HARBOURFRONT CENTRE GREEN STRATEGIES CHARRETTE

APRIL 7, 2009

FACILITATED BY:

SUSTAINABLE BUILDINGS CANADA

SUSTAINABLE BUILDINGS CANADA

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1.0 EXECUTIVE SUMMARY

Harbourfront Centre (HFC) buildings and property are a central part of Toronto's public realm. The greening of an important space such as HFC is not only significant because of the direct environmental impacts and the improved performance of its own facilities, but because it represents a unique opportunity to engage, educate and inspire the public in the process.

Few other places in the city receive the quantity and diversity of visitors, and the free, open, creative nature of the venue has a long history of building lasting memories and relationships. By tying sustainability into the numerous activities, facilities and experiences that one finds at HFC, a whole new audience not typically engaged in this issue will not only learn about and improve the sustainability of HFC, but carry the message away with them, amplified.

To deliver this message HFC must lead by example. Through the Design Charrette process many opportunities for improving the environmental performance of HFC were identified. Three groups were formed to examine opportunities for existing buildings, the site in general, and the associated messaging and communications.

While the primary buildings of HFC represent an excellent example of adaptive reuse occupying former industrial buildings, they were renovated at a time when energy conservation was not a primary consideration. The Sustainable Design Charrette identified a number of approaches for improving the environmental performance of these buildings. As with all sustainable building projects, the first task is to minimize the use of existing systems – maximize day-lighting potential, natural ventilation, better insulation and window glazing. Secondly, consideration should be given to ensure that systems in use are as efficient as possible through maintenance, replacement or retrofit. Thirdly, HFC can improve the operation of building systems to decrease energy use through building automation, sensors, and controls. Finally, there may be the potential to integrate renewable energy solutions or other forms of self generation.

Of particular interest is the rooftop potential of HFC for a combination of green roof and solar installations. Green roof opportunities range from traditional sedum coverage to community gardening, while the large flat roof expanse and clear southern exposure provides opportunity for both solar thermal and photovoltaic systems.

The larger site has many considerations: parking and transportation, landscaping and irrigation, waterfront ecology and marina operations, waste management, and most importantly how the site can affect the environmental awareness and ultimately the behaviour of both the tenants and the users.

In part because of its position on the waterfront, HFC has a distinct opportunity to showcase the latest innovations in water management. Wherever walkways and hard surfaces are required, permeable pavement should be used. Only lake water or rainwater should be used for purposes such as toilets and irrigation. Onsite treatment should return only clean water to the lake. The construction of an underground parking garage also represents a great opportunity to integrate a water cistern for rain water harvesting.

Natural vegetation intelligently planned provides needed shade for visitors, in addition to absorbing rainwater and creating a cooling effect. Proper plant selection will also reduce the need for overall maintenance.

Waste represents a significant portion of the environmental footprint of the HFC, with millions of visitors coming for various outdoor events and activities. While the HFC is currently doing an admirable job of waste management, 100% waste diversion can be achieved through a focus on organics with onsite processing, and through ongoing visitor education.

To guide the greening activities around HFC a set of guiding principles was established: authenticity, engagement, inspiration, creativity, and possibility. This will ensure that greening initiatives will result in real measurable benefit while emphasizing HFC's strength of providing a dynamic, accessible environment for the public.

By their nature, Charrettes deliver a thumbnail sketch of viable options from a large pool of possibilities. To get a firmer conclusion or set of next steps, HFC should carefully consider the results presented herein, define which options are viable, and decide how to proceed. The themes and approaches identified represent a reasonable point of departure.

2.0 BACKGROUND

Harbourfront Centre is committed to transforming its 10 acre site into a green district on Toronto's waterfront. As part of its core operations, the organization wishes to explicitly adopt principles and practices throughout the organization that are inherently green and sustainable.

As part of this effort, HFC contacted Sustainable Buildings Canada (SBC) to assist in developing a sustainability Vision Statement, and ultimately in developing and delivering an Integrated Design Charrette that would bring together a variety of green building specialists including architects, mechanical, electrical and structural engineers, experts in costing lighting, building envelope, renewable energy, and environmental marketing and program management.

The visioning exercise included key HFC staff, stakeholders and sustainability experts. The session examined a host of sustainability attributes and features, eventually arriving at a vision that would help guide the greening of HFC (generically termed "the project").

> ***Harbourfront Centre's Green Vision:***
>
> "HARBOURFRONT CENTRE WILL TAKE A LEADERSHIP POSITION THROUGH THE GREENING OF THE HARBOURFRONT CENTRE DISTRICT IN A MANNER CONSISTENT WITH ITS ARTISTIC DIVERSITY AND CULTURAL ROOTS. THIS SHOULD RESULT IN THE DEVELOPMENT OF A SITE THAT IS A MODEL OF GREEN TRANSFORMATION THROUGH AGGRESSIVE AND INTELLIGENT IMPROVEMENTS, AND IN DOING SO, HARBOURFRONT CENTRE WILL ENGAGE CONSTITUENTS THROUGH PROGRAMMING, EDUCATION AND BECOMING A SOURCE OF INSPIRATION TO ALL."

Using this vision as a guide, SBC and HFC staff developed a series of scenarios that would be further explored as part of the Design Charrette. These are described in Section 2.0.

SBC engaged 6 facilitators, a building simulator, and a "Green Globes" rating system consultant who assisted in both the preparation and delivery of the Charrette. Three recognized sustainability experts also assisted on the day of the Charrette providing guidance and assistance to the teams as required.

SBC is pleased to present this final report and wishes to thank the facilitators, modelers and experts and most importantly, the participants and HFC staff whose efforts made the Charrette successful.

3.0 DESIGN CHALLENGES

Harbourfront - York Quay Centre is described as follows: A multi-disciplinary artistic and cultural focus orientated building showcasing works in contemporary visual arts, crafts, literature, music, dance and theater. The building was originally a two storey converted warehouse. A third storey office addition was recently added.

Harbourfront Centre is comprised of York Quay Centre, and the Enwave Power Plant Art Gallery and Theatre. The York Quay Centre is a 3 storey, 50,795 square foot building that was built prior to 1960. The renovated Power Plant is 31,400 square feet. There are approximately 100 people working in the building, which operates 7 days a week for 12 hours per day. The building is owned by Harbourfront Centre and managed by Mr. Helder Melo.

Developing a sustainability strategy for such a large, multipurpose complex was a challenge. Three Teams were formed to tackle the challenge, each from a different but ultimately complementary perspective. The 3 scenarios were:

Group 1:

GREENING ON-SITE EXISTING BUILDINGS AND OPERATIONS

The examination of the on-site buildings operations will be guided by the Green Globes assessment framework. Participants will seek to improve the building operations through a thorough examination of the various energy and water-using end uses and equipment, alternative equipment including renewable energy will be considered with the intent of establishing a holistic package of improvements.

Group 2:

GREENING THE SITE

Greening the site focuses on the non-building operations on the site (while recognizing that the buildings and the site are intrinsically linked. Site waste streams, water and energy use will be considered, as will unique opportunities to showcase "green" features. It is anticipated that the development of the green characteristics of the site can serve as a lynchpin for the green messaging.

Group 3:

DELIVER GREEN MESSAGING THROUGH DEMONSTRATION, EDUCATION AND PROGRAMMING AND REACH-OUT TO LOCAL NEIGHBOURHOODS – ENGAGE AND PARTNER

This track will ultimately bring together the results of activities undertaken in the buildings and on the site as part of a strategic green messaging initiative. Participants in this group will seek to identify the strategic partnerships and messaging that might occur, including funding assistance as required. The green messaging must also recognize the strong educational programming and history that Harbourfront has already established.

It is important to note that while the facilitators attempted to ensure similar approaches to the discussions, ultimately each team defined their own scope, process and perspective. The results of the discussions are reported "as is" in Sections 4 through 6.

4.0 "GREEN GLOBES" ANALYSIS OF THE EXISTING BUILDINGS

To develop a baseline understanding of the existing site facilities, Jiri Skopek of Jones Lang LaSalle did a preliminary analysis of the existing buildings using the Green Globes rating system checklist.

See Appendix A for more information about the Green Globes Rating System and the full Green Globes Report.

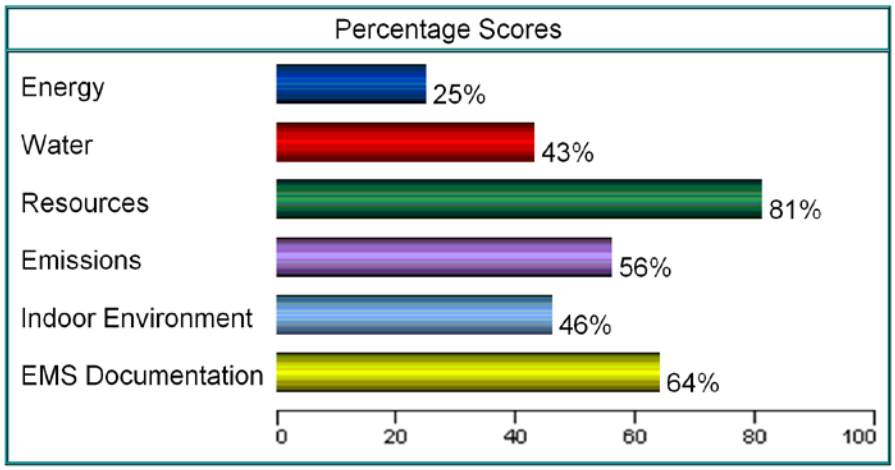
4.1 PRE-ASSESSMENT RATINGS – YORK QUAY CENTRE AND POWER PLANT

The pre-assessment is combined with a Building Energy Evaluation, and a "walk-through" visual assessment of the building and its major building energy consuming systems, to help ensure that any potential energy retrofit measures, which may be suggested in connection with the charrette or BOMA BESt program, are practical and cost effective.

The York Quay Centre achieved a Green Globes score of 25% for its energy consumption. The Power Plant achieved a Green Globes score of 45% in the energy category. The 2008 energy performance for the entire Centre was 96.2 ekWh/ft^2/year (3,729.7 MJ/m^2). This is very high energy usage, and indicates considerable opportunity for improvement.

GHG emissions (CO_2 equivalent) were 3,179.5 Tonnes/year. Energy costs were $608,177. If all recommended energy savings measures were implemented, the annual saving potential could be in the order of $162,800, with a resulting GHG emissions reduction of approximately 743.5 Tonnes.

Percentage of points achieved by Harbourfront - **York Quay Centre** for each module:

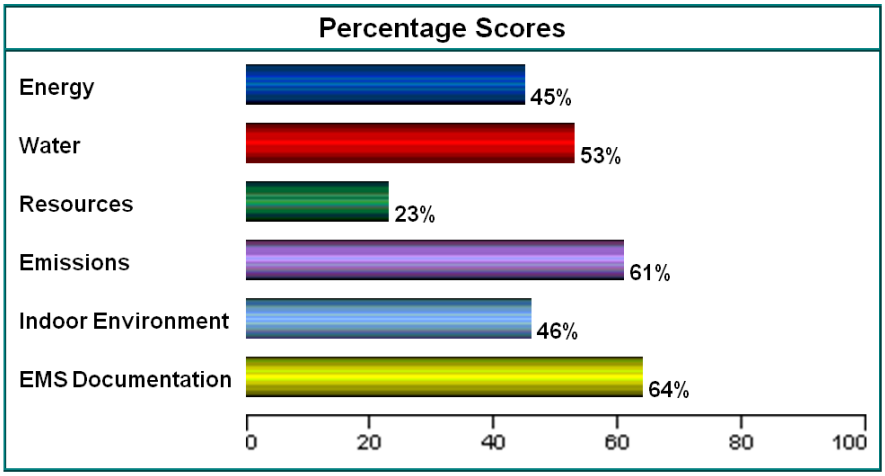


York Quay Centre – 2 Green Globes

Overall Rating of 46% before the Charrette

-

Percentage of points achieved by Harbourfront – **Power Plant/Art Gallery** for each module:



Power Plant/Art Gallery – 2 Green Globes

Overall Rating of 48% before the Charrette

5.0 EXISTING BUILDINGS TEAM – TEAM 1

Team one was facilitated by Jiri Skopek and Neil Barratt of Jones Lang LaSalle and included:

- Angelo Poto, City of Toronto
- Kirk Johnson, City of Toronto
- Dwight Powrie, Enbridge Gas Distribution
- Brian Skol, Harbourfront Centre
- Chris Hodgson, Harbourfront Centre
- Randy Sa'd, Harbourfront Centre
- Roberto Garcia, Ontario Sustainable Energy Association
- Daryoush Kalali, Jones Lang LaSalle
- Livio Nichilo, Internat Energy Solutions Canada Inc.
- Bill Scott, Toronto Hydro
- Judy Lipp, Toronto Renewable Energy Cooperative
- Bjarne Pedersen, Architectural Lighting Design

5.1 SUMMARY OF RECOMMENDATIONS

Based on Group 1 deliberations, interviews, site observations, and an evaluation of the building's monthly utility use and costs, the following table summarizes opportunities.

5.1.1 ENERGY

Lighting

- Diode (LED) exit signs
- Lighting retrofit
- Lighting and day lighting Controls
- Task lighting (In York Quay Centre)
- Maximize the use of natural daylighting

Heating, Cooling & Ventilation

- Solar preheated ventilation air system
- High efficiency water heater: condensing water heaters, or tankless (instantaneous) hot water heaters
- Solar hot water heating for industrial purposes
- Direct-fired space heating/ventilating systems
- Geo-exchange
- Demand controlled ventilation
- Furnace heat recovery
- Solar cooling
- Ice harvesting-off peak ice
- Energy-efficient motors, fans, pumps, variable speed drives

In Power Plant/ Art Gallery:

- Atmospheric boilers-replacement
- Installing high-efficiency modulating or condensing boilers.
- Installing automatic vent dampers
- Installing low-flow faucet aerators and electronic infra-red sensors or self-closing, metered faucets

Green Energy and Innovative Energy Efficiency Features

- Solar PVs
- Possibility to generate electricity
    - Investigate geo-exchange particularly during the construction of Canada Square
- Green Roof in combination with solar-particularly when roof retrofit is desirable
- Smart Grid (Grid as battery)
- Hydrogen Economy Demonstration
- Community Power with condos-Enwave
- Estimated min. savings 20%=$150,000

- Est. project value: $800,000
- 6 year payback
- City/Enbridge loan funds
- Incentives funds

Envelope

- Replacement of the windows
- Solar glazing-feed in tariff-federal building
- Overcomes overheating
- Retrofit entrances
- Compartmentalization of space
- Green Roof-Tremco structural assessment
- Rainwater collection

Energy Management

- Establish an Energy Policy
- Perform full energy audit (HVAC+ Lighting)
- Perform full energy production audit
- Implement sub-metering

5.1.2 WATER

Water Conserving Features

- low flow toilets that use less than 6L/flush
- In Power Plant/ Art Gallery:
- Low flush urinals that use less than 3L/flush or waterless urinals
- Low flow faucets (7.5 liters/min.)
- Automatic valve controls and/or proximity detectors
- Collected rainwater

5.1.3 RESOURCES

Facilities for Storing and Handling Recyclable Materials

- Fluorescent and high-intensity discharge (HID) lamp recycling program

In York Quay Centre:

- Facilities for the recycling of the paint thinner and other solvents

Waste Reduction Work Plan

- Large amount of wall board from exhibitions
- Partnership with OKAM
- Specify a 75% diversion rate for construction waste (from landfill and incineration)

5.1.4 EMISSIONS, EFFLUENTS AND POLLUTION CONTROLS

Air Emissions

- High-efficiency, low-emission boilers
- Boiler maintenance schedule and records keeping

Ozone Depletion

- In York Quay Centre:
- Ozone-depleting refrigerants phase-out (R-22)
- Replacement the halon fire-fighting equipment with alternatives

Water Effluents

- Floor drains protection in areas where chemicals are stored

Hazardous Products, WHMIS, Health & Safety

- Establish WHMIS Program
- Storing hazardous chemicals and materials under appropriate conditions

5.1.5 INDOOR ENVIRONMENT

Ventilation System

- Permanent carbon dioxide monitoring

- In a major retrofit situation, consider providing natural ventilation of the building's spaces

Control of Pollutants at Source

- Airflow monitors and controls
- Continuously regulate room pressure differentials
- Environmentally-preferable cleaning materials

IAQ Management

- Annual indoor air quality audit
- Develop documented procedures for maintaining good IAQ
- Continuous monitoring of temperature and humidity

Lighting Management

- Schedule of maintenance and cleaning of luminaires.
- Regular group re-lamping and re-ballasting program

5.1.6 ENVIRONMENTAL MANAGEMENT SYSTEM

Environmental Management System (EMS) Documentation

- Establish an Environmental Management Policy
- Document in the policy manual goals and targets

Environmental Purchasing

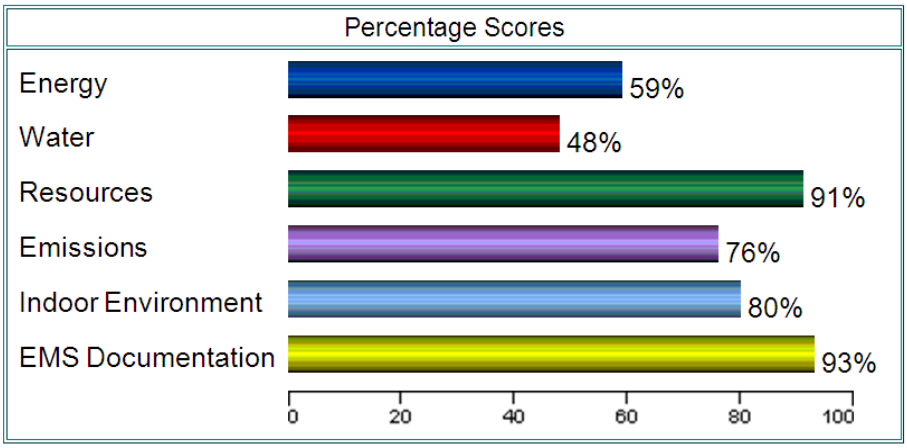
- Set up an Environmental Purchasing Plan

Emergency Response

- Provide a site map showing the location of environmentally significant features and equipment

5.2 ASSESSMENT RATING – AFTER SUSTAINABILITY CHARRETTE

Percentage of points achieved by **Harbourfront Centre** for each module:



Harbourfront Centre – 4 Green Globes

Potential Rating Improvement

Overall Rating of 72% after the Charrette

6.0 SITE TEAM – TEAM 2

The Site team was co-facilitated by Bob Bach and Mike Singleton of SBC. The team members included:

- Helder Melo, Harbourfront Centre
- Steve Poulos, Global Warming Prevention Technologies
- Bernie McIntyre, TRCA
- Tom Ponessa, Delcan
- Paul Leitch, Johnson Controls
- Andrew Wilcox, Enwave
- Robert Plitt, Evergreen Brick Works
- Dianne Young, Exhibition Place
- Robert Cooke, Smart Metering Systems
- Shana Stott, City of Toronto
- Cindi Van Den Hoevel, Mariposa Cruises

The group started with an examination and confirmation of the scope for the ensuing deliberations. This scope was subsequently defined as:

WASTE, SOLID WASTE, WATER, NON-BUILDING ENERGY USE, TRANSPORTATION, RENEWABLE ENERGY

Next, the team identified a series of potential objectives that might be considered for the site. These included:

- Carbon neutral or carbon negative, net generator of energy
- Net providers of energy
- Zero storm water
- Key performance indicators (KPI) – adopt a key environmental indicator (KEI) – create the KEI and then measure – create a "public resource" audit – and then minimize or increase utilization – e.g. improve utilization of what is here. The resources would include both hard resources such as water and soft resources such as intelligence
- Experiential performance as well – behavioural change
- Hard and soft infrastructure – programming and demonstration

- Plot the sustainability path and walk the talk
- Make the site work and make it obvious that the site is green – infrastructure should be interactive – visually get the message
- Public is actively engaged in the greening of the site – e.g. stewardship activities – planting trees, laying stones etc
- Cascading resources – e.g. rain water for turbines, remove as much energy from things as we can before letting it go
- Procurement policies – policies under which the tenants operate
- Inspire change in behaviour towards sustainable practices – the mechanism is the programs
- Improve the natural environment and ecology
- Optimize bio-diversity

With this long list in place, the team attempted to summarize the objectives in a manner that would accommodate a subsequent and more detailed analysis. The resulting summarized objectives included:

- Net energy generator
- 100% waste diversion, zero landfill
- Zero automobile use
- 100% water re-use
- Inspire behaviour change towards sustainability
- Improve site ecology
- Create a green focus and brand it – the focus will knit the various activities together

These are further explored in Section 5.1 below.

While the team was not charged with examining messaging and/or programming associated with the site scenario, a number of notable opportunities were identified, including:

- Programming – ability to modify behaviours – educate, provide incentives – link the events to the low carbon vision – the reason Harbourfront is here is to have programs – tie them to the events and use incentives to engage visitors
- Provide messaging regarding environmental impacts of activities – e.g. Exhibition Place informs major shows on what their environmental impacts are
- Showcase environmental products/service providers in a “product knowledge” environment

- Set specific goals and use legitimate measuring tools to ensure authenticity of the results. Showcase these results as part of the "green features" and integrate them into the programming where possible.

The team also identified a number of activities that should be undertaken in support of the eventual greening of the site. These included:

- Development of a "Values Charter" that users/stakeholders sign or commit to as part of their involvement in the process.
- There should be a series of comprehensive audits that include:
    - Transportation management and needs (including environmental impacts). Need to know how visitor access the site.
    - Waste audit and diversion assessment including full cycle analysis
    - Transportation metrics can be take the form of the City's transportation performance measures:
        - Number of parking spots
        - Number of bikes etc
        - % of waste diversion
- Also consider integrating transportation systems through "nodal" linking – trains, with bikes, with boats etc
- Consider partnering with Kortright Centre – twinning with like-minded initiatives, sharing programming etc.
- The greening of the site could also become the focus for the site and one of the keys ways to engage users.
- Whatever activities are undertaken, they must be grounded in a sense of realistic budget constraints. One way to achieve this will be through phasing.

6.1 OBJECTIVES

The following discussion presents the specific items that Team 2 identified as potential means of achieving the various objectives.

6.1.1 NET ENERGY GENERATOR

The team anticipates that this opportunity would be primarily covered by the buildings team, however some potential activities include:

- Wind turbines – explore latest vertical turbines
- Consider holistic solutions – multi-purpose – tri-generation etc.
- Through the use of a combined heat and power and a district system, it might be possible to have the site be a net generator on some days
- The intent should be to first reduce consumption – use the vegetation, etc. to help get the loads down, then focus on the supply/generation of power
- Solar PV – while building integrated systems offer obvious opportunities, there might be other solar PV systems that can be explored
- Solar hot water generation might also be possible

6.1.2 100% WASTE DIVERSION

- Start small – e.g. – composting kitchen waste, yard trimmings and other on-site organics. Demonstrate the possibilities with small (and less expensive) systems first – part of the phased in philosophy
- Use compost as a feedstock for the green roofs or other on-site needs – again, start small but adhere to the principal of the "closed loop"
- Do source separation of all (most) materials. Use the CNE example as a guide.

6.1.3 ZERO AUTOMOBILE USE

- Re-consider the need for the expanded parking lot – use buses, etc. to ferry people from alternate lots.
- Promote public transportation as part of the messaging – make it cheap and easy to get to HFC
- Need to examine ways to re-cover the lost revenue

6.1.4 100% WATER RE-USE

- Storm water capture is critical - re-use – if a parking lot is being built, consider also building a cistern
- Ensure new buildings incorporate latest low-use technologies.
- All irrigation should be done using re-cycled/lake water
- Water focused educational component

6.1.5 IMPROVE SITE ECOLOGY

- Prescribe the outcome, not the technology.
- Use vegetation for multi-purpose – shade, water management, wind break etc - E.g. reduce storm water run-off – could use a green roof
- Green roofs are a big opportunity. Roofscapes on site could include the surrounding apartments. Potential for use of the vegetation on site. Very good optic.
- Take a holistic approach to all activities - establish multi-purpose solutions – matrix of outcomes – deal with storm water and re-use water, integrate solutions
- Choose the right permeable and surface materials
- Incorporate natural vegetation – green the site using the appropriate vegetations
- Lack of shade – Need to **create a canopy**, not grass – long term healthy trees
- Bioswale – vegetation acts as a transportation system for the water.
- "Ecology walk" similar to Kortright's "bio-diversity walk"

7.0 MESSAGING TEAM – TEAM 3

The messaging team was facilitated by Anthony Watanabe and Jeff Ranson of the Innovolve Group. Team members include:

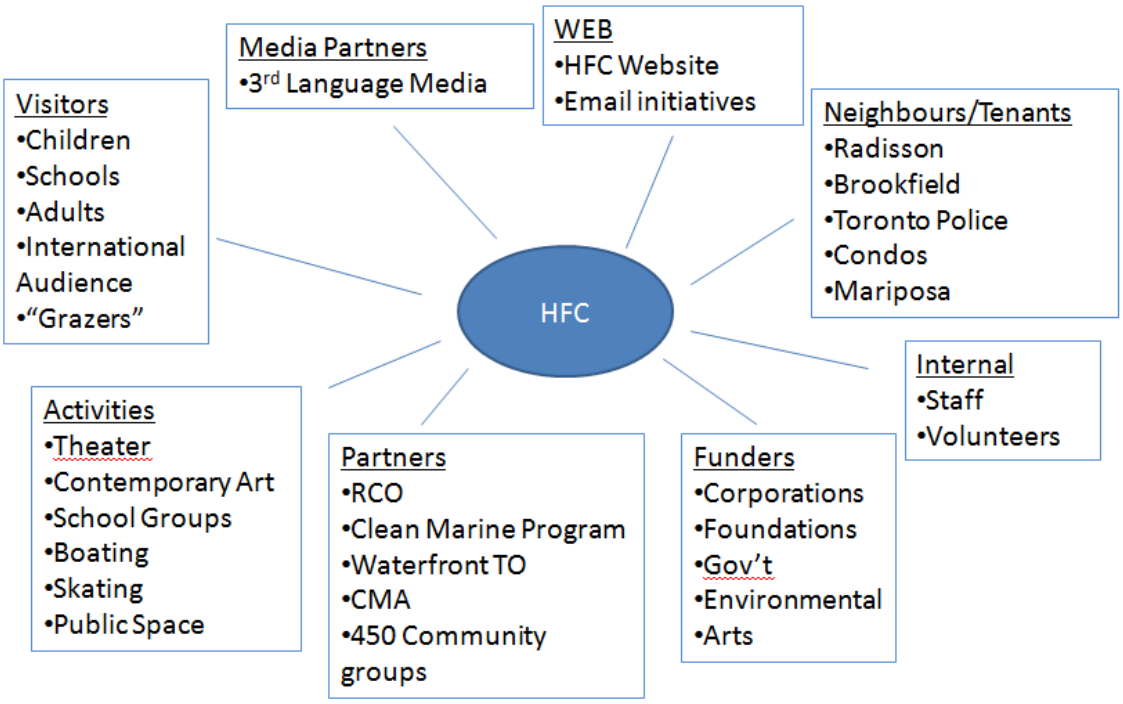
Marsha O'Connor, Ontario Place Corporation
Robert Elms, Greening Greater Toronto
Andrew Souvaliotis, Harbourfront Centre
Christopher Tidey, Harbourfront Centre
Lorrie Ann Smith, Harbourfront Centre
Shauna Seabrook, Harbourfront Centre
William J.S. Boyle, Harbourfront Centre
Ben Marans, Toronto Atmospheric Fund

The team began by reflecting on the types of relationships between the public and Harbourfront centre. The resulting discussion confirmed that HFC has the unique opportunity to connect with people around issues of sustainability because:

- A huge volume of people visit HFC annually
- Visitors have an emotional attachment to HFC
- The public takes an active and engaged role in HFC and its programming, and therefore are primed for a deep and engaged interaction around sustainability
- As an arts and cultural venue, sustainability education is unexpected, therefore disarming, and thus can be experienced through a unique lens
- School children make up a large part of the visitor population at HFC and can be a powerful force for engaging parents and continuing the relationship with HFC
- HFC visitors represent one of the most diverse groups of individuals – across age, ethnicity, economic and accessibility lines – acting as a mirror for the general population
- HFC is closely connected to its neighbours (condos, offices, shops) and is interwoven into the neighbourhood.
- HFC through its connection with the waterfront has the unique opportunity to connect visitors to the natural environment of the lake

In order to further understand the types of engagement taking place at HFC, a discussion took place on the nature of the activities, facilities, key partners, neighbours, tenants, and visitors. **Figure 1** outlines the key stakeholder groups discussed.

HFC Stakeholders & Channels



The group recognized the need for **guiding principles** to regulate the communications activities taking place at HFC around sustainability. It was determined that all initiatives should reflect the values of:

- AUTHENTICITY – that any greening initiative be authentic and substantive, not just for show, or perception.
- ENGAGEMENT – sustainability at Harbourfront Centre should be a two-way dialogue.
- INSPIRATION – visitors should not only be informed, but inspired to carry on the message of greening into their own lives.
- CREATIVITY – initiatives should continue to support the Harbourfront Centre's core mission of supporting the arts, and utilize that expertise to engage people around sustainability in new and unique ways.
- POSSIBILITY – That greening initiatives be achievable technologically and economically demonstrating that if Harbourfront Centre can do it, others can as well.

Using the guiding principles three objectives were laid out:

1) Build a solid green foundation - *"Take care of our own house"*
2) Identify connection points to key stakeholders and find compelling narratives
3) Build unique and engaging platforms to inspire change within and without

7.1 IDEAS AND OPPORTUNITIES

In creating the guiding principles and objectives, numerous opportunities and ideas were explored.

- Clean Marine Program – mandate that all marina properties at HFC participate
- Expand the Harbour Kids Program to include more sustainability content
    - potential to partner with an NGO to develop content (Evergreen/WWF)
- Link environmental requirements to licensing standards for the boats in the harbour
- Passive educational items – technology spotlights, ecological spotlights – to meet the needs of the "Grazers" who visit HFC
- Focus on water issues/water efficiency. There are many environmental groups, venues etc…
    - by focusing on this one issue HFC can differentiate as well as reinforce its connection to the lake
    - Potential partner: Toronto and Region Conservation Authority (TRCA)
- Expand the HFC website to present more sustainability information and extend connection to visitors over a longer duration
    - i.e. Cisco partnership around 1 million act of green
- Explore the opportunity for public gardens/food gardens as part of a green roof installation
    - Allotment gardens for local community?
- Create an alliance of properties to support each other in greening efforts and communications
    - Partners could include Exhibition Place, Ontario Place, City of Toronto Parks and Rec., Waterfront Toronto
    - Initiatives could involve sharing best practices, procurement pooling, green waterfront tours
    - Could use Partners in Project Green (Pearson Eco-Industrial Initiative) as a model
- Showcase "Natural" art exhibitions
- Technology showcases highlighting new technologies applied at HFC
    - E.g. a "solar walk" – solar awning covering the boardwalk along the lake – sponsorship opportunity for solar manufacturers and takes advantage of new government subsidy for solar power.
    - Green boating showcase – highlight environmentally friendly boating in partnership with the marina

APPENDIX A: GREEN GLOBES REPORT

Green Globes

Existing Light Industrial Buildings

Harbourfront Centre

Toronto, Ontario

ECD JONES LANG LASALLE

Energy and Sustainability Services

Green Globes Rating System

The *Green Globes for Existing Buildings* rating program was designed to evaluate and rate the best energy and environmental practice in the management and operation of existing buildings. The goals of the program are to monitor current practices and identify opportunities to save energy and water, reduce waste and prevent water, air and land pollution during building management and operation, based upon the key elements of eco-efficiency. The program involves a graduated rating system designed to recognize buildings that have achieved various levels of energy and environmental performance. In general, the designations reflect the following objectives for each rating level:

1 Green Globe (15-34%): To participate in the Green Globes Eco-Rating Program, a building design must have identified and initiated some measures to improve the energy and environmental performance such as energy use reduction strategies, water conservation steps, waste reduction, etc. A key component should be commitment to a set of guiding environmental principles.

2 Green Globes (35-54%): This designation indicates that the building management team has moved beyond awareness and commitment to sound energy and environmental operational practices, and has demonstrated good progress in reducing environmental impacts.

3 Green Globes (55-69%): This designation indicates excellent progress in achieving eco-efficiency results through current best energy and environmental management and operational practices.

4 Green Globes (70-84%): This designation indicates leadership in terms of energy and environmental management and operational practices and commitment to continuous improvement and industry leadership.

5 Green Globes (85-100%): This designation is reserved for select buildings, which are serving as national or world leaders in energy and environmental performance, and are introducing energy and environmental management and operational practices that can be adopted and implemented by others.

Green Globes Rating Summary – Harbourfront Centre

Total Point Possible	Percent Achieved Before	Percent Achieved After	AREAS AND SUB-AREAS OF ASSESSMENT
350	**25%**	**59%**	**1 – ENERGY**
80			1.1 – Energy Consumption
130			1.2 – Energy-efficiency Features (lighting, boilers, controls, hot water, envelope, green energy)
80			1.3 – Energy Management (energy policy, audits, monitoring and targets, energy training, financial resources, sub-metering, operating manual, maintenance schedules)
60			1.4 – Transportation (public transportation, cycling facilities, car-pooling)
80	**43%**	**48%**	**2 – WATER**
80			2.1 – Water Efficiency (water consumption, water saving features, landscaping and irrigation, management)
110	**81%**	**91%**	**3 – RESOURCES**
55			3.1 – Waste Reduction and Recycling (facilities, waste reduction work plan)
55			3.2 – Site (environmental site assessments, remediation and ecological enhancement)
175	**56%**	**76%**	**4 – EMISSIONS, EFFLUENTS AND POLLUTION CONTROL**

30			4.1 – Air Emissions (low emission burners, management)
45			4.2 – Ozone Depletion (refrigerants, management of refrigerants, halons)
20			4.3 – Water Effluents (floor drains, roof drains, management)
47			4.4 – Hazardous Materials (asbestos, radon, PCBs, storage tanks, drinking water)
33			4.5 – Hazardous Products and WHMIS (WHMIS, health and safety, management, pesticides)
185	**46%**	**80%**	**5 – INDOOR ENVIRONMENT**
143			5.1 – Indoor Air Quality (ventilation, filtration, humidification, cooling towers, parking and receiving, pollution at source, IAQ management)
32			5.2 – Lighting (features, management)
10			5.3 – Noise (volume, acoustic privacy)
100	**64%**	**93%**	**6 – ENVIRONMENTAL MANAGEMENT SYSTEM**
30			6.1 – Environmental Management System (EMS) Documentation (policy, goals, targets, action plans)
25			6.2 – Environmental Purchasing (including energy-efficient products)
20			6.3 – Emergency Response (procedures, legislation, contingency plan)
25			6.4 – Tenant Awareness (communication strategies, tenant satisfaction)
1000	46%	72%	Total Points

1. ENERGY

Energy is an important operational cost as well as an environmental parameter because energy use relates directly to climate change and global warming as well as a variety of air emissions. These atmospheric emissions include hydrocarbons, CO_2, and airborne particles as well as sulphur dioxide and oxides of nitrogen which produce acid rain. From a cost perspective, there is a direct relationship between energy savings and cost savings.

1.1 Energy Consumption

The York Quay Centre achieved a score of 25% for its energy consumption. The Power Plant achieved a score of 45% in the energy category. The 2008 energy performance for the entire Centre was 96.2 ekWh/ft²/year (3,729.7 MJ/m²). This is very high, and indicates considerable opportunity for improvement.

GHG emissions (CO_2 equivalent) were 3,179.5 Tonnes/year. Energy costs were $608,177. If all recommended energy savings measures were implemented, the annual saving potential could be in the order of $162,800, with a resulting GHG emissions reduction of approximately 743.5 Tonnes.

The York Quay Centre score has been revised to 59% based on recommended improvements developed during the Charrette, including lighting upgrades, heat recovery, high-efficiency water heating equipment, green roof, solar pre-heated ventilation air system, Active Solar, Photo Voltaic, Ground Source (Geo-exchange), energy-efficient windows and doors, and performing an integrated Energy Audit.

This Power Plant/Art Gallery score has been revised to 68% based on the Charrette's recommendations which include heat recovery, high-efficiency water heating equipment, green roof, solar pre-heated ventilation air system, Active Solar, Photo Voltaic, Ground Source (Geo-exchange), and energy-efficient windows and doors.

1.2 Energy Efficiency Features

HIGHLIGHTS

Harbourfront - York Quay Centre has the following energy-efficiency features:

Lighting

Energy efficient lighting that includes:

- compact fluorescents
- T8 or T5 fluorescents
- High efficiency lighting accounts for 75% of the building's lighting.

Controls

- Temperature setback and weather compensation are implemented.
- There is a BAS (building automation system).

Hot Water

- The building has hot-water saving devices.
- Hot water is maintained between 50-55^{o}C

Envelope

- A condition assessment of the building envelope has been carried out in terms of water infiltration condensation.

OPPORTUNITIES FOR IMPROVEMENT

The following suggestions are common solutions to improve energy efficiency and reduce costs at Harbourfront Centre - York Quay Centre and Power Plant/Art Gallery. They are offered for consideration; however, Harbourfront Centre is advised to conduct an investment grade audit to ensure that they can produce optimal results for the building.

Lighting

Consider a lighting retrofit. Re-lamping with energy efficient lighting is one of the most common building retrofits because it can produce significant savings. For example:

- Install light emitting diode (LED) exit signs.
- Consider high intensity discharge (HID) lamps or high-intensity fluorescent fixtures where high levels of light are required over large areas, and for locations where bulb replacement is difficult.
- Install daylight sensors, or occupancy sensors in areas such as stairwells and storage rooms, and implement a timed automatic shut-off system for all non-essential lighting during unoccupied hours.
- Use aisle lighting or task lighting to concentrate light in specific areas instead of brightly lighting an entire space.

Boilers *(Only in Power Plant/ Art Gallery)*

- Consider installing high-efficiency modulating or condensing boilers.
- Consider installing automatic vent dampers.

Hot Water

- As the building undergoes future retrofits, consider installing either condensing water heaters, or tankless (instantaneous) hot water heaters for where the demand for hot water is occasional rather than continuous, and the volume required is relatively low. If hot water is to be used for industrial purposes, like garages, consider a solar water heating system.

(Power Plant/ Art Gallery)

- Consider installing low-flow faucet aerators and electronic infra-red sensors or self-closing, metered faucets.

Other Energy Efficiency Features

Consider installing some of the following energy-efficiency features:

- infrared heating
- high efficiency packaged units
- de-stratification fans
- high efficiency air compressors
- direct-fired space heating/ventilating systems
- energy-efficient motors on fans/pumps and/or variable speed drives
- heat recovery

Consider also innovative energy efficiency measures, such as:

- a green roof
- a solar preheated ventilation air system
- cogeneration
- thermal insulation coating
- other energy-saving systems, measures or technologies

Green Energy

- Investigate the possibility of purchasing "green energy".
- Evaluate the potential of harnessing a renewable energy source on site.
- Investigate possibilities for the direct or indirect supply of renewable energy to the buildings.

Envelope

- Consider performance and condition assessment of the building envelope in terms of moist air transfer, air flow and heat transfer. Evaluate the maintenance and life cycle cost of all building and roof materials.
- As the building undergoes future retrofits, consider replacing existing doors and windows with high-efficiency units. Double glazed, low-E, gas-filled windows have window frame spacers with high thermal integrity to reduce heating and cooling costs by up to 20%. If the existing windows and doors are to be retained, high performance weather stripping and window film will increase their thermal performance.
- Consider installing shading devices appropriate to the building. Exterior shading by deciduous trees, awnings, solar blinds or low-e film over large glass areas can reduce solar heat gain by 55%. Overheating can be also reduced by green roofs and high-albedo (reflective) roof coatings.
- Consider the following measures to increase door efficiency.

    - Build a vehicle entrance lobby within the building structure. This is the most effective solution, but it is also the most expensive.
    - Fit motorized, insulated doors to goods entrances that are only used occasionally, complete with:
    - clear operating instructions;
    - an interlock to turn off the heating when the door is open;
    - an audible alarm, which triggers after the door has been open for a pre-set time.
    - Insulate access doors. The standard U-value for vehicle access and similar large doors is 0.7 W/m2 ·°C.
    - Fit plastic strip curtains or fast-acting doors to regularly used goods entrances.
    - Provide separate personnel access alongside goods doors.
    - Provide pneumatic seals around vehicle loading bay doors.
    - Pressurize the building using a make-up air heater.
    - Heat the building using gas-fired infrared heaters.

- The building's heating, cooling, ventilation, and lighting systems should be compartmentalized on an occupancy/zone basis. Ensure air-tightness between differing occupancies/zones.
- Conduct air-sealing of the top part of the building, including mechanical penthouses, if applicable.
- Conduct air-sealing of the bottom part of the building, including parking areas and entrance doors.
- Conduct air-sealing of the vertical shafts and elevators, if applicable.
- Investigate the energy saving potential of increasing the wall insulation based on the recommendation of the building condition report. Application of the insulation should be guided by the *Model National Energy Code for Buildings (MNECB)*.
- Investigate the energy-saving potential of increasing the roof insulation based on the recommendation of the building condition report. Application of the

insulation should be guided by the *Model National Energy Code for Buildings (MNECB)*.

1.3 Energy Management

A comprehensive energy management program can contribute significant savings to the bottom line. Many energy management measures can be low cost or cost nothing at all. Harbourfront - York Quay Centre achieved a score of 16% for energy management.

This score has been revised to 96% based on the Charrette's recommendations which include Performing an Integrated Energy Audit, Maintenance Schedules, Sub Metering

HIGHLIGHTS

Maintenance Schedules

- There is a regular maintenance schedule for the mechanical systems and building envelope that includes:
    - checking of air-supply grilles to ensure they are not blocked and are delivering fresh air as required
    - checks for refrigerant leaks
- There is a preventive maintenance program for the building systems and envelope.

OPPORTUNITIES FOR IMPROVEMENT

Consider the following best practices that could produce savings for Harbourfront - York Quay Centre.

Energy Policy

- The building might benefit from having an energy policy. This is a declaration of principles that guides planning operations with respect to energy management. The policy should be signed by senior management.

Energy Audit

- An energy audit for the building would help to specify cost-effective measures to conserve energy, by pointing out areas that unnecessarily consume too much. The energy audit should have been performed within the past three years.

Energy Management, Monitoring and Targeting

- Prepare an energy management (reduction) plan to address energy issues raised in the energy audit.
- Monitor energy use monthly to identify the areas of highest expenditure and trends of energy consumption. With deregulation of energy, monitoring helps management to understand and control demand and thereby negotiate with suppliers.
- Setting realistic targets can serve as a basis for establishing benchmarks and comparing the energy performance over time.
- As there does not appear to be movement towards energy targets, review progress so far and re-evaluate the potential for a building upgrade.
- Monitor monthly usage and peak demand in 15 or 30 minute increments, and hourly kilowatt (kW) demand for a typical weekday and weekend day for each of the four seasons. Investigate measures to flatten the load profile, thereby rendering the facility more attractive to power vendors.

Energy Training

- Develop an ongoing training plan for each building staff member with updates for key procedures that affect energy usage such as the efficient operation of the HVAC system. Ensure that new staff receive necessary training early. All training and updates should be documented.

Financial Resources

- Ensure that funds for improvements are available, either through an energy-efficiency improvement budget or through participation in an energy-efficiency financing program.

Sub Metering

- The building should have sub-meters for monitoring major energy uses to establish building load profile and demand structure.

Operating Manual

- Provide an easy-to-follow manual that lists all the services contained within the building, with a description of function, operating instructions, standard control settings and basic trouble-shooting.

Maintenance Schedules

- A systems maintenance schedule reduces energy consumption by improving the efficiency of the various systems. Consider as part of the regular maintenance schedule:

    - checks on the correct operation of ventilation and cooling controls
    - checks on the correct operation of the HVAC plant and air distribution system

- checking of temperature, humidity and fresh air controls to ensure they are set correctly and are responding as intended
- identification and investigation of all occurrences of excess energy use

1.4 Transportation

A daily journey totaling as little as 8 km by car can, over one year, emit as much CO_2 as that emitted to provide heat, light and power for a person in an office. Harbourfront - York Quay Centre received a score of 73% for providing alternatives to automobile commuting.

HIGHLIGHTS

Public Transportation

- There is access to public transport within 500 meters of the building.
- There is service at least every 15 minutes during rush hour.

Cycling Facilities

- There are bicycle parking racks that are sheltered from rain.
- There are changing facilities and showers for building tenants and staff.

OPPORTUNITIES FOR IMPROVEMENT

Other Measures

- Provide other measures to reduce car dependency, such as car pooling, facilities for shared vehicle transportation, purchase of transit passes or improved signage and landscaping.

Vehicle Fleet Management

- Investigate the possibility of purchasing alternative fuel vehicles. Consider installing alternative fuel re-fueling stations either on-site or in reasonable proximity.
- Develop a policy that requires at least 50% of new cars, vans and light trucks purchased in the current fiscal year to use alternative fuels such as ethanol, methanol, propane, natural gas, hydrogen or electricity.

2. WATER

This section assesses the water-conserving features of the building as well as its water management. A successful water management program begins with an understanding of how the facility and its occupants use and dispose of water. This makes it possible to plan effective measures to achieve reductions.

2.1 Water Efficiency

Harbourfront - York Quay Centre achieved 43% for installing water-conserving features and implementing water-management best practices. Based on the reported consumption of 29373 m³ for the period of twelve months ending December 2008,

Based on Charrette recommendations Harbourfront - York Quay Centre could achieve a score of 48% through low flow toilet fixtures.

HIGHLIGHTS

Water Conserving Features

- The building uses the following water-conserving fixtures:
  - low flush urinals that use less than 3L/flush
  - automatic valve controls and/or proximity detectors
  - low flow faucets (7.5 liters/min.)
- The building reuses its process water.
- The landscaping minimizes the use of irrigation.

Water Management

- There is a written policy intended to minimize water use, and encourage water conservation.
- Regular monitoring is conducted.
- A water audit has been done within the last three years.
- There are documented water reduction targets.
- There are regular procedures for checking for and fixing water leaks.

OPPORTUNITIES FOR IMPROVEMENT

Water Conserving Features

- As water fixtures need replacing, or even earlier, consider installing:
  - low flow toilets that use less than 6L/flush

- Once-through water-cooled air-equipment should be evaluated for conversion to closed-loop cooling methods.

- Ensure the use of water for clean-up procedures is minimized. Vehicle fleets should be washed only when necessary. High pressure water devices or adjustable trigger nozzles should be used for washing and rinsing, and employees should be instructed to only use as much water as is required. Try to use dry floor cleaning methods such as sweeping and vacuuming. All wastewater leaving the building should pass through an interceptor before being discharged into a sanitary sewer. If possible, capture runoff from vehicle washing for reuse in the pre-washing of vehicles or floors.
- Consider using collected rainwater for irrigation or vehicle washing.
- Examine the feasibility of using greywater for irrigation in the event of a major retrofit.

(Power Plant/ Art Gallery)

- Low flush urinals that use less than 3L/flush or waterless urinals
- Automatic valve controls and/or proximity detectors
- Low flow faucets (7.5 liters/min.)
- Low flow showerheads (9.0 liters/min.)
- Investigate possibilities for the reuse of process water.

3. RESOURCES

Buildings consume many resources, including the land they are built on, the materials used in their construction, the products used for their maintenance, and the equipment and products used by the tenants. This section evaluates the waste generated by the building as well as site stewardship. The original building materials used in the construction of the building are not included in the assessment of existing buildings.

Harbourfront - York Quay Centre achieved 81% for managing resources through waste reduction and site stewardship.

Based on Charrette recommendations Harbourfront - York Quay Centre could achieve a score of 91% through providing facilities for the recycling or reuse of paint thinner and other solvents, waste-reduction targets Implementation.

3.1 Waste Reduction and Recycling

Buildings generate a large quantity of waste in addition to waste paper. Harbourfront - York Quay Centre achieved 49% for implementing best practices for waste management.

HIGHLIGHTS

Facilities for Storing and Handling Recyclable Materials

- There are separate storage/handling facilities for paper products, glass, metal and plastic.
- There are collection points to separate paper, glass, metal and plastic near the areas where waste is generated.

Waste Reduction Workplan

- A waste audit has been done within the last three years.
- Regular monitoring of waste is conducted.

OPPORTUNITIES FOR IMPROVEMENT

Facilities for Storing and Handling Recyclable Materials

- Establish a fluorescent and high-intensity discharge (HID) lamp recycling program.
- Where the facility involves processing or consumption of food consider providing composting, either on-site or centralized (off-site) for occupants' food scraps and any outdoor or indoor landscape waste.

(York Quay Centre)

- Provide facilities for the recycling of the following automotive and aircraft wastes:
  - batteries
  - paint thinner and other solvents

Waste Reduction Workplan

- Conduct regular monitoring of waste to determine the actual quantities of waste generated by the facility, and to evaluate whether the targets are being met. Monitoring can be done by recording the weight or volume of garbage that leaves the facility.
- Implement programs that reduce the volumes of waste generated through reduced consumption of packaging and non-durable goods, as well as the reuse of materials and products. Recycling programs should strive to achieve high waste diversion rates. Establish waste-reduction targets.
- The feasibility of recycling construction, renovation and demolition waste should be investigated whenever applicable. There should be a written policy that is intended to minimize the reduction of construction waste being sent to landfill.

Durability

- Identify areas of the building that experience high levels of wear and tear, weather exposure, accidents and vandalism. In the event of a retrofit, consider providing additional impact protection for these areas.

3.2 Site

Harbourfront - York Quay Centre achieved 100% for measures to minimize the impact of the building on the site and/or to enhance the site.

HIGHLIGHTS

Site Pollution

- The site is known to be free of contamination. A document search has been conducted and there is no reason to suspect that the site is contaminated (i.e. it has never had underground storage tanks (USTs) or outside aboveground storage tanks (ASTs); it was always an office or other facility that did not use chemicals; it has not been situated near gas stations or other problem industries; there have been no previous polluting businesses on the site.)
- A Phase 1 Environmental Site Assessment has been conducted that shows that the site is not contaminated.

Site Enhancement

- There is an indication that the ecological value of the site has been ecologically enhanced.

OPPORTUNITIES FOR IMPROVEMENT *(Power Plant/ Art Gallery)*

Site Pollution

- Conduct a site assessment to determine if the site is contaminated and, if necessary, conduct a clean-up of the site.

4. EMISSIONS, EFFLUENTS AND POLLUTION CONTROLS

For the purposes of this evaluation, pollutants include emissions from boilers, ozone-depleting substances found in refrigerants and fire-fighting equipment, asbestos, PCBs, radon, pesticides, and hazardous materials such as those found in cleaning products, lubricants, water treatment chemicals and fuels. Their environmental impacts relate to the degree of toxicity of each product and their release into the environment.

Harbourfront - York Quay Centre achieved a total score of 56% for having in place emissions, effluents and pollution controls as well as good management practices for hazardous products and waste, health and safety, WHMIS, and for providing safe drinking water.

This score has been revised to 76% based on the Charrette's recommendations which include Water Effluents protection.

4.1 Air Emissions

OPPORTUNITIES FOR IMPROVEMENT *(Only in Power Plant/ Art Gallery)*

Boiler Emissions

As existing boilers reach the end of their useful life, consider replacing them with high-efficiency, low-emission boilers. High efficiency boilers not only reduce emissions - but also energy consumption by about 20%. The maintenance requirements of both conventional and low-NOx burners are minimal, comprising an annual check and cleaning. However, because low-NOx boilers require more burners, this may slightly increase maintenance costs.

- Keep records of annual or six-monthly maintenance and monitoring of heating equipment i.e. cleaning of burners, monitoring of controls, and analysis of flue gas.

4.2 Ozone Depletion

Harbourfront - York Quay Centre achieved 42% based on its use and management of refrigerants and fire-fighting systems.

HIGHLIGHTS

Management of Ozone Depleting Substances

- There is a refrigerant management plan that includes requirements for:
  - maintenance reports, loss reports and leak test results
  - staff training
  - periodic leak testing

- There is a maintenance contract for the cooling system with a certified contractor.
- On-site ozone-depleting substance (ODS) recovery facilities for motor vehicles comply with federal guidelines.

OPPORTUNITIES FOR IMPROVEMENT

Refrigerants

- The building is cooled with R22 (HCFC 22), which has an ozone-depleting potential (ODP) of 0.5 and a global warming potential (GWP) of 510.

Management of Ozone Depleting Refrigerants

- Document a phase-out plan for ozone-depleting refrigerants, such as CFCs, that will result in the use of refrigerant with an ODP of zero. Note that under Canada's *Strategy to Accelerate the Phasing-out of Uses of CFCs and Halons*, there is a ban on refilling and topping up existing equipment using these substances.

Halons

- Where possible, consider a phase-out plan to replace halon fire-fighting equipment with alternatives. Ensure that there is a contract with a certified contractor for maintenance, that there is an inventory of halons in the building, and that all maintenance records and field documentation on halon releases and leak monitoring are kept on site.

4.3 Water Effluents

Harbourfront - York Quay Centre achieved 30% based on best practices to manage liquid effluents.

The implementation of the Charrette's recommendation would result in a score of 70%.

HIGHLIGHTS

Waste Water Effluents

- Roof drains are disconnected from sanitary or combined sewers.
- The application of chemicals to control ice hazards is minimized, while still protecting the safety of personnel.

OPPORTUNITIES FOR IMPROVEMENT

Waste Water Effluents

- Protect floor drains in areas where chemicals are stored. At a minimum, there should be containment of hazardous materials. This can consist of large secondary containers for storing the materials.

Waste Water Effluents Management

- Consider reducing the amount of water that flows off the property, for example, by installing porous paving, increasing vegetation or installing rain-water catchment systems.
- Consider on-site treatment of water run-off from hardscapes.
- Establish and monitor the procedures for flushing cooling coils containing glycol to ensure that glycol losses to the drain are minimized or eliminated.
- Ensure that snow piles are located to minimize the effects of spring run-off on the environment.

(Power Plant/ Art Gallery)

- Minimize the use of chemicals to control ice hazards.

4.4 Hazardous Materials

Harbourfront - York Quay Centre achieved 95% for avoiding hazardous materials that are inherent in many buildings and their systems and/or for implementing best practices with regards to their management as well as for providing safe drinking water.

HIGHLIGHTS

Asbestos

- The building was constructed after 1981 and is free of asbestos.

Radon

- The building is unlikely to have high-risk levels of radon.

Storage Tanks

- There are storage tanks for heating oil or emergency generator fuel.
- There a storage tank management plan, which ensures legal compliance and includes the following operation and maintenance procedures:
  - inventory (reconciliation) control
  - a tank upgrade and replacement schedule
  - system testing (e.g. leak tests and dipping for diesel in water and for water in diesel)

- filling, transferring operations and spill protection (e.g. overfill protection and spill containment)
- an emergency preparedness plan
- a record keeping protocol
- a protocol for tank closure, abandonment or removal

Drinking Water (lead and bacteria)

- Safe drinking water is provided.

4.5 Hazardous Products, WHMIS, Health & Safety

Harbourfront - York Quay Centre achieved 36% for applying best practices relating to the storage, usage and disposal of hazardous products by building maintenance staff and contractors, for implementing the Workplace Hazardous Materials Information System (WHMIS) and health & safety measures, and for applying integrated pest management methods.

The implementation of the Charrette's recommendation would result in a score of 100%.

HIGHLIGHTS

Health & Safety and Management of Hazardous Products

- There is a designated person responsible for advising workers of potential and actual hazards, ensuring that workers use prescribed protective equipment devices and taking every reasonable precaution for the protection of workers.
- There is a Health and Safety Committee that meets regularly and carries out regular inspections of the premises.

Pesticides

- Pesticides are not used routinely for seasonal landscaping.
- The pesticide contractor is licensed and employs integrated pest management methods. There are records of the type and frequency of pesticide use. Tenants are notified of pesticide applications in areas that they use.

OPPORTUNITIES FOR IMPROVEMENT

WHMIS Program

- Locate Material Safety Data Sheets (MSDSs) near the chemical storage areas.
- Provide spill clean-up kits near chemical storage areas.
- Ensure that safety equipment such as eye-wash stations are located near areas where chemicals are likely to be used.
- Where hazardous chemicals ("controlled products") are present in the building, a hazardous materials management plan should be in place.
- Keep Material Safety Data Sheets (MSDSs) current (less than 3 years old).

- Provide WHMIS labels on regulated products to ensure the safe handling of those products.

Health & Safety and Management of Hazardous Products

- Hazardous chemicals and materials must be stored under appropriate conditions in a secure location.
- Suitable education, training and updates should be provided for staff that are required to handle or transport hazardous materials and wastes.
- Keep a detailed and up-to-date inventory of hazardous materials produced by and used in the building. This inventory should include meticulous records of the hazardous waste in the facility and leaving the facility.

5. INDOOR ENVIRONMENT

Environmental management of a building needs to be done in a comprehensive way that also considers the health and comfort of occupants. Many environmental features actually enhance occupant well being. This section addresses issues such as indoor air quality, lighting and noise.

Harbourfront - York Quay Centre received a score of 46% for having a healthy indoor environment.

This score was revised to 80% based on the Charrette's recommendations.

5.1 Indoor Air Quality

There are many pollutants in the indoor air of most buildings. Satisfactory indoor air quality can be achieved by removing pollutants at source, diluting them with fresh air or doing both. Harbourfront - York Quay Centre received a score of 37% for indoor air quality which has been revised to 78%, based on the Charrette's recommendations.

HIGHLIGHTS

Ventilation System

- Air intakes are far from sources of pollution such as parking areas, bus stops or stagnant water on the roof. This ensures that only clean air is circulated through the building's HVAC system.
- Air intakes are at least 10 m apart from exhausts so as to avoid "re-entrainment" of exhaust air.

Humidification System

- The building uses steam humidification.

Parking and Receiving

- There is carbon monoxide monitoring.

Control of Indoor Pollutants

- There have been no observations or complaints of mould or excess moisture.
- Areas with potentially high contaminant levels have effective local exhaust.
- Smoking is not permitted in the building.
- The building's water system avoids the occurrence of *Legionella*.

OPPORTUNITIES FOR IMPROVEMENT

Ventilation System

- Ensure that grilles on outdoor air intakes are free of obstruction such as contamination from leaves, snow, insects and pigeon droppings and that outdoor air dampers are drawing properly.
- Ensure that the building's non-vehicle-related spaces are sufficiently ventilated.
- Provide ventilation system controls capable of separately controlling building zones.
- Consider permanent carbon dioxide monitoring to control carbon dioxide levels and building ventilation rates in offices areas.
- In a major retrofit situation, consider providing natural ventilation of the building's spaces.

Filtration System

- Provide air filtration with at least efficiency rating of MERV 7 (Minimum Efficiency Reporting Value) or Average Atmospheric Dust Spot Efficiency of 25-30% according to ASHRAE Test Standard 52.1.-1992.

Parking and Receiving

- Ensure that precautions are taken to prevent intake of exhaust fumes at the loading dock.

Control of Pollutants at Source

- Where contaminant control ventilation systems are required, equip localized exhausts with airflow monitors and controls, and continuously regulate room pressure differentials.
- Ensure that there are additional, documented, practices to reduce indoor pollution from potentially hazardous areas.
- Instruct cleaning contractors to use environmentally-preferable cleaning materials and minimize the use of those which are not biodegradable, include phosphates, or fall under the Hazardous Products Act.
- Develop a checklist of items concerning IAQ issues that must be reviewed with architects, engineers, contractors, and other professionals prior to renovation and repairs.

IAQ Management

- There should be a complaint form and incident log for addressing occupant concerns regarding indoor air quality.
- Conduct an indoor air quality audit each year. An IAQ profile of the building can help to identify problems and form the basis for improvements.
- Develop documented procedures for maintaining good IAQ including:

    - HVAC operations
    - housekeeping procedures

  - preventive maintenance
  - procedures for unscheduled maintenance
  - mould management
- Provide continuous monitoring of temperature and humidity.

5.2 Lighting

Lighting factors that affect visual comfort of occupants include visibility, glare, contrast ratio and colour rendition. Harbourfront - York Quay Centre achieved a score of 62% for lighting.

The implementation of the Charrette's recommendation would result in a score of 84%.

HIGHLIGHTS

Lighting Features

- High frequency ballasts are fitted to luminaires.
- There are controllable internal or external blinds in office areas to prevent glare at visual display terminals (VDTs).
- Lighting levels meet Canadian Occupational Health and Safety Regulations and ISNEA guidelines for lighting levels. Lighting levels are suitable for visual display terminal (VDT) viewing.
- Suitable individually controlled task lighting is generally provided.

OPPORTUNITIES FOR IMPROVEMENT

Lighting Features

- Maximize the use of natural daylighting (for example, through the use of roof skylights or light pipes).

Lighting Management

- Implement a planned schedule of maintenance and cleaning of luminaires.
- Implement a regular group re-lamping and re-ballasting program.

5.3 Noise

Noise is a frequent cause of complaints in industrial buildings and can be distracting. However in open plan areas, low noise levels can result in lack of acoustic privacy. Harbourfront - York Quay Centre achieved a score of 100% for noise.

HIGHLIGHTS

- The sound levels appear to be acceptable. It is easy, in open office areas, to engage in a conversation using a normal voice, understand a phone conversation, and have a private conversation using lowered voices.

- There appears to be sufficient acoustic privacy. In open offices, speech can be heard but not generally understood in adjacent work stations, and it is possible to have a private conversation using lowered voices. In enclosed offices, it is possible to maintain confidentiality using normal voice levels.
- There are devices to absorb airborne sound.

6. ENVIRONMENTAL MANAGEMENT SYSTEM

This section evaluates the likelihood that the building will achieve continuous improvement thanks to its management system. Although a building's management may have an unwritten culture of strategic planning, as well as a commitment to conform to regulations and achieve energy efficiency through stringent operations and maintenance, these efforts can be greatly enhanced by a more formal documented approach.

Harbourfront - York Quay Centre achieved a score of 64% for its documentation, and its environmental purchasing practices as well as for its environmental emergency response plans and communications with tenants.

The Charrette revealed a number of improvements in environmental management that would improve the overall score to 93%.

6.1 Environmental Management System (EMS) Documentation

Harbourfront - York Quay Centre achieved 53% for documenting its environmental policy, goals, targets and action plans.

The implementation of the Charrette's recommendation would result in a score of 87%.

HIGHLIGHTS

- There are stated goals and targets for:
  - energy conservation and efficient use
  - water conservation and efficient use
  - resource use reduction, re-use and recycling
  - eco-purchasing - i.e. factoring environmental considerations in purchasing decisions

- There are documented action plans to improve the environmental performance of the building that include strategies, time frames, training needs and budgets.

OPPORTUNITIES FOR IMPROVEMENT

- Consider writing an environmental management policy that articulates a common purpose and coordinates efforts in all departments/areas.
- Document in the policy manual goals and targets for:
  - reduction in use and proper handling of hazardous products
  - training and education

6.2 Environmental Purchasing

Eco-purchasing is a procurement strategy that reduces the volume and toxicity of wastes. It is based on the premise that all the environmental resources and costs of materials, manufacturing, labour, transportation, packaging, merchandising, storage and disposal are wasted when a product is discarded.

Harbourfront - York Quay Centre achieved 24% for its environmental purchasing plan.

The implementation of the Charrette's recommendation would result in a score of 100%.

HIGHLIGHTS

- Staff who purchase hazardous products provide and review material safety data sheets (MSDS).

OPPORTUNITIES FOR IMPROVEMENT

- Prepare an environmental purchasing plan that assigns responsibilities, ensures that those who do purchasing have adequate training, refers to products used by in-house staff, stipulates requirements for cleaning contractors, and provides education to tenants.
- Provide staff with a list of feasible environmentally-friendly substitutes and their suppliers.
- Include in the purchasing policy, a statement to reflect management's interest in purchasing energy saving equipment where applicable.

6.3 Emergency Response

The purpose of an environmental emergency response program is to limit the adverse effects of any man-made or natural disaster on the occupants and the environment.

Harbourfront - York Quay Centre achieved 85% for its emergency response program.

HIGHLIGHTS

- There are detailed procedures for quick and effective action in the event of an environmental emergency. They include up-to-date contacts to obtain assistance promptly and to report the emergency. There is also a protocol to assess the risks of re-occupying the building in the case of evacuation.
- The environmental emergency response plans refer to local, municipal, provincial and federal applicable legislation with respect to emergency procedures, reporting and record-keeping.
- There is equipment on-site such as spill control kits, absorbents, and personal protection equipment for quick and easy access.

- There are contingency plans for both short-term and long-term power failures that address the following elements: communication to tenants; security; provision of emergency power and water; and, if necessary, evacuation.

OPPORTUNITIES FOR IMPROVEMENT

- A site map showing the location of environmentally significant features and equipment can help to plan emergency response. This is helpful for emergency crews.

6.4 Occupants Awareness

Communication with tenants serves to inform them of environmental initiatives in the building, increase their environmental awareness and motivate them to implement measures of their own.

Harbourfront - York Quay Centre achieved 100% for tenant environmental awareness.

HIGHLIGHTS

- There is a communications strategy with tenants regarding environmental initiatives and practices.
- There are communications to tenants on the environmental measures that they can implement in the workplace to contribute to energy and water conservation and efficient use, to waste reduction and recycling and to the proper handling, storage and disposal of toxic products.

APPENDIX B: BUILDING ENERGY PERFORMANCE INDEX (BEPI)

Harbourfront Centre - Building Energy Performance Index

2008 Utility Consumption and Cost

Building	Area	ELECTRICITY			NATURAL GAS			WATER			Totals			
Name	ft²	kWh	ekWh/ft²	$	m³	ekWh/ft²	$	m³	L/ft²	$	ekWh	ekWh/ft²	$	$/ft²
Power Plant	31,400	-	-	-	97,525	32.6	47,144	-	-	-	1,024,013	32.6	47,144	1.50
York Quay Centre	50,795	4,192,200	51.0	436,959	256,668	53.1	124,074	49,016	596.3	88,032	6,887,214	104.1	649,065	8.83
	82,195	**4,192,200**	**51.0**	**$436,959**	**354,193**	**45.2**	**$171,218**	**49,016**	**596.3**	**$88,032**	**7,911,227**	**96.2**	**$696,209**	**8.47**

Notes:

- Main electricity meter serves York Quay Centre (50,795 ft²) and Power Plant (31,400 ft²). Total 82,195 ft².
- York Quay Centre, Power Plant and Enwave Lobby served by separate natural gas meters. Power Plant total includes Enwave Lobby.
- Water consumption and cost total of 4 individual meters.

APPENDIX C: BUILDING ENERGY EVALUATION

1. ENERGY AND WATER EVALUATION

1.1 METHODOLGY

The following outlines the methodology used to first assess the building's potential for an energy optimization and retrofit project.

- Utility Data Collection – Monthly consumption and cost data are extracted from utility invoices to determine exactly how much energy the building is using, and what the facility paid for that energy. Allows for the establishment of an accurate BASELINE of actual energy use and costs, against which future energy use and costs can be evaluated.

- Enter data to a database format – Allows the data to be used for various engineering functions throughout the duration of the project. The database is set up in EXCEL format to allow for ongoing updating and analysis throughout the pre and post retrofit periods

- Analyze data trends, excesses, anomalies – Utilizing Metrix Utility Accounting software, a weather correlated energy baseline is developed. Graphing the energy use data allows the analyst to identify heating, cooling and base load components, and to pinpoint uncharacteristic and undesirable energy use trends that give a first indication of the magnitude of energy saving potential.

- The Building Energy Performance Index (BEPI) is established based on the building's gross floor area. This breaking down of energy and water use based on building floor area allows for immediate evaluation of building energy "performance" against similar facilities – focusing on the effectiveness of installed measures after implementation of building energy retrofit strategies.

- Allocation of energy use by major end user – Through trend analysis, the percentage of a building's major energy end uses is allocated to help identify energy reduction potential.

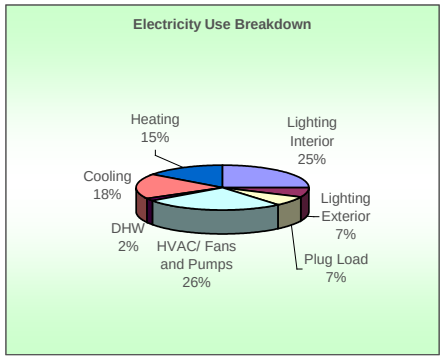
- Based on results of the site investigation, utility analysis and end use energy allocation for each utility, a retrofit "opportunity" program framework is developed, with estimated implementation costs and simple payback period.

1.2 BUILDING ENERGY ALLOCATION AND PROJECTED SAVINGS

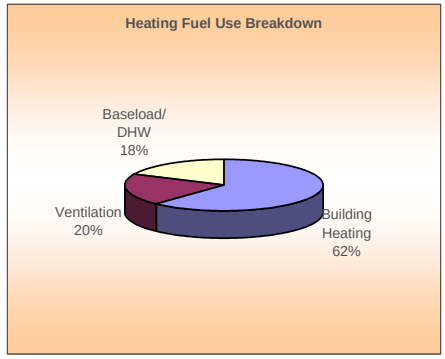
The following "Building Energy Allocation and Projected Savings" table shows the results of the initial energy analysis. Monthly electricity, natural gas and water use data are analyzed, with energy use apportioned to the major end users, anomalies identified, and a pre retrofit and post retrofit, or "target" BEPI, established. Overall energy and water reduction potential is identified, with expected cost savings based on current energy and water rates.

Graphical presentation of the utility data is shown in Section 1.3. Detailed analysis and review of actual energy consumption and demand trends form the building block for the allocation of energy use by major building equipment, and in the development of projected or "potential" energy and cost savings, and resulting Greenhouse Gas Emissions (GHG) reduction.

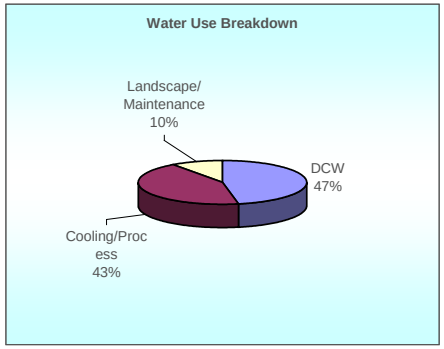
Harbourfront Centre	82,195	ft2	Building Energy Allocation and Projected Savings						
Electricity	2008	Year							
Annual Energy	4,192,200	kWh							
Total Utility Cost	$ 436,959	$ 0.104	Unit cost		Reduction	22%	Projected		
Electricity	51.00	kWh/ft2	1,976.37	MJ/m2			39.99	kWh/ft2	1,549.47	MJ/m2
End Use	Calculated End Use Allocation	kWh/ft2	Annual Energy	Annual Cost $	End Use Red'n Pot'l	Projected Annual Utility Use	Projected Utility Savings	Projected Annual Cost Saving	Overall Red'n
Lighting Interior	25%	12.75	1,048,050	$ 109,240	30%	733,635	314,415	$ 32,772	8%
Lighting Exterior	7%	3.57	293,454	$ 30,587	30%	205,418	88,036	$ 9,176	2%
Plug Load	7%	3.57	293,454	$ 30,587	10%	264,109	29,345	$ 3,059	1%
HVAC/ Fans and Pumps	26%	13.26	1,089,972	$ 113,609	30%	762,980	326,992	$ 34,083	8%
DHW	2%	1.02	83,844	$ 8,739	10%	75,460	8,384	$ 874	0%
Cooling	18%	9.18	754,596	$ 78,653	10%	679,136	75,460	$ 7,865	2%
Heating	15%	7.65	628,830	$ 65,544	10%	565,947	62,883	$ 6,554	2%
Totals	100%	51.00	4,192,200	$ 436,959		3,286,685	905,515	$ 94,383	22%
						39.99	kWh/ft2	1,549.47	MJ/m2



Heating Fuel	2008	Year							
Annual Energy	354,193	m3							
Total Utility Cost	$ 171,218	$ 0.483	Unit cost		Reduction	30%	Projected		
Heating Fuel	45.25	ekWh/ft2	1,753.30	MJ/m2			31.67	ekWh/ft2	1,227.31	MJ/m2
End Use	Calculated End Use Allocation	ekWh/ft2	Annual Energy	Annual Cost $	End Use Red'n Pot'l	Projected Annual Utility Use	Projected Utility Savings	Projected Annual Cost Saving	Overall Red'n
Building Heating	62%	28.05	219,600	$ 106,155	30%	153,720	65,880	$ 31,847	19%
Ventilation	20%	9.05	70,839	$ 34,244	30%	49,587	21,252	$ 10,273	6%
Baseload/ DHW	18%	8.14	63,755	$ 30,819	30%	44,628	19,126	$ 9,246	5%
Totals	100%	45.25	354,193	$ 171,218		247,935	106,258	$ 51,365	30%
						31.67	ekWh/ft2	1,227.31	MJ/m2



Water	2008	Year							
Annual Consumption	49,016	m3							
Total Utility Cost	$ 88,032	$ 1.796	Unit cost		Reduction	19%	Projected		
Water	596.34	Litres/ft2	55.42	L/m2			480.65	Litres/ft2	44.67	L/m2
End Use	Calculated End Use Allocation	Litres/ft2	Annual Energy	Annual Cost $	End Use Red'n Pot'l	Projected Annual Utility Use	Projected Utility Savings	Projected Annual Cost Saving	Overall Red'n
DCW	47%	280.28	23,038	$ 41,375	30%	16,126	6,911	$ 12,413	14%
Cooling/Process	43%	256.43	21,077	$ 37,854	10%	18,969	2,108	$ 3,785	4%
Landscape/ Maintenance	10%	59.63	4,902	$ 8,803	10%	4,411	490	$ 880	1%
Totals	100%	596.34	49,016	$ 88,032		39,507	9,509	$ 17,078	19%
						480.65	Litres/ft2	44.67	L/m2

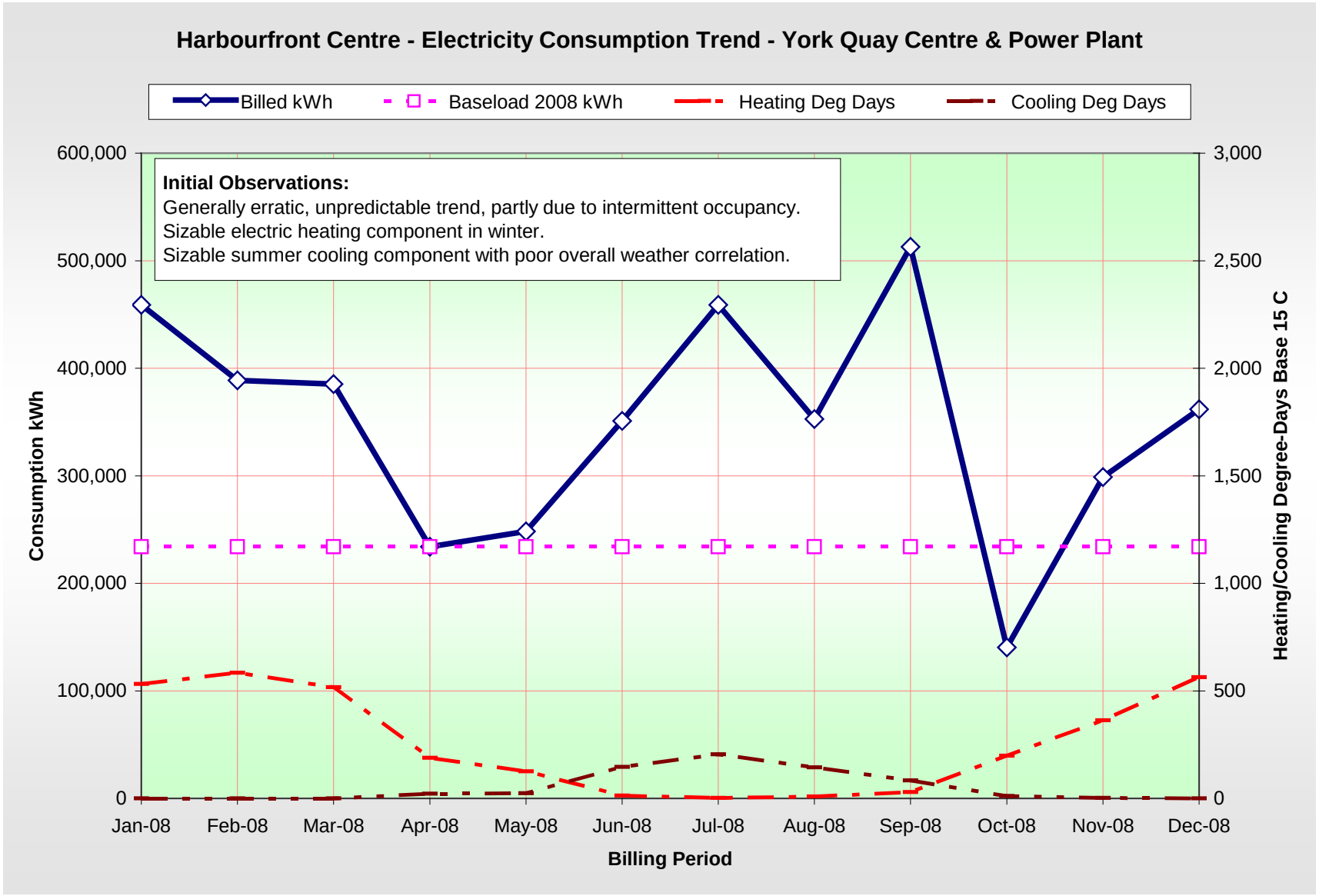


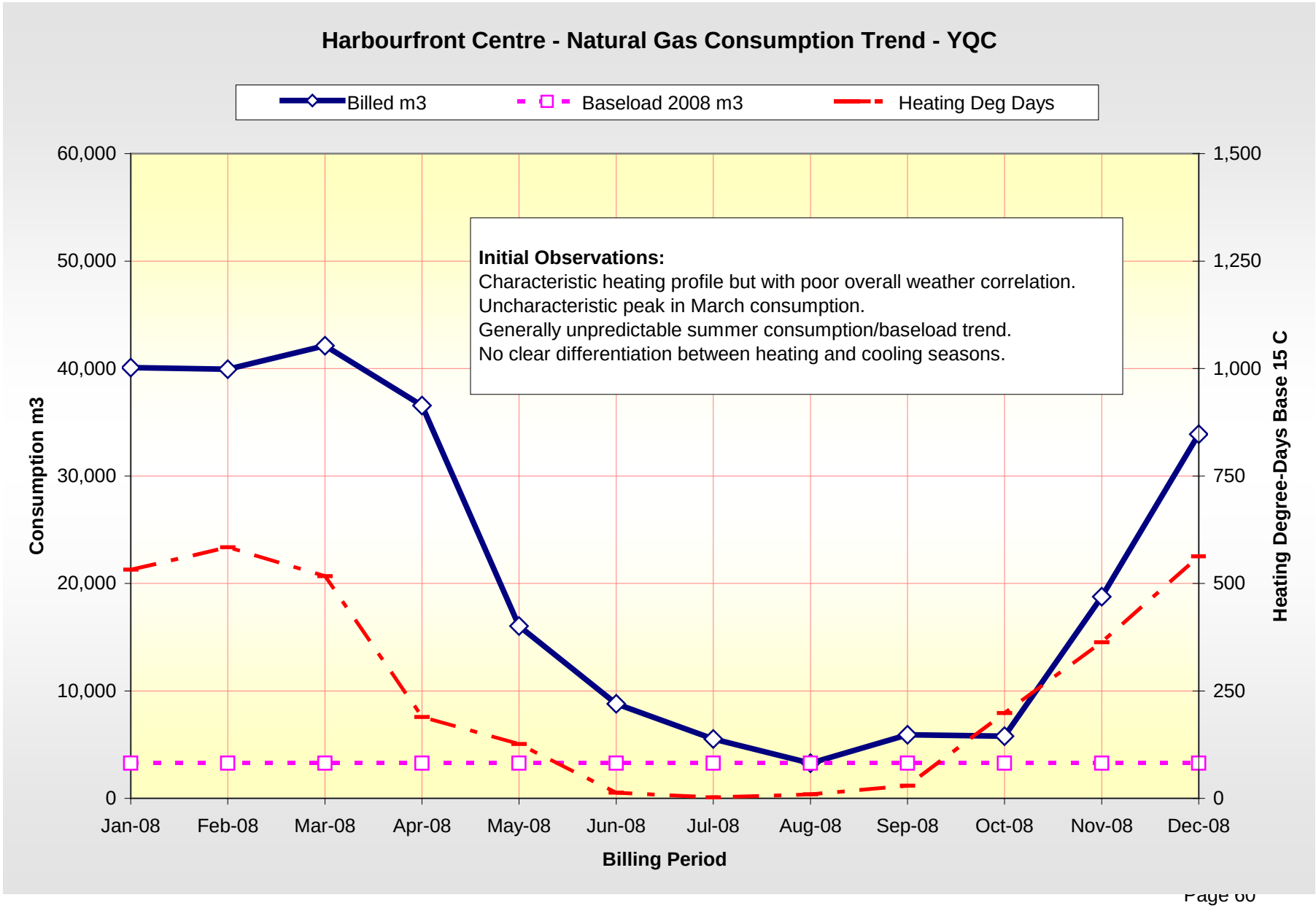
		Existing ekWh/ft2	Annual Energy ekWh	Annual Cost $	Annual Cost $/ft2	Projected ekWh/ft2		Projected Cost Savings	Overall Red'n
Building Total		96.25	7,911,227	$ 696,209	$ 8.47	71.66		$ 162,827	23%
		3,729.67	MJ/m2			2,776.78	MJ/m2		

1.3 ENERGY TREND GRAPHS AND INITIAL OBSERVATIONS

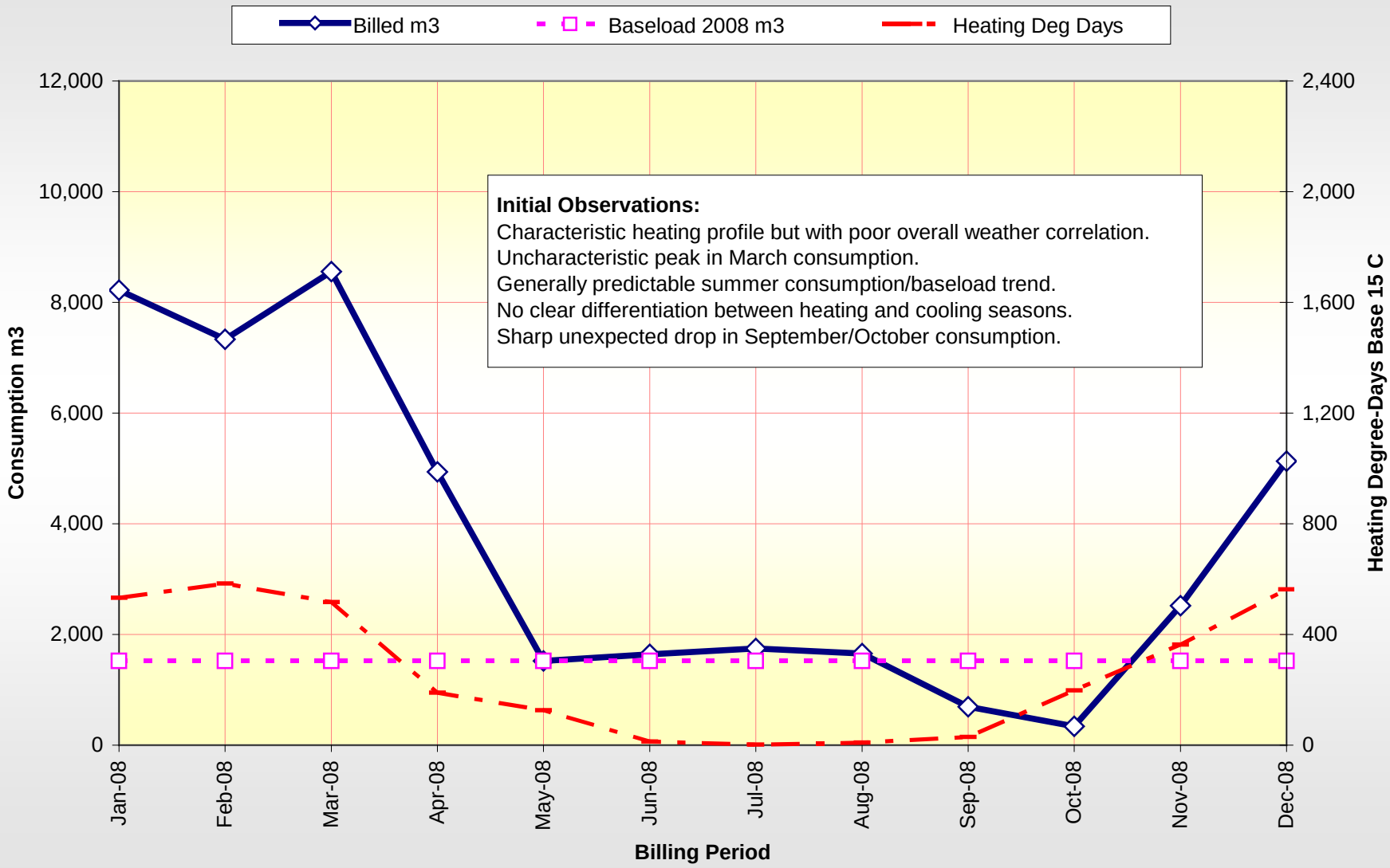
The following graphs are developed to help identify daily and monthly energy use patterns, and help focus on high energy use or "target" areas that would likely benefit from optimization of building operational strategies, and through equipment replacements and upgrades.

Each graph is accompanied by initial observations on energy use trends. To the trained energy analyst, graphical presentation of the monthly electricity, natural gas and water consumption data serves as a "window" into actual energy use, and in the accurate defining of a building's energy performance and savings potential.

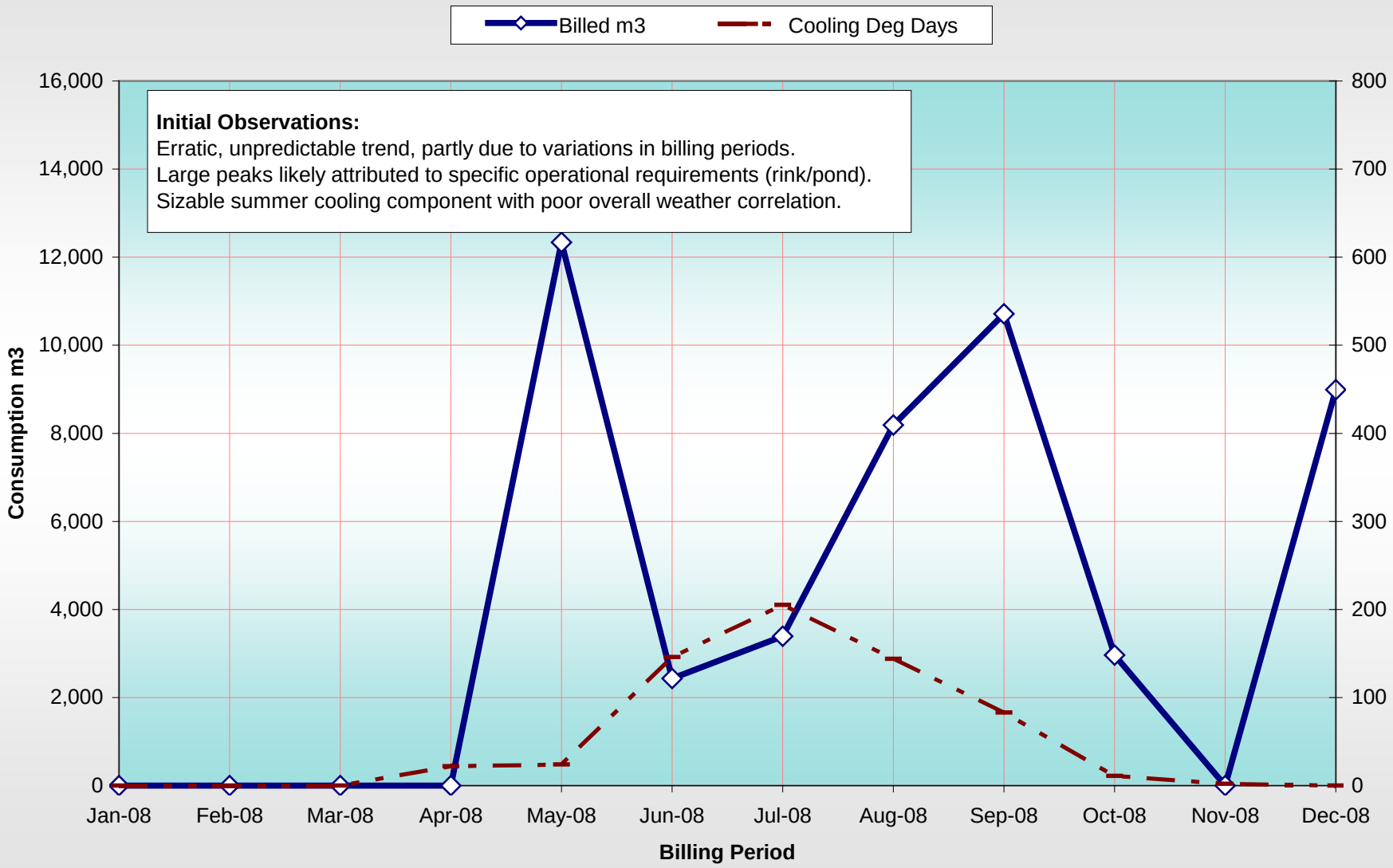

Harbourfront Centre - Electricity Consumption Trend - York Quay Centre & Power Plant
Billed kWh
Baseload 2008 kWh
Heating Deg Days
Cooling Deg Days
Initial Observations:
Generally erratic, unpredictable trend, partly due to intermittent occupancy.
Sizable electric heating component in winter.
Sizable summer cooling component with poor overall weather correlation.
Consumption kWh
Heating/Cooling Degree-Days Base 15 C
600,000
500,000
400,000
300,000
200,000
100,000
0
3,000
2,500
2,000
1,500
1,000
500
0
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Billing Period


Harbourfront Centre - Natural Gas Consumption Trend - YQC
Billed m3
Baseload 2008 m3
Heating Deg Days
Initial Observations:
Characteristic heating profile but with poor overall weather correlation.
Uncharacteristic peak in March consumption.
Generally unpredictable summer consumption/baseload trend.
No clear differentiation between heating and cooling seasons.
Consumption m3
60,000
50,000
40,000
30,000
20,000
10,000
0
Heating Degree-Days Base 15 C
1,500
1,250
1,000
750
500
250
0
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Billing Period

Harbourfront Centre - Natural Gas Consumption Trend - Power Plant



Harbourfront Centre - Water Consumption Trend - Total 4 Meters



2. ESTIMATED POTENTIAL SAVINGS AND ENVIRONMENTAL IMPACT

2.1 ENERGY RETROFIT PROJECT COST ESTIMATE

The following table lists major building equipment and systems, together with typical areas for potential energy and cost reduction.

Based on target energy use developed through the detailed analysis of utility data and trend graphs (refer to Section 1.2 and 1.3) and by applying current construction and equipment costs, a preliminary estimate of overall project retrofit cost and simple payback period are developed.

The "Energy Retrofit Project Cost Estimate" is intended only as a guideline or tool to assist the qualified energy analyst to better identify a building's energy reduction potential. Once having determined a given building's "performance" when compared to other facilities of similar size, function and operation, and after detailed analysis of energy and water use trends, the approximate cost of energy conservation retrofit strategies and equipment changes can be developed.

Harbourfront Centre
Energy Retrofit Project Cost Estimate

Electricity End Use	Y/N	Energy Savings Opportunities	Implementation Cost $/ft2	Implementation Cost $	Potential Cost Savings $	Simple Payback Years
Lighting Interior	x	Fluourescent Lamp Conversion to T-8	$ 1.95	$ 160,000		
	x	Convert Exit Lamps to LED	$ 0.07	$ 6,000		
	x	Replace Incandescent lamps with CFL	$ 0.06	$ 5,000		
	x	Existing Controls Optimization	$ 0.36	$ 30,000		
Total				**$ 201,000**	**$ 32,772**	**6.1**
Lighting Exterior	x	Major Retrofit - HE Lamps	$ 0.61	$ 50,000		
	x	Existing Controls Optimization	$ 0.06	$ 5,000		
Total				**$ 55,000**	**$ 9,176**	**6.0**
Plug Load	x	High Efficiency Appliances	$ 0.36	$ 30,000		
	-	Remove Unnecessary Loads	$ 0.00	$ 0		
	-	Circuit Control	-			
Total				**$ 30,000**	**$ 3,059**	**9.8**
HVAC Fan Systems	-	Major Equipment Replacement	-			
	x	Fan Systems Overhaul/Upgrade	$ 0.36	$ 30,000		
	x	New Building Automation System	$ 0.73	$ 60,000		
	-	Existing BAS Upgrade/Optimization	-			
	x	Recommissioning/Air Balancing	$ 0.61	$ 50,000		
	-	Exhaust Air Heat Recovery	-			
Total				**$ 140,000**	**$ 27,004**	**5.2**
HVAC Pump Systems	-	Major Equipment Replacement	-			
	x	Pump Systems Overhaul/Upgrade	$ 0.36	$ 30,000		
	x	Upgrade/Optimize Pump Control	$ 0.18	$ 15,000		
	x	Recommissioning/Water Balancing	$ 0.18	$ 15,000		
Total				**$ 60,000**	**$ 13,633**	**4.4**
Domestic Hot Water	-	Boiler Replacement	-			
	-	Optimize Control/Delivery Temperature	-			
	x	Low Flow Fixtures Replacement	$ 0.24	$ 20,000		
Total				**$ 20,000**	**$ 874**	**22.9**
Cooling Plant	-	Replace R-22 Refrigerant Chiller	-			
	-	Retrofit/Overhaul Existing Chillers	-			
	x	Chiller Maintenance/Controls Optimization	$ 0.36	$ 30,000		
	x	Cooling Tower Control - VFD/Winterize	$ 0.30	$ 25,000		
	x	Building Envelope/Solar Film/Shading	$ 0.30	$ 25,000		
Total				**$ 80,000**	**$ 7,865**	**10.2**
Electricity Total				**$ 586,000**	**$ 94,383**	**6.2**

Heating Fuel End Use	Y/N	Energy Savings Opportunities	Implementation Cost $/ft2	Implementation Cost $	Potential Cost Savings $	Simple Payback Years
Heating Plant	x	Heating Boiler Replacement	$ 1.95	$ 160,000		
	-	Retrofit/Overhaul Boilers	-			
	-	DHW Boiler Replacement	-			
	x	Summer Boiler/Boiler Control	$ 0.36	$ 30,000		
	-	Stack Heat Recovery	-			
	x	Kitchen Equipment Upgrade/Replace	$ 0.18	$ 15,000		
	x	Optimize Ventilation Rate	$ 0.18	$ 15,000		
	-	Optimize Humidification	-			
	x	Building Envelope/Infiltration/Pressurization	$ 0.30	$ 25,000		
Heating Fuel Total				**$ 245,000**	**$ 51,365**	**4.8**

Water End Use	Y/N	Energy Savings Opportunities	Implementation Cost $/ft2	Implementation Cost $	Potential Cost Savings $	Simple Payback Years
Domestic Cold Water	x	Water Audit Recommendations	$ 0.74	$ 61,000		
	x	Exterior Use Controls/Optimization	$ 0.24	$ 20,000		
Water Total				**$ 81,000**	**$ 17,078**	**4.7**

	Implementation Cost $	Potential Cost Savings $	Simple Payback Years
Grand Total	**$ 912,000**	**$ 162,827**	**5.6**

2.2 GREENHOUSE GAS EMISSIONS TABULATION AND REDUCTION POTENTIAL

Recommended facility upgrades will have a positive effect on the environment by reducing Greenhouse Gas Emissions (GHG's) generated in the production of electricity, and the burning of natural gas and other fossil fuels.

The following tabulates current energy use values, estimated energy savings, and the resulting reduction in GHG's through implementation of an energy optimization program.

A. Existing Conditions				GHG (Tonnes)			
Utility	Units	Base Year Energy	Energy Units kBtu	CO_2	CH_4	N_2O	CO_2 Equiv
Electricity	kWh	4,192,200	14,303,786.4				2,504.2
Natural Gas	m^3	354,193	12,694,277.1	641.0	0.344	2.114	675.3
Total			26,998,063.5				3,179.5
B. Target Conditions				**GHG (Tonnes)**			
Utility	Units	Target Energy	Energy Units kBtu	CO_2	CH_4	N_2O	CO_2 Equiv
Electricity	kWh	3,286,685	11,214,168.5				1,963.3
Natural Gas	m^3	247,935	8,885,994.0	448.7	0.241	1.480	472.7
Total			20,100,162.5				2,436.0
A - B = Net Reduction				**GHG (Tonnes)**			
Utility	Units	Energy Reduction	Energy Units kBtu	CO_2	CH_4	N_2O	CO_2 Equiv
Electricity	kWh	905,515	3,089,617.9				540.9
Natural Gas	m^3	106,258	3,808,283.1	192.3	0.103	0.634	202.6
Total			**6,897,901.0**				**743.5**

*Net GHG Reduction Potential - Tonnes

APPENDIX D: UTILITY SAVINGS OPPORTUNITIES CHECKLIST

Utility Savings Opportunities Checklist

General	*Typical Building Simple Payback Period*	YES	NO	Maybe
Analyze energy & water bills, recover billing errors, identify anomalies, troubleshoot	Immediate/Short Term	☑	☐	☐
Power Factor correction	3 to 5 years	☐	☐	☑
Energy Star Best Practice training	Immediate/Short Term	☑	☐	☐
Shift to day cleaning to reduce lighting hours of operation	Immediate/Short Term	☐	☑	☐
Audit Lease Agreements to incorporate energy efficiency standards	Immediate/Short Term	☑	☐	☐
Signage, stickers, reminders, etc., about energy efficiency, energy awareness campaign	Immediate/Short Term	☑	☐	☐

Building/Envelope		YES	NO	Maybe
Double glaze/thermal windows	> 5 years	☑	☐	☐
Solar reflective film	> 5 years	☑	☐	☐
Internal window shades/blinds	> 5 years	☑	☐	☐
Reduce glass areas	3 to 5 years	☐	☑	☐
Recaulk leaky windows/door frames	3 to 5 years	☑	☐	☐
Repair/replace roof	> 5 years	☑	☐	☐
Low absorption roofing	> 5 years	☐	☐	☑
Repair cracks in building	3 to 5 years	☑	☐	☐
Bi-annual check and upgrade of weather-stripping prior to heating and cooling season	Immediate/Short Term	☑	☐	☐
Vestibules or revolving doors at all exterior entrances	3 to 5 years	☐	☐	☑
Optimize/Reduce Vestibule Heater Setpoints	Immediate/Short Term	☑	☐	☐
Air curtains at loading areas	3 to 5 years	☐	☐	☑
High speed overhead doors at loading areas	3 to 5 years	☐	☑	☐
Solar Wall	Site investigation required	☐	☐	☑

Lighting		YES	NO	Maybe
Convert all fluorescent lighting to high efficiency T8 or T5 Lamps with electronic ballasts	> 5 years	☑	☐	☐
Reduce lighting levels (rewiring and relamping to reduce ambient foot-candles)	3 to 5 years	☑	☐	☑
Convert EXIT Lights to LED Type	Immediate/Short Term	☑	☐	☐
Change out incandescent lamps to CFL (compact fluorescent)	3 to 5 years	☑	☐	☐
Replace HID with linear fluorescents (T5, T5HO)	> 5 years	☑	☐	☐
Provide high efficiency task lighting and reduce ambient light levels in open office areas	3 to 5 years	☑	☐	☐
Motion sensors in washrooms/offices/boardrooms/storage areas with intermittent occupanc	3 to 5 years	☑	☐	☐
Photocell control/re-wiring to shut off lighting in areas with sufficient sunlight	3 to 5 years	☑	☐	☐
Reduce lighting operating hours (timers, occupancy sensors, overrides)	3 to 5 years	☑	☐	☐
Central lighting control system	3 to 5 years	☑	☐	☐
Review occupancy and routinely verify that lighting controls are shutting off all lights as nece	Immediate/Short Term	☑	☐	☐
More flexible switching/zoning	Immediate/Short Term	☑	☐	☐
Photocell control to replace timer or manual control of perimeter lighting	> 5 years	☑	☐	☐
Photocell control to replace timer or manual control of outdoor parking lighting	> 5 years	☑	☐	☐
Regular cleaning of fixtures to maintain desired lighting levels	Immediate/Short Term	☑	☐	☐
Install skylights and reduce ambient lighting	> 5 years	☐	☐	☑
Lamp replacement program	Immediate/Short Term	☑	☐	☐

HVAC - Air Systems		YES	NO	Maybe
Optimize/reduce HVAC operating hours (schedules, overrides)	Immediate/Short Term	☑	☐	☐
Night/weekend shut-down of non-critical air systems/packaged rooftop units	Immediate/Short Term	☐	☐	☑
Optimize/adjust space temperatures (occupied/unoccupied)	Immediate/Short Term	☑	☐	☐
Routinely check and clean evaporator/condenser coils on all air systems	Immediate/Short Term	☑	☐	☐
Repair duct leaks and repair missing/damaged insulation on ducts and piping	> 5 years	☑	☐	☐
Install programmable thermostats/timers	Immediate/Short Term	☐	☐	☑
Calibrate existing field devices (sensors, thermostats)	Immediate/Short Term	☑	☐	☐
Replace aging fan motors with high efficiency type	> 5 years	☑	☐	☐
Improved zoning of HVAC air handlers and air distribution for after-hours occupancy	3 to 5 years	☑	☐	☐
Replace variable inlet vanes (VIV) with variable frequency drives (VFD) on VAV systems	3 to 5 years	☐	☐	☑
Routinely check and repair malfunctioning terminal units (VAV boxes, fan coil units, inductior	Immediate/Short Term	☑	☐	☐
Shut-off ventilation air at night (close outside air dampers)	Immediate/Short Term	☐	☐	☑
Optimize main air system controls and set points for free cooling	Immediate/Short Term	☑	☐	☐
Routinely check outside air dampers/motors/seals/linkages to ensure proper operation	Immediate/Short Term	☑	☐	☐
Timer controls on exhaust fans	Immediate/Short Term	☑	☐	☐
Retro- commission airside economizers on packaged rooftop units	Immediate/Short Term	☑	☐	☐
Optimize total air-flow rates in constant air volume systems to suit occupancy	Immediate/Short Term	☑	☐	☐
Optimize ventilation air using CO2 controls	3 to 5 years	☑	☐	☐
Nighttime precooling (for buildings with Time-Of-Use electrical rates)	3 to 5 years	☑	☐	☐
Occupancy sensor control of HVAC terminal units (VAV boxes, fan coil units, induction units)	3 to 5 years	☑	☐	☐
Fine tune thermostat settings for unit heaters in loading and service areas	Immediate/Short Term	☑	☐	☐
Complete air systems balancing	> 5 years	☑	☐	☐
Exhaust air heat recovery	> 5 years	☑	☐	☐

HVAC - Heating Plant		YES	NO	Maybe
Summer boiler or boiler shutdown during cooling season	> 5 years	☑	☐	☐
Shut-off natural gas to boilers and packaged rooftop units during the cooling season	Immediate/Short Term	☑	☐	☐
Alternate Domestic Hot Water (DHW) Boiler	> 5 years	☑	☐	☐
Routinely check/adjust fuel/air ratios on combustion heating systems	Immediate/Short Term	☑	☐	☐
Routinely check and clean heat transfer surfaces	Immediate/Short Term	☑	☐	☐
Fuel conversion - electric heating to natural gas (boilers, packaged rooftop units)	> 5 years	☐	☑	☐
Replace boiler or boilers with high efficiency type	3 to 5 years	☑	☐	☐
Calibrate heating control systems - optimize outside air reset schedule	Immediate/Short Term	☑	☐	☐
Boiler stack heat recovery/preheat options	Site investigation required	☑	☐	☐
Replace aging pump motors with high efficiency motors	> 5 years	☑	☐	☐
Install variable frequency drives on heating distribution pumps	3 to 5 years	☑	☐	☐
Replace leaky steam valves and traps	Immediate/Short Term	☑	☐	☐
Initiate a steam trap maintenance and repair program	Immediate/Short Term	☑	☐	☐
Improved Maintenance	Immediate/Short Term	☑	☐	☐

HVAC - Cooling Plant		YES	NO	Maybe
New high efficiency chiller/chillers	> 5 years	☑	☐	☐
Replace existing chillers with new chiller using non CFC/HCFC refrigerant	> 5 years	☑	☐	☐
Cooling controls upgrade	3 to 5 years	☑	☐	☐
Calibrate existing control systems	Immediate/Short Term	☑	☐	☐
Waterside economizer	3 to 5 years	☑	☐	☐
Winterize cooling tower	3 to 5 years	☑	☐	☐
Replace aging pump motors with high efficiency motors	> 5 years	☑	☐	☐
Install variable frequency drives on cooling and condenser water pumps	3 to 5 years	☑	☐	☐
Clean/repair/replace leaky valves	Immediate/Short Term	☑	☐	☐
Thermal storage	Site investigation required	☑	☐	☐
Improved Maintenance	Immediate/Short Term	☑	☐	☐

Water		YES	NO	Maybe
Low flow fixtures (lavatories, urinals, toilets)	3 to 5 years	☑	☐	☐
Automatic proximity control (lavatories, urinals, toilets)	3 to 5 years	☑	☐	☐
Reduce/optimize landscape water use and plant watering	Immediate/Short Term	☐	☑	☐
Convert to artificial plants or plants requiring little water	Immediate/Short Term	☐	☐	☑
Reduce/eliminate number of "once-through" water-cooled air conditioning units	> 5 years	☑	☐	☐
Conduct a water audit of all water fixtures	Immediate/Short Term	☑	☐	☐
Routinely check/repair/replace leaky faucet components (washers, aerators)	Immediate/Short Term	☑	☐	☐
Install variable frequency drives on cold water booster pumps	3 to 5 years	☑	☐	☐
Replace aging kitchen appliances with Energy Star rated types	> 5 years	☑	☐	☐
Optimize/reduce DHW delivery temperature	Immediate/Short Term	☑	☐	☐
Convert electric DHW heaters to natural gas	> 5 years	☑	☐	☐

Workplace		YES	NO	Maybe
PC power management (surge protection)	3 to 5 years	☑	☐	☐
PC power management (modern equipment)	3 to 5 years	☑	☐	☐
PC power management (system standby and other energy conservation systems)	Immediate/Short Term	☑	☐	☐
Replace aging appliances and office equipment with Energy Star rated appliances	> 5 years	☐	☐	☑
Equipment OFF tagging and employee training	Immediate/Short Term	☑	☐	☐
Janitorial OFF sweep (task lighting, PC's, printers)	Immediate/Short Term	☑	☐	☐
Vending misers	3 to 5 years	☐	☐	☑
Escalator/elevator control (sleep mode)	> 5 years	☐	☑	☐

APPENDIX E: HARBOURFRONT CENTRE SITE MAP

Harbourfront Centre Green Strategies Charrette