy demand in Quebec, as average indoor temperatures of 20°C must be maintained while...
outdoor temperatures drop to minus 30°C. During the initial charrette, multiple systems for energy savings were evaluated, and in the following months, Engineers Frédéric Genest and Roland Charneux of PMA worked on seven further design iterations that were more fully developed and modeled with energy simulation software. The final choice was a geothermal heating system with centralized heat recovery ventilators. The energy system, designed to pretreat 100 percent of the fresh air for all of the units, is oversized both in duct capacity and preheating capacity. Pretreated makeup air comes in at 25 to 28°C instead of at 18°C. This system has a positive net value and will pay for itself in less than 20 years. The geothermal system also provides a certain degree of cooling in the summer. All the units have electric baseboard heaters as a backup system. The baseboards are a bit undersized but could handle 100 percent of the heating requirement if the geothermal heat pumps require maintenance or repairs. Daniel Pearl explains the rationale of the hybrid heating system: “First, we have the resilience of redundant systems in case of any problems with the primary geothermal system. Second, there’s individual electrical metering for every unit’s baseboards. So you have an incentive to save energy by turning down the thermostat. At Rosemont, some of the people hardly use their baseboard heaters. It’s patterns of life that’s going to change things, not simply technologies.”

The geothermal plant is located in the basement of the community pavilion in the courtyard. It is sized to meet about a third of the overall heating demand, and like most of the installations at Rosemont, it was designed to easily expand over time. Five large boilers meet the overall domestic hot water demand. The installation cost is a bit higher than that of 155 smaller ones, but maintenance is easier and overall payback from high-efficiency boilers covered the additional capital costs very quickly. A drawback is that the abuse of hot water must be controlled by the residents themselves because hot water is included in the rent.

Construction materials and indoor air quality
To increase the effectiveness of mechanical ventilation, the filters for the centralized HRVs have a MERV rating of 13, which is the highest in this class of use. Besides cross ventilation being part of every unit of CV, significant research went into choosing materials and finishes with minimum toxicity or VOC off-gassing. Exterior facade materials include torrified wood, corrugated metal, brick veneer, water-sealed fiber cement,
and galvanized metal. Windows are aluminum clad. Most of the wood used in the project is FSC (Forest Stewardship Council) certified. Due to the size of the project, the extra cost was minimal.

Foundations rest directly on bedrock, part of which required rough leveling. Blasting was prohibited due to the proximity to the metro, so excavation was done by machine, and the excavated stone was crushed on site. Much of the stone aggregate was used as fill and as drainage material; the excess was hauled away at no charge and used in another project. With respect to paints and stains and other interior finishes, the additional costs for using better products were minimal, due to the scale of the project, but not all finishes are toxic-free due to budget constraints. The biggest challenge was ensuring that these materials were ordered in advance since many were not stock items.

**Water management**

Water management was a major environmental theme at Rosemont, as at Benny Farm. Civil Engineer Mario Gendron worked on both projects: “At Benny Farm we looked at water management, especially on-site management of storm water and wastewater with on-site retention with flow control. We looked at how to use rainwater to recharge the water table and how to treat sanitary water on site with constructed marshlands. Unfortunately, this was not fully implemented, primarily because the city sewer system already has a large capacity. But we do have roof water being percolated into the soil through perforated pipes to recharge the local water table.” Separate pipe systems were installed at Benny Farm, but those systems were not put into service.

At Rosemont, all surface runoff is managed on site in a retention basin in the central courtyard. The dry basin fills with water, and percolation catches 80 percent of the suspended solids. Pollutants and oils are not treated. The overflow goes into the city sewer, and then the basin dries out again. The overflow is designed to handle rainstorms of an intensity that occurs once in a hundred years.

Gendron explains that handling water at the source is a key to managing water: “All the impervious surfaces that we have created over the last hundred years present a large problem in terms of runoff and heat islands. Theoretically, you don’t need a big water treatment plant for a big city. When you draw the first line of a city plan, you can manage storm water and sanitary water almost completely and self-sufficiently on site with rain gardens and marshlands for treating sewage. The keyword is integrated water solutions, one part of which is non-potable water. The idea is to work closer with nature, but that’s not what civil engineers have been trained to do. They are trained to take the water and get rid of it as soon as possible. Integrated solutions are exactly the opposite. Using them, we try to manage the water where it is, slow down the flow, give it back to the water table, and treat it at the same time – really just doing what nature
installations. The Quebec government now allows any social housing to go after this ten percent, so we’ve changed the government’s mentality and convinced them to raise their standards.”

In spite of the limited construction budget of CAD 110 per square foot, the overall strategy was to anticipate the incorporation of advanced green systems. It’s what l’OEUF calls “future proofing.” Pearl says: “To future-proof a building, you have to find the right balance between performance and resilience and cost. We don’t know how systems and technologies are going to evolve in the future. You have to make your solution viable for today but resilient for tomorrow.” The integration of infrastructure for future measures and a “loose fit” design approach to enable the addition of more green strategies proved very attractive to the founding board members. Such a phased infrastructural strategy is unusual, but it was eventually accepted by city and provincial officials. The phased strategy allows residents to gain more control over their own future growth and gives them time to master the operation of their initial green measures before taking on others. It is important for future residents to have a say in what they want to invest in, since there are numerous attractive options from which to choose. Funding programs for renewable technologies from the various government agencies continue to change, and projects thus require more than one primed option.

The buildings at Rosemont were close to 40 percent better than energy code on day one, but they were also prepped from the start to easily accommodate the later addition of green roofs, rooftop photovoltaic panels, solar hot water heating, expansion of the geothermal system, and other green measures. For example, a third of the cost of installing green roofs has already been covered. The roof framing is designed for the future...
roof loads, and the higher parapet is already in place. The light-colored roofing membrane is root resistant. Rooftop water supply is installed for future irrigation and for cleaning the rooftop HRVs. By having the hot water system partially but not totally centralized, solar preheating can be installed at any time. The roof is designed to support these loads too, the support points are installed, and the piping and conduits between the roofs and the basement mechanical rooms are in place.

The basement under the central pavilion has extra room to add a heat pump, and there are multiple locations to add further vertical wells to feed it. Installation of a solar air heating system is prepared on the southeast and southwest facades, currently clad with black metal panels. The residents see this option as a lower priority because the pre-conditioning of makeup fresh air from the geothermal heat pumps is so efficient.

Risk management
Risk management is not limited to the construction phase of a project; it begins in the design stage and lasts until at least one year after occupancy. One of the major lessons learned from Benny Farm was the need to somehow include additional measures to limit the risk inherent in a public bidding process, especially given compulsory selection of the lowest bidder, regardless of his reputation or track record. Little money was available to accomplish this, and city officials were not supportive of duplicating engineering consultants. After six months of negotiations, city officials finally accepted having multiple engineering consultants work together: the primary engineer for design, a second independent commissioning authority hired by the client, and a third commissioning agent hired by the general contractor. Establishing this system of double-checks was a step forward. Although it required additional work to coordinate the various consulting engineers and their overlap, this collaborative effort was effective. The overall cooperation of the general contractor and his subcontractors was also a key element in successfully building Rosemont.

It was critical to adequately define the various roles of the different commissioning engineers. Therefore, before the start of construction, the client’s independent commissioning authority completed three tasks: an independent review of the primary engineer’s proposal (mostly to evaluate the simplicity and buildability of the design), development of a plan for project commissioning during and after construction, and the formulation of an outline specification for the roles and responsibilities of the third engineer, the commissioning agent to be hired by the general contractor. Pearl says the way of collaborating with contractors is crucial: “At Benny Farm we had one engineer. He did the first engineering concept, the construction drawings, and supervision. The city didn’t pay him enough for the supervision of such complex systems, and that led to problems. That lesson led to a different approach at Rosemont, where at the beginning we had a design engineer and a commissioning engineer hired separately by the client, and the three of us got together and added a commissioning agent, a third engineer who was a kind of a security guard to be hired by the contractor. This collaborative constellation represents a new model, a new way of working with contractors. Convincing the contractor to be on our side in what is usually an adversarial process proved successful. We don’t want to work against industry. We have to bring industry on board in a new kind of hiring and training process. In the affordable residential sector the atypical commissioning agent is the one we required the general contractor to hire. His major role is to educate or thoroughly inform the general contractor and subcontractors of the sequencing of the work, the verification protocols, and the green measures, both in their wide scope
and in their details. The role of all three engineers was critical since many of the engineering systems were not simple for the client representatives to follow and observe on their own during the construction process."

**Commissioning, monitoring, and maintenance**

Construction progressed largely according to schedule, delayed only by a fire on the site. 155 units were built within 18 months, completed at the end of 2010. Commissioning, or putting the systems into operation and working out all the bugs, is normally done before occupants move into a building, but commissioning and performance monitoring are basically nonexistent in social housing in Montreal. Pearl explains the challenge: “Given that so few green affordable projects are built, it was important to not simply commission the projects but to monitor the performance for at least one year after full occupancy. CMHC and NRCan provided money for such monitoring, yet these agencies had to struggle with cutbacks of their own budgets, which delayed timely monitoring. The process and the structure are very fragile. Hundreds of things could have stopped the project, but determination and a shared vision among many people give the resilience.”

Especially for innovative projects, monitoring should begin on day one, to collect data to verify design assumptions, prove the actual performance, and to fine-tune the operation of the systems. At Benny Farm, the team thought about monitoring as they went along; at Rosemont, it was planned from the start. Pearl tells the story: “For Rosemont, we received the money to write the monitoring plan on time, but the money to start the actual monitoring was delayed, so we couldn’t start setting up the monitoring until the fall of 2012. A first three-month test trial was completed in the summer of 2013, but it was discovered that not all of the monitoring equipment was fully functional. The partial results looked very promising, from indoor air quality to natural daylighting to base energy savings. The next task was to get the residents to accept their units being part of a large-scale monitoring exercise for a year.” By the end of 2013, more than 20 percent of the units at CV agreed to participate in the monitoring project, and the official process commenced in February 2014. Parameters being monitored include indoor environmental quality, thermal and electrical energy consumption, and efficiency of control systems.

Rosemont incorporates through units, tight envelopes, passive solar design, and other features that are nonstandard in social housing; therefore, it will be informative to compare the performance with a double-loaded corridor design in Montreal over a period of a year or two. The cost would be low in consideration of the valuable data obtained. During the pilot monitoring phase, opportunities for optimizing the systems were determined and implemented, and opportunities for optimizing the operation of the systems are being documented and passed on to the users and operators. Pearl says the transfer of this information to the residents is very important to the energy performance: “It’s not good enough to have a green project – it’s how you live in the green project that determines how ecological the project functions.”
The nonprofit and the co-op collaborated to get a maintenance contract for the shared geothermal system for the 155 units. The TRG figured out with the city of Montreal a new way of shaping the budget to include maintenance of the equipment after takeover of the building. "Daniel Pearl: "We wanted a maintenance contract in place before the buildings were handed over. We decided to develop a strategy for who is going to maintain the systems. The people can't do it themselves. With a system that incorporates diverse technologies, sometimes you can't even find one contractor who can handle it all. You have signals coming from the system that should be sent to a cell phone so that a technician can intervene faster; we're still developing that aspect of technical support." The keyword here is "persistence." This is where measurement and verification come in; it requires a strategy, not waiting until a building is delivered and then finding contractors who can handle maintenance of the systems. Training and education must be an integral part of the process.

Life at Rosemont

The residents of Rosemont can now decide themselves which improvements they will make, and when. They have a certain autonomy, including some control of whether there will be bigger or smaller rent increases. Giving the residents control of their own future means they must understand their building and their options. With 155 units, and now many residents who were not involved during the design process, how can they all know about the possibility of expanding the geothermal system, adding solar panels, green roofs, urban agriculture, photovoltaic, or composting? The potential has been designed in, but how will it be exploited by future residents? User education is a prerequisite, and the TRG is responsible to issue a users' guide, not only to explain future options, but to provide information needed for maintenance and proper operation of the buildings. Many residents have had problems understanding certain aspects of the design, such as not having air conditioning: "Why aren't the windows designed so that we can install air conditioners?" Someone with technical understanding needs to be on the site to talk to the residents when such questions arise. The consulting engineers cannot be expected to attend the resident meetings, so documenting technical information is imperative.

When the residential units at Rosemont were first advertised, the co-op was flooded with applications. A selection committee was established to decide which applicants would be chosen as co-op members and future neighbors. Selection criteria were defined. The co-op sought people who are community-minded, environmentally responsible, and willing to learn. Half the apartments are subsidized, so half of the members had to have income below a certain level. The group decided that it would be appropriate also to allow high-income people, provided they are willing to invest the time in the co-op, so there is a wide range of professions and levels of education within the co-op. A certain percentage of the apartments are barrier free. Finding mobility-reduced people who would also be good co-op members was a challenge, but one that added diversity. The large units also added diversity. There is ethnic diversity, there are new immigrants, there is a desirable mix of generations. This mix and balance provides a good framework for social equity. Because there is a mix of unit sizes, when a family's children move out, the parents can move into a smaller unit without having to leave the neighborhood.

This rich micro-neighborhood of Rosemont works because residents were chosen who want a community experience. There is a very strong collective feeling, a small-town brand of friendship and respect. The founders worked hard to achieve this quality of life, in which sharing plays a major role.
we learned from Benny Farm – that is, introducing redundancy. In nature, redundancy is a part of sustainable systems. Simplicity is another principle. The systems at Benny Farm and Rosemont are still too complex for the users. Clients don’t have the knowledge, time, or experience. We need to find simple, passive solutions that are easy for the residents to use. Restrictions of building codes and subsidy programs don’t permit many types of these solutions, yet sophisticated systems are inappropriate for the context of community housing. Can a plumber do something in that mechanical room? The systems need an operation manual. The buildings do too. The more complicated the system, the more resources you need for operation. There needs to be full-time maintenance and a budget for maintenance.

Integrating high-tech systems into social housing is a fundamentally risky undertaking because the general contractor is in charge of putting a commercial-grade system into a residential-grade project. Typically, contractors who do social housing projects don’t have experience with complex projects, and they can’t adequately coordinate the subcontractors in such projects. Engineer Frederic Genest puts it in a nutshell: “Most of the contractors working in affordable housing are jobbers. For them, Rosemont, with 155 units, was 155 jobs.” One way L’OEUF responded to this was by elevating its prequalification requirements, and the market has been catching up since the time Rosemont was done.

Bernard Olivier says that loose fit is a design strategy that should be used for future projects: “We have to make spaces large enough and flexible enough to allow for other functions and other installations in the future. Our buildings will last longer than the energy systems that we have presently, and in 20 years there will be better alternatives that we can’t imagine today – but we can plan for them. So the question is: How do

Anne-Marie Pelletier tells specifically what is shared: “The residents share power. Every member has one vote as a tenant. They share the collective space, of course. We share the little problems of living together. We share a way of living that respects other people. We share what is happening in our community. We share our thoughts because we see each other often. There is a lot of sharing going on. People share food, flowers, recipes. We all have this common project even though we are all very different. The project is largely finished, but in a way the story is just starting. We have the equipment, we have people living in all the units, and we’re now looking forward to monitoring, we’re trying to correct some little glitches here and there, there is some education that needs to be done, there is a community that needs to be sewn together, to build a community takes some time. Rosemont is a work in progress. Living at Rosemont is an adventure in urban lifestyle change.”

Reflecting on the results at Rosemont
Considering that Rosemont was an exercise in applying the lessons learned at Benny Farm, the question arises: Is Rosemont simple enough? Mark Poddubiuk sees potential to simplify further: “Integrated design, with interconnected multiple systems, offers benefits, but it also creates a balance that is very fragile. If one thing goes wrong, all of a sudden a series of other things that you based on that one assumption all fall apart. That’s the most significant improvement we made as we applied the lessons
you make a building that can accommodate future changes? Designing buildings to allow for versatile usage is actually more valuable than just greening the technology. We just finished designing the renovation of a convent in the suburbs of Montreal, and it happens that the building was sold before it was finished. An interesting lesson is that they are going to reuse the building as it is, without a single change. Actually, the nuns who owned the building for over 100 years had used it for offices, a hospital, school, and dormitories for the nuns. They had a kind of spatial arrangement that allowed these things to happen, and in their new program they were wise enough to say that we should design this so that it could be a residence, or an office, or maybe something else. As it happened, they sold the building and now it’s going to be a student residence, whereas it was supposed to be 50 percent offices before. So we should think of designing buildings that are not overly specific to the current technology and the current use and that will be easier to use in the future than something that’s too highly specific.”

Ian Ball tells that Rosemont opened the door to larger-scale sustainability projects: “At the beginning of the project, we studied a district geothermal system that could serve Rosemont as well as the neighboring sites. When you think about communities and urban density, we have to begin thinking not about individual residences but rather ways of sharing heat – you know, let’s huddle around the fire. It’s a mentality issue, and it’s going to be difficult to change.”
The performance of Rosemont can be assessed by determining how well it fulfills its mission as a neighborhood of 155 green, affordable homes. The target of affordability was fully achieved. Rental or mortgage costs are below market levels, utility costs are very low, due to the efficient geothermal system and clever building design, heating costs will remain low, independent of rising fuel prices, and the prime location allows the residents to live in the city without a car. And even greater savings are programmed, because the buildings are prepped for the addition of further cost-efficiency improvements.

TRG agent Yann Omer-Kassin considers Rosemont an outstanding achievement both as social housing and a co-op development because it created a cohesive neighborhood virtually as soon as the buildings were standing: “Rosemont is a very good example of what social housing can and should be. For the last 25 years, social housing has been housing for poor people. That’s the view we have. Under the old programs, we have our typical square buildings with residents who might know one another, but there’s no sense of community. The cooperative model advantage is that there is a possibility of community-building. The energy that comes out of this co-op is very particular. The way the site was designed, the synergy among the people here, who come from very different backgrounds – there is a very particular dynamic here that I never saw before. When you come here, you hear the children playing outside. There are a lot of cooperatives in Montreal where you don’t hear or see children and you don’t detect any feeling of a micro-society. This community is building itself on its own. We’re not responsible for that dynamic, and neither are the architects; the people who have been working together from the start are responsible for that. I think we’ve helped. We were necessary as the coordinator between the professionals, contractors, funds management, and the training to be able to manage. With this project, we are starting to go beyond what is normally expected of social housing, such as environmental issues, environmental education, and the community-building synergy. These are things that grow from the grassroots here, and if it’s a success, or if it’s becoming a success, it’s because of the people who live here.”

The residents are generally content with their homes, although the units are relatively small and a few technical problems (e.g. noise, vibration, cold ground floor) have been experienced. There are so many positive aspects to living in Rosemont that the residents accept the compromise. There is a waiting list for the units (one hundred percent occupancy and a very low turnover rate), not only because of the affordability, but because Rosemont is a genuine community, the buildings are green, and the location is excellent. Frank Suerich expresses an opinion certainly shared by many: “I love my apartment. I have a bright, warm apartment and almost no heating bills, but besides that, the most exciting thing for me is living in this community which has a lot of people who are very idealistic but also realize that it’s not easy living together, and I think our selection committee did an amazing job of finding people who are willing to work hard but also compromise.”

The bottom-line proof of the success of Rosemont is that the residents feel privileged to live there. They are proud to be a part of this special community. Anne Marie Pelletier sums up the feeling: “I love the courtyard, and I love the fact that I chose it. There were a couple of alternative designs, and we decided on this one. I look at it and I think: I’m part of this. Even if I leave, I’m part of this. We had consultants who educated us and involved us, and we learned and made decisions. And I think that makes a big difference. I’ll always be proud of this project. I don’t know what the future will bring, but I’ll always have built this co-op.”
Energy analysis has become much more sophisticated over the past two decades. To compare energy consumption at Rosemont in terms of international standards, the raw data collected is expressed in kilowatt-hours per square meter per year (kWh/m²/y). To place these numbers in perspective, the IEA (International Energy Agency) states the following with respect to passive house energy standards: “Passive house refers to a widely-used German energy label. It is a voluntary label with stringent energy requirements; it requires keeping the overall energy consumption of a building below 120 kilowatt-hours per square meter per year (this is around one-third of energy demand in the average household in the United States and almost half the energy demand in the average household in the European Union)18.” In Quebec, residential collective housing projects consume a total of 170 – 220 kWh/m²/y, of which half (or about 100 kWh/m²/y) is attributed to heating17.

Monitoring of energy consumption and indoor environmental quality at Coteau Vert began in March 2014. The preliminary results for the first three months show a total energy use of 80 to 100 kWh/m²/y, of which heating energy use accounts for about 50 kWh/m²/y. The large energy savings are primarily due to the preconditioning of make-up fresh air by the geothermal system, the general airtightness of the project, passive solar gain, and strategically sized glazed openings. This impressive performance is confirmed by the very low heating bills of many of the tenants. The upper floors use significantly less energy than the grade-level units during the heating season, whereas the lower garden units remain very comfortable throughout the hot summer months.

Multiple interviews and surveys were carried out by a third-party researcher over a nine-month period in 2013 and 2014. The following statements summarize the preliminary findings of the post-occupancy evaluations18. Over 77 percent of residents believe that their buildings are significantly better than most affordable housing units. The majority of residents pay significantly less for their heating than in their previous residential units (some residents at grade level pay more). With respect to indoor environmental quality, thermal comfort is quite satisfactory during the winter months, and natural daylight, given the double-sided orientation of the units, is considered very satisfactory. Overall comfort of occupants and air quality were also found to be quite satisfactory19. As positive as this data may be, additional measures should be included at Rosemont to even out the temperature differences and energy costs that vary significantly between the highest and lowest floors.

17 Statistics from Natural Resources Canada, Quebec residential sector 2014: http://oee.nrcan.gc.ca/organisme/statistiques/
18 The post-occupancy evaluations with respect to indoor environmental quality (IEQ) via surveys and interviews were conducted by Silvestre Cela Mercier, Msc, ArchiScience. The preliminary conclusions represent about 15 surveys completed to date.
19 Preliminary measurements show that the average CO₂ (carbon dioxide) levels are below 700 ppm. The general design criteria aim to keep CO₂ levels below 1,000 ppm.
Future avenues

Affordable, community-based design and construction in North America, by Daniel Pearl

Rendered perspective of the south-west facade design for Bois Ellen.
Few projects will see either a team of client representatives or a team of consultants as devoted as those at Rosemont and Benny Farm. Reflecting on the future, next wave of community housing projects across Canada, where future residents may be less able to play such an active role, it will be imperative to adopt a design approach that is less focused on active technology, constant maintenance, or heroic efforts by board members. In other words, projects will have to be designed more in line with the European principles affiliated with passive house thinking. Such an approach would call for a significant investment in the building envelope and the incorporation of passive design principles right from the outset. In return, the overall management and operations by the cooperative housing groups would be much simpler, and long-term replacement costs would be significantly reduced or postponed. Ensuring better thermal comfort throughout the building envelope's lifetime, not to mention guaranteed energy savings and less-demanding maintenance for the residents and building operators, will make this simplified approach enticing to a wide range of client groups.

Five years ago, it wouldn’t have been possible to imagine the application of this approach in the community housing sector because of the sparseness of high-quality building envelope materials in North America or because the cost premiums for many items were still exceedingly high. Today, there are more and more high-performant, reasonably priced products available on the market, although some components are still challenging to find locally or in North America. However, this is changing every day. Although in general the costs of these materials have decreased, they remain above the modest capital cost budgets of many affordable housing projects. Adopting a passive house approach will probably require a pilot project status because the construction costs will be higher than those for Rosemont (or more than the ten percent additional funding allotted by the SHQ for green, affordable housing construction budgets). Nevertheless, the savings, whether in replacement costs, maintenance, or operations, should more than compensate for the initial additional capital investment required if a lifecycle costing analysis were to be carried out. Most importantly, the passive house approach includes a degree of resilience that is rarely seen when it comes to affordable housing.

Over the last three years, L’OEUF and a dedicated team of consultants have been planning the next large-scale social housing project: Towards passive house. Designed as a large-scale residential housing project in the city of Laval, located immediately to the north of the Island of Montreal, its construction started in August 2014. “The Bois Ellen Cooperative Residence,” designed for seniors and families, includes major innovations with respect to building envelope, energy efficiency, thermal comfort, and interior air quality that we rarely if ever see in this depth at this scale for affordable housing. Although there was relatively modest, dedicated client representation (compared with Rosemont) present throughout the design process, the client representatives clearly expressed their preference for a residential building that is easy to maintain and pleasant to inhabit without requiring the same amount of involvement that Rosemont and Benny Farm solicited. Building

20 Passive house projects emphasize the use of passive or built-in means to achieve energy efficiency, such as the appropriate choice of window technologies based upon solar exposure and emphasis on a well-insulated and air-tight building envelope, with very minimal thermal bridging.
on all of the experience gained from Benny Farm and Rosemont, the project team strategically identified the most appropriate sustainable innovations that respected the modest budgets of cooperatives and affordable housing projects while envisioning a more modest time investment on the part of the cooperative and its board members. The design will be very important to monitor side-by-side with the current and earlier pilot projects at Rosemont and Benny Farm. The project team sought to develop the design of a building that responded to the programmatic requirements of Bois Ellen while respecting its capital budget limitations (still only ten percent above conventional social housing budget in Quebec). Therefore, the building systems and technologies selected meet at least two and sometimes all three of the following criteria:

1. It is an energy-efficient, robust, and cost-effective (over 30-50 years) building design requiring little maintenance (for instance, justifying a higher initial investment with high-performance windows and doors for significant energy savings and little maintenance over many years);

2. It integrates a durable and resilient installation of building systems or products that reduce the risks associated with premature building decay or dysfunction (for instance, the design and construction of details that mitigate or eliminate thermal bridging in the building envelope and in the building systems, since concrete-framed, steel-studded exterior walls have a marred history of deterioration over a longer period in Quebec);

3. It incorporates building systems, products, and installations that improve the comfort and quality of the interior environment (including indoor air quality, natural daylighting, and physical comfort as well as simplified but efficient make-up fresh air for the mechanical systems and measures to reduce heat island issues).

Each decision during the preparation of the contract documents was carefully considered with respect to one or more of the following four guiding criteria: energy efficiency, comfort, durability, and resilience. With limited additional funding, it was important to prioritize which components of the criteria described above would be included during the initial construction phase and which could potentially easily be added over time in an evolving manner, similar to Rosemont.

In an integrated design process (IDP), as at Benny Farm and Rosemont, the Bois Ellen project was opened with an initial charrette, encouraging interdisciplinary collaboration among the project team members. One of the innovations that everyone agreed upon from the very first charrette was to keep things as simple as possible above all else. The client representatives for Bois Ellen had very little experience with green measures or green technologies, and it was paramount to shield them from future headaches that could come with more complicated installations.

A whole-building-analysis energy-simulation approach was adopted even before the first design charrette as a useful way to understand and forecast the complex performance issues over multiple timelines for the proposed building design. The various early design options and analytic processes, both during and following the initial charrette, were consistent with passive house principles. In brief, this project emphasizes the use of passive means to achieve energy efficiency and thermal comfort, such as the appropriate

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23 Passive house projects emphasize the use of passive or built-in means to achieve energy efficiency, such as the appropriate choice of window technologies based upon solar exposure and emphasis on a well-insulated and airtight building envelope with very minimal thermal bridging.

24 Curt Hepting, of Enersys Analytics Inc., uses a custom-made shorthand Excel spreadsheet program (based on DOE 2 engine) to evaluate whole building design variants for live residential building simulations during charrettes.
housed project to easily evolve to further improve energy efficiency and building comfort while ensuring an adaptability and robustness in the face of future weather events and potential climate change.

The final design for Bois Ellen, currently under construction, should approach the energy efficiency of Rosemont 25 even though the building carcass (concrete frame) is much more difficult to build with respect to significantly reducing thermal bridges. As a response to the lessons learned from Benny Farm and Rosemont, there is a calculated balance of individual unit energy saving measures, whereby residents’ living habits directly affect their energy bills, and efficient centralized building energy measures, whereby individual maintenance responsibilities are kept to an absolute minimum. From a more holistic perspective, the future of inspiring social housing in Canada must be directly linked with the creation of high-quality adjacent public spaces and the accompanying lifestyle that will animate such public realms. For people to willingly do without their own private backyards, we will need beautiful, lush, public gardens and courtyards. This is the real challenge.

My partner Sudhir Suri sees part of the solution in opening our minds to long-term thinking: “In North America generally, we have lived in a culture which defines affordability on a very short timescale. But there are legacy issues that are starting to surface in politics. And as soon as we start paying attention to the legacy issues – what are we actually leaving behind when we go – we will start thinking further into the future. And as soon as we

25 The base-case scenario before designing Bois Ellen projected heating energy use of about 144 kWh/m²/y and total energy use of about 240 kWh/m²/y. The “towards passive house” final design, now under construction, projects an average heating energy use of about 43 kWh/m²/y and an average total energy use of about 135 kWh/m²/y, both relatively close to use at Rosemont, but without using renewables or geothermal heat pumps, so only conventional maintenance and operation is required for this co-op.
start thinking further into the future, it will be less and less possible for municipalities to ignore the operations and maintenance budget for a building that they're commissioning today. It will be less and less possible for the provincial government to not think about the life and cost of its infrastructure 100 years from now. I think very soon there will be a crisis of conscience about what we must build now. We really don't have a choice. And I think it's not going to be a threat-based shift, based on doom and gloom. I think it will be a pride-based shift. We won't want to be the generation that didn't leave things better for the generation afterwards. It is partially demographic.

Speaking to populations who are thinking more and more of their legacy, one of the offshoots will hopefully be a decrease in short-term thinking. It will decreasingly be an option. Once we have people thinking that way, community-based design is going to take a big jump. And construction is going to get better. And I hope we build enough of it to actually make an impact. And if we can do it here in Quebec, we can do it pretty much anywhere. And so the examples that we create will be used — and *that* will achieve measurable change. For me, that's the future. It's redefining what the future means to us, what affordability is, what the timescales are. We have to do as much work on getting people to look farther into the future as we do on the techniques of building. It's a sort of temporal 'think globally, act locally' — it's 'imagine the future, act in the now.'"
Green Energy Benny Farm (GEBF)

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Key people involved in the birth, development and promotion of GEBF
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Project Manager
Alex Hill, (2005 – 2011 for final design and construction phase)
Project Manager
Luba Serge, (2005 for design phase)
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Rosemont: Coteau Vert (CV) and Un toit pour tous (UTPT)

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Bois Ellen

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*Daniel Wentz was born in California and received a Bachelor of Architecture from Virginia Polytechnic Institute and State University. He has practiced as an architect in the USA and in Europe, and works as a freelance writer and translator living near Basel, Switzerland.

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