Greening the Infrastructure at Benny Farm

Benny Farm was built in 1947 to house veterans returning from the World War Two, embodying the Social ideals of the time.

By 1990 Benny Farm had fallen into disrepair. Over 12 years 7 different visions for its redevelopment were proposed.
green building strategy

Modern industry is focused on cost efficiency, with little concern for the extensive waste it produces. This construction process is sensitive and responsive to its immediate and remote environmental impact.

Contextual response and aesthetic impact
Renovated as well as new buildings reuse original brick which was dismantled, tested, cleaned and reinstalled, creating a precedent for large scale in situ masonry recycling and blurring the boundaries between old and new buildings and materials. Original cast iron radiators were to be found compatible with the new geothermal heating system. Their visual presence, efficiency and thermal comfort contribute to the quality of the apartments. The exterior walls and roofs of the original buildings were upgraded to include green roofs and improve air tightness. Close attention to envelope performance and longevity will reduce the risk of premature degradation and mold problems.

Ethical standards and social equity
Extensive building renovation and on-site material reuse, instead of demolition and rebuilding, promotes local labor and skills, at a cost competitive with more industrialized techniques. Work was in part realized within the existing financial and contractual framework for subsidized housing, accelerating construction and reducing the number of parties involved.

Ecological quality and energy savings
Waste generation and pollution linked to new building material production were both considerably reduced through inventive on-site reuse of bricks, wood flooring, heating radiators and piping. New materials were chosen based on their recycled content, such as fly ash concrete with supplementary cementitious materials (CDM).

Economic performance and compatibility
Renovation and reuse, while demanding for the designers who need to document and evaluate existing materials and systems, was equivalent in cost or cheaper than new construction. The building designs also integrate spaces and the required infrastructure to allow for their later completion or the addition of other systems funded through energy cost savings. As an example, green roofs can be added later on some buildings as the structure and roofing membranes were designed to support the added loads of green roofs.

Quantum change and transferability
New expertise was developed on the technical challenges of upgrading a common local construction type: reuse of exterior brick cladding or old hot water heating systems, acoustic separations, building insulation and air tightness, integration of new mechanical systems in existing spaces, all within strict budget constraints.

construction system

building facilities
green roof
new buildings
re-used brick

energy services
radiant heating and cooling
evacuated tube solar panels
geothermal energy
heat recovery
water services
storm water retention
percolation beds and landscaping
grey water collection and re-use

sustainable best practice details
research project by L’OEUF and Dominique Derome

3600kg of waste is thrown into the landfill during the construction of a typical 200m² house.

brick cycle
sorting and re-use of bricks on site

High performance envelope
CBRC research put into practice at Chao Sai

Upgrades to structure
To support the added loads of green roofs
200 L MODU, steel beams
MODO/insulation/air tight finish
Chao Sai, concrete

1. demolition

2. sorting

3. cleaning and stacking

4. re-use

High performance materials
L'OEUF receives funding from the community.

1992 – 94

Articles related to the socio-cultural heritage of Benny Farm appear in the local newspapers.

Ethical standards and social equity

1992

L’OUEF is founded when Mark Poddubiuk and Daniel Pearl begin researching housing in Amsterdam.

1992 – 94

CBRC research put into practice at Chao Sai.

1992 - 94

L’OUEF receives 16000$ from the community.

1992

VBSE receives 5000$ from the community.

1992-1993

Leclaire/Bruggen: 200 L MODU, steel beams
MODO/insulation/air tight finish
Chao Sai, concrete

1992

1. demolition

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fresh air

90% of our lives are spent indoors, where air pollution is often worse than outdoors. Quality of life and health is improved by reducing polluting materials and systems, and integrating passive and assisted ventilation.

Concentrations of many Volatile Organic Compounds are up to ten times higher in concentration indoors than outdoors. VOCs are emitted by a wide array of building products.

Contextual response and aesthetic impact

The building's high efficiency fiberglass windows with operable sashes for natural ventilation, complemented by mechanical systems which integrate supply air preheating using solar panels and exhaust air heat recovery through energy recovery ventilators.

Ethical standards and social equity

Increased energy efficiency to reduce heating costs is coupled with mechanical ventilation systems to ensure high indoor air quality. Operation and maintenance of mechanical systems will be centrally managed by the non-profit corporation to ensure long-term monitoring and performance. Improved indoor air quality reduces risks of respiratory problems for residents.

Ecological quality and energy savings

Cold air is heated prior to distribution through four different techniques: solar panels, energy recovery ventilators, fan coils linked to the geothermal network, and heat transfer between return and supply ducts. Summer dehumidification, for increased comfort, is made possible through fan coils linked to geothermal network. Indoor air quality is improved by the selection of low VOC emission materials.

Economic performance and compatibility

Increased ventilation coupled with energy efficient systems does not increase energy costs for residents over conventional construction.

Quantum change and transformability

The project integrates high efficiency supply of fresh air into affordable housing, defining a new quality standard for this type of construction.

Fresh Air System

1. Solar Wall

Fresh air from the exterior is heated by solar energy:
-20°C air heated to -12°C (cloudy day)
-20°C air heated to -5°C (sunny day)

2. Energy Recovery Ventilator

Energy is recovered from the stale exhaust air:
-50% efficient, transfers heat:
-12°C air heated to 13°C (cloudy day)
-5°C air heated to 15°C (sunny day)

3. Geothermal Loop

When needed, hot water from the geothermal system heats the intake air:
6°C air heated to 16°C (night)

4. Plenum

Supply and return air are adjacent to further recycle energy
16°C air heated to 18°C

Hybrid Solar and Geothermal

Supply air pre-heated (or pre-cooled) by exhaust air from units

Energy Recovery Ventilators

Natural Ventilation

units with windows on both sides of the building allow passive and enhanced natural cross ventilation

Stale, warm air exhaust

Cold air is preheated prior to distribution through four different techniques: solar panels, energy recovery ventilators, fan coils linked to the geothermal network, and heat transfer between return and supply ducts.

Summer dehumidification, for increased comfort, is made possible through fan coils linked to geothermal network.

Indoor air quality is improved by the selection of low VOC emission materials.

Geothermal wells provide a constant source of energy suitable for heating and cooling.

Closed-loop geothermal systems are used for heating and cooling applications.

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75% of this project’s energy does not rely on external infrastructure. It is generated and transformed on-site from the renewable sources of geothermal and solar energy and distributed by a shared infrastructure.

The project integrates tested solar technologies and green building strategies within the constraints of existing buildings and established urban design guidelines. Although large parts of the local electricity is produced by hydro-electric dams, this resource is limited. Increasing local demand is reducing exports to neighbouring regions where coal plants dominate electricity generation. The shared local infrastructure ensures future flexibility in adding new heat sources and redistributing the energy between buildings.

Ethical standards and social equity

The energy infrastructure will be controlled by a board composed of residents, community representatives and technical experts. This will oversee how the revenue from energy savings will be distributed, between management, maintenance, research, expansion of green infrastructure, passing the savings to residents, and investing in ongoing education and dissemination – both to residents and to the community at large. Given the unprecedented scale of the project, potential risks are reduced through multiple back-up systems. The emphasis on risk management is protecting the quality of life and the rights of the residents of this demonstration project.

In order to encourage a wider dissemination of these new technologies, contractors were not chosen based on previous sustainable construction experience. Green infrastructure systems were presented to base building contractors for negotiation and implementation in hopes of encouraging the gradual transformation of the industry.

Ecological quality and energy savings

The thermal comfort of the apartments is greatly improved by radiant heat water distribution, compared to the standard electric baseboard used in similar affordable housing projects. An in-depth and innovative risk management strategy has been incorporated with respect to the solar and geothermal strategies. Due to the fact that the heating requirements outreach the cooling requirements by a factor of 9 to 1, numerous safeguards have been incorporated to respond to the potential for freezing the geothermal earth network.

Economic performance and compatibility

Green Energy Benny Farm is developing a 30-year business plan which integrates energy revenues and costs from operations, maintenance and management. The long term financial viability of the project is a primary concern.

Quantum change and transferability

The project applies the model of a shared infrastructure to numerous systems and various scales. In order to benefit from latent synergies and reduce risks through redundancies, economies of scale allow trained management and operational support.

on-site energy production

Heat energy in Quebec comes from hydroelectric power. The famous La Grande hydro station in Northern Quebec flooded 11 000 sq. km of land and caused widespread environmental contamination.
Conventional water management indiscriminately diverts rainwater, grey water and sanitary waste to treatment facilities. This project values water quality. A viable alternative to the use of water returned to the water table.

To treat grey water filtration. Also, additional treatment is intended to add to the general knowledge base and aid in its regulatory approval. The parallel approach is to implement projects with a smaller scope in order to gather documentation to prove the sustainable argument of grey water percolation, and forces environmental standards are not definitive on infrastructure has been designed to be integrated with urban densification without overburdening limited existing infrastructures.

Quantum change and transitoriness In an effort to evaluate the best long term strategy for on-site water treatment, the proposed water infrastructure has been designed to be integrated in a step-by-step process. Quebec’s current environmental standards are not definitive on the subject of grey water percolation, and forces experimental projects to go through an extensive monitoring process. A less expensive and lower risk approach is to implement projects with a smaller scope in order to gather documentation to prove the case for later expansion. The biological and mechanical grey water filtration systems of Green Energy Benny Farm will treat water from rain in flushing toilets. The water quality data gathered over the first few years of operation of these systems should determine the suitability of the treated water for on-site percolation back to the natural water table and aid in its regulatory approval. The parallel evaluation of the filter marsh and the H2O system is intended to add to the general knowledge base of grey water filtration. Also, additional treatment measures can be added to the systems separately, as needs arise.

A renovation viability study was conducted by LDEK, to prove the sustainable argument of grey water filtration. Jan Diama was the structural engineer.

2003

The first contract was signed for phase 1.

2003

Water consumption L/yr

grey water

grey water into sewers

The grey water reservoir grey water from the 3 buildings is stored and sent to the H2O treatment system for treatment 19 m³/day

grey water collection 2.4 m³/day

filtered water supply

H2O treatment system mechanical filtration of grey water with UV sterilization 3.5 m³/day

grey water reservoir grey water is collected from showers and sinks 4.6 m³/day

grey water collection grey water is collected from showers and sinks 4.6 m³/day

gray water percolation beds collected storm water is allowed to percolate down to the water table

potable water coming from the city 4.4 m³/day

grey water reservoir grey water from the 3 buildings is stored and sent to the H2O system for treatment 3.5 m³/day

H2O treatment system filter marsh is used to flush low-flow toilets 1.4 m³/day

grey water reservoir grey water from the 3 buildings is stored and sent to the H2O system for treatment 19 m³/day

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Green Energy Benny Farm, the independent company created by the project, will lead the operation and growth of the shared infrastructure. A legal mechanism will empower local residents, the community and technical experts, to participate in the determination of their future.
enabling a new future

This prototype for community-driven sustainability is designed to be copied. It puts forward a model for the stewardship of a social, ethical, technical and financial ecology.

construction progress

solar wall installed at Chez Soi
preheats fresh air intake
green Energy Benny Farm will begin operation 2006
monitoring equipment
goethermal test well to test capacity of ground to provide geothermal energy
re-used bricks
after recuperation, cleaning and sorting
bioswale courtyard with view to HCNDG
heat recovery ventilator installation
Chez Soi roof
heat exchanger at Z.O.O. mechanical room
ready to accept geothermal system
GFX - waste water energy recovery
preheats domestic hot water
bioswale courtyard

The most important aspect of the shared green infrastructure is the opportunity that it provides to empower the collective and the individual in the creation of the physical environment. At the same time, it permits government to withdraw from direct participation in the provision of affordable housing. It is a solution to the current housing crisis in North America that is politically, economically, legislatively, and socially realistic. Not unlike a romantic ideal of the city as a reconciliation of competing visions of society in a spirit of compromise and not necessarily consensus, a shared green infrastructure provides a level playing field for a variety of interests. It is possible in that context to imagine an alternative social vision. It legitimizes a broader and growing spectrum of the population and opens the door to a renewed interpretation of the public domain, city-building and dwelling.

Like a quilt, we are proposing to overlay an intense pattern of infrastructure over the entire site, each part having its own distinct character. We intend to distribute different systems as evenly as possible all over the site. Every inch is important and useful to the overall pattern. It is an evolving work based upon an overall pattern, developing as new parts are added.

conventional design process

integrated design process

2005 June
Green Municipality Fund contract signed.

2006
Green Energy Benny Farm will begin operation

2006 - XXXX
Green Energy Benny Farm savings will be reinvested into monitoring the infrastructure.

2006-20XX
The performance of the green infrastructure will be researched and evaluated with financial support from the CMHC.

20XX
Green Energy Benny Farm savings will be reinvested into the completion of the planned infrastructure.