Appendices

Appendix A – Biographies of Experts
Appendix B – Overview of an Integrated Design Process
Appendix C – Charrette Event Site Plans
Appendix D – Charrette Event Agenda
Appendix E – Charrette Event Attendee List
Appendix F – Charrette Event Day 1 Plenary Presentations
Appendix G – Analysis of a Cogeneration System
Appendix H – Attendees Questionnaire
Appendix I – Written testimonials
Facilitator – Bob Bach is a Senior Consultant for Engineering Interface Limited, responsible for activities on energy codes and standards, utility demand side management, building energy and environmental assessments, energy and water conservation technology transfer, building energy intensity data collection and evaluation, and municipal energy and water efficiency programs. He is an engineering graduate of the University of Toronto and is a member of several organizations including ASHRAE and the Arbitration and Mediation Institute of Canada. Bob is an active participant in squash and skiing.

Resource person, water – Kingsley S. Blease is General Manager of Canadian Water Services, and has over 29 years experience in water and wastewater projects, across Canada and the United Kingdom. Kingsley has ten years experience as manager of water efficiency projects, covering all aspects from study, to program design and installation of devices, in both residential and commercial facilities. He is chair of the Ontario Water Works Association Water Efficiency Committee, and is a professional engineer in both Canada and the United Kingdom.

Resource person, MURB HVAC equipment – Larry Brydon is Vice President, and General Manager, Condo Comfort Division of OZZ Corporation. He is a specialist in HVAC and Utility management in hi-rise construction and application specialist for in suite HVAC equipment. Mr. Brydon was previously Vice President Sales and Marketing, Davie Environmental Equipment. He is responsible for research and market development for specialty, advanced integrated appliances.

Facilitator – R.L. Douglas Cane, P.Eng., Caneta Research Inc. has over 15 years of commercial / institutional energy efficiency and energy management experience. He was a member of the ASHRAE Standing Special Committee (SSPC) 90.1 HVAC Subcommittee which developed the HVAC equipment requirements for ASHRAE 90.1- 1999. He has recently worked with architects and engineers to improve building designs under the Enbridge Consumers Gas and Union Gas Design Advisory Programs and was Principal Investigator in the development of NRCan's CBIP Technical Guidelines for offices, hotels, schools and MURBs.
Facilitator – Stephen Carpenter is president of Enermodal Engineering, Canada's leading engineering firm in sustainable building design. Mr. Carpenter was the design facilitator for several of the best known green building projects in Canada including the Waterloo Green Home, Green on the Grand – the first C2000 office building, Niigon Technology Centre on the Moose Deer Point First Nation and Mountain Equipment Co-op – Ottawa store. Mr. Carpenter is the trainer for the Commercial Building Incentive Program (CBIP) and has provided design and energy simulation services on over 20 buildings that have achieved CBIP energy efficiency status.

Resource person, Commercial Building Incentive Program NRCan – Maria Cinquino has a degree in Building Engineering from Concordia University. She has been the Technical Advisor for the Office of Energy Efficiency's Commercial Building Incentive Program since October 1998. She is currently working on developing CBIP guidelines for several building types.

Resource person, solar energy – Per Drewes is a scientist and principal engineer of Sol Source Engineering, a consulting company specializing in photovoltaics. Prior to forming Sol Source Engineering, Per Drewes was a Senior Research Engineer with Ontario Power Technologies and worked in the utility business, specifically in the renewable energy sector, for more than twenty years. Specializing in solar and wind energy, he was project engineer for most of Ontario Hydro’s pioneering work in this technology. Per Drewes is currently teaching do-it-yourself courses at the Kortright Centre for Conservation to people wishing to install photovoltaic systems or small wind turbines at their remote home or cottage. He is also designing and installing photovoltaic systems for a staff building at a remote bird sanctuary and the CN Tower.

Resource person, Toronto Better Buildings Partnership – Heinrich Feistner was educated in Austria and started working as Designer of HVAC systems and specialized in energy conservation in the mid 70's. He worked for ESCO's and for ten years and had his own energy management consulting business. Heinrich started with the City of Toronto's Energy Efficiency Office as Senior Energy Consultant and was involved in the energy retrofit of City-owned buildings and the design and implementation of the Better Buildings Partnership.

Energy simulator – Brian Fountain is an energy engineer with Energy Advantage Inc. providing building simulations and energy performance analysis for a wide variety of commercial, institutional and industrial clients. He has more than 10 years of experience in the energy management services industry. He is recognized by Natural Resources Canada as a CBIP simulator, reviewer and design facilitator.
**Speaker – Marion Fraser** joined Enbridge Consumers Gas in September of 1998, after five years of independent consulting in the energy industry. She is currently redefining the market development function for the core utility as the entire energy industry is restructured in Ontario. Prior to 1993, Marion held a number of positions with Ontario Hydro including market planning, market research and manager of energy management the commercial sector. Marion has a master's degree in public administration from Queen’s University at Kingston and a BA from Glendon College.

**Speaker – Duncan Hill** is a Senior Researcher with Canada Mortgage and Housing Corporation. Duncan investigates mechanical system performance, energy and water efficiency, indoor air quality and retrofit strategies in Highrise residential buildings.

**Energy simulator – Christopher Jones** has experience in the areas of energy simulation, design facilitation, mechanical engineering consulting, system controls, computer programming, and Web application programming. He is an approved facilitator for Enbridge Gas’ Design Advisor Program and is on the Qualified Assessors List for NRCan’s CBIP Program.

Mr. Jones graduated from the University of Victoria, British Columbia with a B.Eng. in Mechanical Engineering and is a registered Professional Engineer in the Province of British Columbia and is a member of ASHRAE.

**Resource person, costing – Gerard McCabe** MRICS, PQS, graduated in 1985 from the University of Ulster (Belfast, Ireland) with a Bachelor of Science degree in Quantity Surveying. He immigrated to Canada in 1987 and worked with A.J. Vermeulen, then Helyar & Associates, as an Associate in 1997, in charge of the Cost Planning and Estimating departments. Mr. McCabe is member of the Royal Institution of Chartered Surveyors, and is past president of the Ontario Institute of Quantity Surveyors.

**Organizer – Sandra Marshall** is a senior researcher with CMHC's Research Division. As part of the Highrise and Multiples Innovation Group, she manages a variety of multi-unit residential research projects aimed at the needs of design professionals and property managers. Among them are a condition survey of condominiums in the GTA, and Integrated Design Charrettes for Sustainable Design. New studies include the development of design strategies for MURBS that employ and redistribute alternative energy at the building envelope.

Sandra has also supported the development of the on-line environmental assessment of MURBS for building owners and managers.

**Facilitator – Joanne McCallum** has had a life long interest in environmental issues and has actively pursued an academic and professional career with a distinct environmental focus. After completing an
undergraduate career in Urban Geography, Joanne subsequently pursued a Master's degree in Environmental Design in Architecture at the University of Calgary. After working with several firms in Calgary, Ottawa and Hamilton, Joanne began her own architectural practice in 1992 that later evolved into McCallum Sather Architects Inc. in 1996. The firm is a general practice architectural firm with a particular focus on environmental design.

**Energy simulator – Craig McIntyre** is a research engineer with Enermodal Engineering Ltd. in Toronto. He is a CBIP Qualified Assessor and has completed numerous simulations and assessments using EE4 and DOE2. He is LEED accredited by the USGBC and has been involved in the design and monitoring of several renewable energy and sustainable building projects.

**Energy simulator – Andrew Morrison, P.Eng., Caneta Research Inc.** is a DOE 2.1 building energy simulation specialist with over seven years experience. Mr. Morrison has extensive knowledge of the MNECB and CBIP performance path requirements and has undertaken numerous modelling assignments using EE4 as part of the Enbridge Consumers and Union Gas Design Advisory Program. Mr. Morrison was involved in the development of CBIP Technical Guidelines for offices, hotels, schools and MURBs. He has also consulted with CBIP to certify that designs/simulation results meet CBIP requirements.

**Facilitator – Douglas Pollard** maintained his own architectural practice in Toronto for thirty years prior to joining CMHC in 1998 as a senior researcher in sustainable community planning. His practice focused on housing and small institutional projects that demonstrated a potential for an intelligent use of land, resources and finances and that optimized the opportunities for user participation in the design process.

He has received several awards for sustainable design and his work has been published in Canada, the U.S. and Europe.

Douglas’ current projects at CMHC include the development of a methodology for citizen participation in sustainable community planning, the development of site/building guidelines for the town of Banff and demonstration projects of sustainable neighbourhoods in first nations and manufactured home communities. Douglas also chairs the National Housing Research Committee's working group on sustainable communities.

**Energy simulator – Stephen F. Pope** has a degree in Environmental Studies and Architecture from the University of Waterloo. He is the principal of an Ottawa architectural practice concerned with green building, sustainable energy, and architectural professional cultures. He is currently working with the C-2000 Program for Advanced Commercial Buildings.
**Resource person, costing – Manoj Ravindran** graduated from the University of Waterloo with a Bachelor of Science degree in Mechanical Engineering. He is a member of the Professional Engineers of Ontario, the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. and also the Canadian Institute of Quantity Surveyors. Mr. Ravindran is now a director at curran mccabe ravindran ross inc. and is responsible for all mechanical and electrical estimating.

**Facilitator – Peter Rowles** is the Senior Vice President of Energy Advantage Inc. Peter has been working for Energy Advantage Inc. since its formation in 1996. Energy Advantage Inc. is a Canadian company providing independent, total energy management services to commercial, institutional and industrial energy users. As head of the Energy and Environmental Group at Energy Advantage, Peter is assisting many commercial clients develop and implement corporate energy management programs.

**Resource person, building eco-assessment – Jiri Skopek** designed the first active solar house in the U.K., in the early seventies. Now he manages ECD’s projects including a suite of building assessment products. They include an ISO 14001 building sector module, the Green Leaf for municipal operations, for the design of new buildings and for existing office, industrial and multi-residential buildings. He adapted the BREEAM methodology for Public Works and Government Services Canada, currently used to assess federally owned buildings. Recently he conducted the CMHC multi-residential pilot using BREEAM Green Leaf, which included a survey of property managers.

As an architect and urban designer, Jiri Skopek has a strong interest in sustainable communities. He won several competitions for entries based on healthy buildings in a sustainable community including the CMHC/CANMET Multi-residential “Ideas” competition and the CMHC “Healthy Housing” Competition.

**Resource person, developer – Alex Speigel** is an architect and developer with 22 years of experience in design and development and a strong interest in sustainable design issues. Following 7 years of private practice in architecture and landscape architecture in Vancouver and Jerusalem, he joined General Leaseholds Limited to direct the development and redevelopment of retail, office and mixed-use projects in communities throughout Ontario. He is currently senior associate with Context Development Inc. developing residential loft projects in Toronto, both new construction and conversions on infill sites east and west of the downtown core.

**Speaker – Tom Tamblyn** has held senior positions in fee-for-service consulting and energy performance contracting businesses, both active in the building energy retrofit sector. He is an engineering graduate of the
University of Toronto, with an MBA from York University. Outside the office, Tom's activities include running, squash, mountain biking, skiing and scuba diving, and community activities that include assisting with volunteer groups and teaching part time at Queens University and the University of Western Ontario.

**Resource person, financial implications – Steven D. Traub** holds an M.B.A. from Queen’s University graduating in 1979. Steven has been employed in various commercial lending positions within the Bank of Montreal since 1981. He has been employed with the Bank of Montreal Real Estate Lending Group in Toronto since 1987 and was actively involved with originating and under-writing real estate loans. Steven’s present position, of Senior Manager, Real Estate Lending Group, involves managing three Real Estate Lenders, and the Manager of After Sales Service as well. Real Estate Assets under his administration exceeds approximately $600,000,000. He reports directly to the Vice-President of the Real Estate Lending Group for Ontario.
The Integrated Design Process (IDP)

The following is an excerpt from the *Transforming your Practice – Integrated Design Charrettes for Sustainable Buildings* participant information handout that was included in the participant kits. It provides an overview of an Integrated Design Process (IDP).

IDP can be used to develop advanced designs in any number of design areas.

“The keys to a successful IDP include the following:

- Full design team is introduced to IDP at the pre-concept stage and establishes higher performance goals to be met by the building, using the client’s program and site requirements. The site and surrounding community are considered as an eco-system which contribute to the sustainability of the project.

- Design issues are dealt with sequentially and build on each other for greater synergy. Team members share knowledge and test ideas, developing greater respect and understanding for each others’ points of view. Simple, interdisciplinary and cost-effective solutions result. A Design Facilitator, who may be part of the traditional design team, and an Energy Engineer/Simulator are important members of a green design team.

- Review all aspects of the design, starting at the community, site and configuration levels in a methodical manner, including quality assurance from the concept to occupancy.\(^1\)

---

1 Participant information handout included in participant kits at *Transforming your Practice – Integrated Design Charrettes for Sustainable Buildings*, November 7\(^{th}\)-8\(^{th}\), 2001, City of Toronto, Metro Hall, 55 John Street.
### Charrette Agenda

**November 7**

**Metro Hall, Council Chambers (2nd Floor)**

1:00 pm  
Welcome and introduction  
Summary of the event agenda

1:20 pm  
Speaker: Marion Fraser, Enbridge Consumers Gas

1:40 pm  
Top green and energy issues in apartment and office buildings  
-MURB issues and examples  
 Speakers: Duncan Hill, CMHC; Andrew Pride, VP Energy Management, MintoUrban Communities  
-Office building issues and examples  
 Speaker: Tom Tamblyn, Engineering Interface Ltd.  
-Solar energy integration  
 Speaker: Per Drewes, Sol Source Engineering

**Metro Hall, breakout rooms TBA**

3:00-5:00 pm  
Break out into design teams with facilitators and simulators  
Introduce subject experts and most important issues  
Design conflicts: e.g. cost vs. indoor air quality, equipment rental vs. ownership

**November 8**

**Metro Hall, Council Chambers (2nd Floor)**

8:00 am  
Overview of the day's events and housekeeping

**Metro Hall, breakout rooms TBA**

8:15 am  
Breakout into teams  
Review of background material and presentation of some optional scenarios  
Design Work begins

Noon  
Working Lunch  
*(buffet will be located at 2nd floor foyer — lunches can be taken into break out room)*

Design work continues

2:30 pm  
Teams finalize their plans

3:30 pm  
Teams present their findings to the other groups (20 minutes per team)

5:30-6:00 pm  
Discussion and wrap-up

### Simulators, Facilitators & Resource Persons

The design teams will be led by a facilitator and energy simulator, based on the number of teams. Other experts will be available on call to assist with specific issues.

- Greg Allen—Allen Kani Associates
- Bob Bach—Engineering Interface Ltd.
- Kingsley Blease—Canadian Water Services
- Larry Brydon—OZZ Corporation Inc.
- Doug Cane—Caneta Research Inc.
- Stephen Carpenter—Enermodal Engineering Ltd.
- Maria Cinquino—Natural Resources Canada
- Per Drewes—Sol Source Engineering
- Heinrich Feistner—Better Buildings Partnership
- Chris Jones—EnerSys Analytics Inc.
- Pat Lawson—Franklin Empire Inc.
- Gerald McCabe—Curran McCabe Ravindran Ross
- Joanne McCallum—Ontario Assoc. of Architects
- Craig McIntyre—Enermodal Engineering
- Andrew Morrison—Caneta Research Inc.
- Michel Parent—Technosim
- Doug Pollard—CMHC
- Stephen Pope—CANMET
- Andrew Pride—MintoUrban Communities
- Manoj Ravindran—Curran McCabe Ravindran Ross
- Peter Rowles—Energy Advantage Inc.
- Jiri Skopek—ECD Energy and Environment
- Alex Speigel—Context Developments
- Steven Traub—Bank of Montreal

... along with others TBD
<table>
<thead>
<tr>
<th>First Name</th>
<th>Last Name</th>
<th>Company</th>
<th>Address</th>
<th>City</th>
<th>Postal Code</th>
<th>Phone</th>
<th>Fax</th>
<th>E-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>James</td>
<td>Aeichele</td>
<td>Seneca College</td>
<td>1750 Finch Ave. E.</td>
<td>Toronto</td>
<td>M2J 2X5</td>
<td>416-491-5050</td>
<td>x416-495-9176</td>
<td><a href="mailto:james.aeichele@senecac.on.ca">james.aeichele@senecac.on.ca</a></td>
</tr>
<tr>
<td>Greg</td>
<td>Allen</td>
<td>Allen Kani Associates</td>
<td>292 Merton St., Suite 2</td>
<td>Toronto</td>
<td>M4S 1A9</td>
<td>416-488-4425</td>
<td>416-488-7608</td>
<td><a href="mailto:alive@foranrep.net">alive@foranrep.net</a></td>
</tr>
<tr>
<td>Bob</td>
<td>Bach</td>
<td>Engineering Interface Ltd</td>
<td>90 Sheppard Ave. E., 7th Fl.</td>
<td>North York</td>
<td>M2N 6X3</td>
<td>416-218-2275</td>
<td>416-218-2286</td>
<td><a href="mailto:bbach@duke-energy.com">bbach@duke-energy.com</a></td>
</tr>
<tr>
<td>Carlos</td>
<td>Baruco</td>
<td>Ryerson University</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><a href="mailto:ksblease@attcalgary.ca">ksblease@attcalgary.ca</a></td>
</tr>
<tr>
<td>Filippo</td>
<td>Biondi</td>
<td>LKM &amp; Partners Inc</td>
<td></td>
<td></td>
<td></td>
<td>705-675-6881</td>
<td>705-675-8330</td>
<td><a href="mailto:lbkeng@cyberbeach.net">lbkeng@cyberbeach.net</a></td>
</tr>
<tr>
<td>Kingsley</td>
<td>Belea</td>
<td>Canadian Water Services</td>
<td>716 Colonel Sam Drive</td>
<td>Oshawa</td>
<td>L1H 7Y2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luke</td>
<td>Bond</td>
<td>Union Gas Ltd.</td>
<td>200 Yorkland Blvd</td>
<td>North York</td>
<td>M2J SC6</td>
<td>416-491-1880</td>
<td></td>
<td><a href="mailto:lbond@uniong.com">lbond@uniong.com</a></td>
</tr>
<tr>
<td>Larry</td>
<td>Brydon</td>
<td>Ozz Corporation</td>
<td>89 Edilan Dr.</td>
<td>Concord</td>
<td>L4K 3S6</td>
<td>905-669-6223</td>
<td>905-660-1341</td>
<td><a href="mailto:lbrydon@ozzc.org">lbrydon@ozzc.org</a></td>
</tr>
<tr>
<td>Marius</td>
<td>de Bruyn</td>
<td>Aesthetics+Design Landscape Architects</td>
<td>145 Genesee Dr</td>
<td>Oakville</td>
<td>L6H 5Y9</td>
<td>905-257-3205</td>
<td></td>
<td><a href="mailto:charrette@plus-design.com">charrette@plus-design.com</a></td>
</tr>
<tr>
<td>Dianne</td>
<td>Byram Grannum</td>
<td>Urban Development Services - City of Toronto</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Doug</td>
<td>Cane</td>
<td>Caneta Research Inc</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Cathy</td>
<td>Capes</td>
<td>Moffat Kinoshita Architects Inc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Stephen</td>
<td>Carpenter</td>
<td>Enmerodal Engineering</td>
<td>519-743-8777</td>
<td>519-743-8778</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Vito</td>
<td>Casola</td>
<td>POWERGENySYS</td>
<td>218 Goulding Ave.</td>
<td>North York</td>
<td>M2R 2P5</td>
<td>416-224-9339</td>
<td>416-224-9338</td>
<td><a href="mailto:vcasola@powergenyysys.com">vcasola@powergenyysys.com</a></td>
</tr>
<tr>
<td>15 Maria</td>
<td>Cinciono</td>
<td>Natural Resources Canada</td>
<td>580 Booth St.</td>
<td>Ottawa</td>
<td>K1A 0E4</td>
<td>613-947-015</td>
<td></td>
<td><a href="mailto:mcinquni@nrcan.gc.ca">mcinquni@nrcan.gc.ca</a></td>
</tr>
<tr>
<td>16 Don</td>
<td>Curic</td>
<td>Ryerson University</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 Judith</td>
<td>Dimirri</td>
<td>Ryerson University</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 Domenic</td>
<td>Dimuzio</td>
<td>Enbridge Consumer's</td>
<td>500 Consumers Rd.</td>
<td>North York</td>
<td>M2J 1P8</td>
<td>416-495-8350</td>
<td></td>
<td><a href="mailto:domicen.dimuzio@ccp.enbridge.com">domicen.dimuzio@ccp.enbridge.com</a></td>
</tr>
<tr>
<td>19 Per</td>
<td>Drewes</td>
<td>Sol Source Engineering</td>
<td>66 Lewis Drive</td>
<td>Newmarket</td>
<td>L3Y 1R7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 Heinrich</td>
<td>Feisther</td>
<td>City of Toronto - BBP</td>
<td>City Hall, 100 Queen St. W., 20th Fl., East Tower</td>
<td>Toronto</td>
<td>M5H 2N2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 Brian</td>
<td>Fountain</td>
<td>Energy Advantage Inc</td>
<td>690 Dorval Dr.</td>
<td>Oakville</td>
<td>L8K 3W7</td>
<td>905-337-2205</td>
<td>905-337-2209</td>
<td><a href="mailto:brian.fountain@energyadvantage.com">brian.fountain@energyadvantage.com</a></td>
</tr>
<tr>
<td>22 Marion</td>
<td>Fraser</td>
<td>Enbridge Services Inc</td>
<td>500 Consumers Rd.</td>
<td>North York</td>
<td>M2J 1P8</td>
<td>416-495-8350</td>
<td></td>
<td><a href="mailto:marion.fraser@ccp.enbridge.com">marion.fraser@ccp.enbridge.com</a></td>
</tr>
<tr>
<td>23 Duncan</td>
<td>Hill</td>
<td>CMHC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 Michael</td>
<td>Hunter</td>
<td>MCW custom Energy Solutions</td>
<td>416-598-2920</td>
<td>416-598-5394</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 Christopher</td>
<td>Jones</td>
<td>EnerSys Analytics Inc</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 K.</td>
<td>Kawagishi</td>
<td>K. Kawagishi</td>
<td>60 Shangarry St.</td>
<td>Toronto</td>
<td>M1R 1A6</td>
<td>416-757-7657</td>
<td></td>
<td><a href="mailto:kawagishi@home.com">kawagishi@home.com</a></td>
</tr>
<tr>
<td>27 Gustav</td>
<td>Lang</td>
<td>Minto Urban Communities</td>
<td>655 Bay St., Suite 1001</td>
<td>Toronto</td>
<td>MSG 2K4</td>
<td>416-977-0777</td>
<td>416-977-6174</td>
<td><a href="mailto:glang@minto.com">glang@minto.com</a></td>
</tr>
<tr>
<td>28 Glen</td>
<td>Leis</td>
<td>Enbridge Consumers Gas</td>
<td>50 Adelaide Parkway</td>
<td>Markham</td>
<td>L3R 6H3</td>
<td>905-943-6823</td>
<td></td>
<td><a href="mailto:gleis@enbridgeservices.com">gleis@enbridgeservices.com</a></td>
</tr>
<tr>
<td>29 Sandra</td>
<td>Marshall</td>
<td>Canada Mortgage and Housing Corporation</td>
<td>700 Montreal Road</td>
<td>Ottawa</td>
<td>K1A 0P7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 Ron</td>
<td>Mazza</td>
<td>Read Jones Christoffersen Ltd</td>
<td>510 - 144 Front Street West</td>
<td>Toronto</td>
<td>M5J 2L7</td>
<td>416-977-5335</td>
<td>416-977-1427</td>
<td><a href="mailto:rmazza@eric.ca">rmazza@eric.ca</a></td>
</tr>
<tr>
<td>31 Gerrard</td>
<td>McCabe</td>
<td>Curran McCabe Ravindran Ross</td>
<td>160 Bedford Rd, Suite 303</td>
<td>Toronto</td>
<td>M5R 2K9</td>
<td>416-925-1424</td>
<td>416-925-2329</td>
<td><a href="mailto:gcmmccabe@cmrzm.com">gcmmccabe@cmrzm.com</a></td>
</tr>
<tr>
<td>32 Joanne</td>
<td>McCallum</td>
<td>McCallum Sather Architects Inc</td>
<td>157 Catherine St. N.</td>
<td>Hamilton</td>
<td>L8L 4S4</td>
<td>905-526-6700</td>
<td></td>
<td><a href="mailto:mcallum@mcallumsather.com">mcallum@mcallumsather.com</a></td>
</tr>
<tr>
<td>33 Craig</td>
<td>McIntyre</td>
<td>Enmerodal Engineering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34 Linda</td>
<td>McPhee</td>
<td>Canadian Wood Council</td>
<td>1400 Blair Place, Suite 210</td>
<td>Ottawa</td>
<td>K1J 8B8</td>
<td>613-747-5544</td>
<td>613-747-6264</td>
<td><a href="mailto:lmcphee@bcwc.ca">lmcphee@bcwc.ca</a></td>
</tr>
<tr>
<td>35 Richard</td>
<td>Morris</td>
<td>City of Toronto - BBP</td>
<td>City Hall, 100 Queen St. W., 20th Fl., East Tower</td>
<td>Toronto</td>
<td>M5H 2N2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36 Andrew</td>
<td>Morrison</td>
<td>Caneta Research Inc</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37 Joseph</td>
<td>Orlov</td>
<td>LKM Consulting Engineers</td>
<td>235 Lesmill Rd</td>
<td>Toronto</td>
<td>M3B 2V1</td>
<td>416-445-8255</td>
<td></td>
<td><a href="mailto:lkmin@lkmen.org">lkmin@lkmen.org</a></td>
</tr>
<tr>
<td>38 Kevin</td>
<td>Parent</td>
<td>Kevin Parent Architect</td>
<td>21 Grenville St, 2nd Fl.</td>
<td>Toronto</td>
<td>M4Y 1A1</td>
<td>416-531-7136</td>
<td></td>
<td><a href="mailto:kparch@on.aibn.com">kparch@on.aibn.com</a></td>
</tr>
<tr>
<td>39 Michel</td>
<td>Parent</td>
<td>Technomis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 Lalith</td>
<td>Perera</td>
<td>Ruks Engineering</td>
<td>18 Automatic Rd, # 18</td>
<td>Brampton</td>
<td>L6S 5N5</td>
<td>905-789-9652</td>
<td></td>
<td><a href="mailto:ozones@rukeng.org">ozones@rukeng.org</a></td>
</tr>
<tr>
<td>41 Doug</td>
<td>Pollard</td>
<td>CMHC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42 Stephen</td>
<td>Pope</td>
<td>CETC/NRCan</td>
<td>580 Booth St.</td>
<td>Ottawa</td>
<td>K1A 0E4</td>
<td>613-947-9823</td>
<td>613-996-9909</td>
<td><a href="mailto:spo@nrcan.gc.ca">spo@nrcan.gc.ca</a></td>
</tr>
<tr>
<td>43 Michael</td>
<td>Presutti</td>
<td>MEP Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44 Andrew</td>
<td>Pride</td>
<td>MintoUrban Communities</td>
<td>427 Laurier Avenue West, Suite 1010</td>
<td>Ottawa</td>
<td>K1R 7Y2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45 Laura</td>
<td>Rachlin</td>
<td>Rachlin Architect Inc</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46 Farah</td>
<td>Rahman</td>
<td>Architects Alliance</td>
<td>205-317 Adelaide St. W</td>
<td>Toronto</td>
<td>M5V 1P9</td>
<td>416-593-6500</td>
<td>416-593-4911</td>
<td><a href="mailto:frahanman@architectsalliance.com">frahanman@architectsalliance.com</a></td>
</tr>
<tr>
<td>47 Manoj</td>
<td>Ravindran</td>
<td>Curran McCabe Ravindran Ross</td>
<td>160 Bedford Rd, Suite 303</td>
<td>Toronto</td>
<td>M5R 2K9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48 Melissa</td>
<td>Rocchi</td>
<td>McCallum Sather Architects Inc</td>
<td>157 Catherine St. N.</td>
<td>Hamilton</td>
<td>L8L 4S4</td>
<td>905-526-6700</td>
<td></td>
<td><a href="mailto:roccchi@mcallumsather.com">roccchi@mcallumsather.com</a></td>
</tr>
<tr>
<td>49 Mark</td>
<td>Rosen</td>
<td>Ryerson University</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 Robert</td>
<td>Rousseau</td>
<td>Finn Projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51 Peter</td>
<td>Rowsley</td>
<td>Energy Advantage Inc</td>
<td>690 Dorval Dr.</td>
<td>Oakville</td>
<td>L8K 3W7</td>
<td>905-337-2205</td>
<td>905-337-2209</td>
<td><a href="mailto:rowsley@energy.on.ca">rowsley@energy.on.ca</a></td>
</tr>
<tr>
<td>No.</td>
<td>Name</td>
<td>Company/Department</td>
<td>Address</td>
<td>City</td>
<td>Postal Code</td>
<td>Phone 1</td>
<td>Phone 2</td>
<td>Email Address</td>
</tr>
<tr>
<td>-----</td>
<td>---------------</td>
<td>-------------------------------------------</td>
<td>----------------------------------</td>
<td>------</td>
<td>-------------</td>
<td>-----------</td>
<td>-----------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>52</td>
<td>Anna</td>
<td>Sawicki</td>
<td>Urban Development Services - City of Toronto</td>
<td>Toronto</td>
<td>M4P 1E4</td>
<td>416-487-5256</td>
<td>416-487-9766</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Graeme</td>
<td>Scott</td>
<td>Halsall Engineers and Consultants</td>
<td>2300 Yonge St, Ste 2300, Box 2385</td>
<td>Toronto</td>
<td>M5G 2C8</td>
<td>416-462-3226</td>
<td>416-462-3206</td>
</tr>
<tr>
<td>54</td>
<td>Melanie</td>
<td>Sherwood</td>
<td>Toronto Hydro</td>
<td>577 Bay St, Suite 423</td>
<td>Toronto</td>
<td>M5G 2C8</td>
<td>416-499-8000</td>
<td>416-499-7446</td>
</tr>
<tr>
<td>55</td>
<td>Robert</td>
<td>Shute</td>
<td>The Mitchell Partnership Inc.</td>
<td>165 Kenilworth Avenue</td>
<td>Toronto</td>
<td>M4L 3S7</td>
<td>416-392-7706</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>Judy</td>
<td>Simon</td>
<td>IndEco</td>
<td>229 Yonge St, Suite 500</td>
<td>Toronto</td>
<td>M5B 1N9</td>
<td>416-863-0202</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>Ian</td>
<td>Sinclair</td>
<td>MCW custom Energy Solutions</td>
<td>165 Kenilworth Avenue</td>
<td>Toronto</td>
<td>M4L 3S7</td>
<td>416-499-8000</td>
<td>416-499-7446</td>
</tr>
<tr>
<td>58</td>
<td>Mike</td>
<td>Singleton</td>
<td>CEEA</td>
<td>165 Kenilworth Avenue</td>
<td>Toronto</td>
<td>M4L 3S7</td>
<td>416-499-8000</td>
<td>416-499-7446</td>
</tr>
<tr>
<td>59</td>
<td>Jiri</td>
<td>Skopek</td>
<td>ECD Energy and Environment</td>
<td>165 Kenilworth Avenue</td>
<td>Toronto</td>
<td>M4L 3S7</td>
<td>416-499-8000</td>
<td>416-499-7446</td>
</tr>
<tr>
<td>60</td>
<td>Alex</td>
<td>Speigel</td>
<td>Context Developments</td>
<td>165 Kenilworth Avenue</td>
<td>Toronto</td>
<td>M4L 3S7</td>
<td>416-499-8000</td>
<td>416-499-7446</td>
</tr>
<tr>
<td>61</td>
<td>Jacqueline</td>
<td>Swaby</td>
<td>BBP</td>
<td>165 Kenilworth Avenue</td>
<td>Toronto</td>
<td>M4L 3S7</td>
<td>416-499-8000</td>
<td>416-499-7446</td>
</tr>
<tr>
<td>62</td>
<td>Ruthann</td>
<td>Symons</td>
<td>Enbridge Consumers Gas</td>
<td>500 Consumers Rd.</td>
<td>North York</td>
<td>M2J 1P8</td>
<td>416-495-5795</td>
<td>416-495-8350</td>
</tr>
<tr>
<td>63</td>
<td>Tom</td>
<td>Tamblyn</td>
<td>Engineering Interface Ltd.</td>
<td>390 Crawford St</td>
<td>Toronto</td>
<td>M6J 2V9</td>
<td>416-537-6799</td>
<td>416-899-5641</td>
</tr>
<tr>
<td>64</td>
<td>Andy</td>
<td>Taylor</td>
<td>Weinstein Taylor and Associates</td>
<td>390 Crawford St</td>
<td>Toronto</td>
<td>M6J 2V9</td>
<td>416-537-6799</td>
<td>416-899-5641</td>
</tr>
<tr>
<td>65</td>
<td>Arran</td>
<td>Timms</td>
<td></td>
<td>390 Crawford St</td>
<td>Toronto</td>
<td>M6J 2V9</td>
<td>416-537-6799</td>
<td>416-899-5641</td>
</tr>
<tr>
<td>66</td>
<td>Steven</td>
<td>Traub</td>
<td>Bank of Montreal-Personal &amp; Commercial Finance First Canadian Place, 11th Floor</td>
<td>390 Crawford St</td>
<td>Toronto</td>
<td>M5X 1A1</td>
<td>416-867-4950</td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>Sidney</td>
<td>Tung</td>
<td>Urban Development Services - City of Toronto</td>
<td>City Hall, 100 Queen Street West, 20th Floor, East Tower</td>
<td>Toronto</td>
<td>M5H 2N2</td>
<td>416-867-4950</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>Nestor</td>
<td>Uhera</td>
<td>BBP</td>
<td>City Hall, 100 Queen St W., 20th Fl., East Tower</td>
<td>Toronto</td>
<td>M5H 2N2</td>
<td>416-867-4950</td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>Seema</td>
<td>Varma</td>
<td>IndEco</td>
<td>City Hall, 100 Queen St W., 20th Fl., East Tower</td>
<td>Toronto</td>
<td>M5H 2N2</td>
<td>416-867-4950</td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>Tery</td>
<td>Whitehead</td>
<td>Enbridge Consumers Gas</td>
<td>500 Consumers Rd.</td>
<td>North York</td>
<td>M2J 1P8</td>
<td>416-753-6269</td>
<td>416-495-6163</td>
</tr>
<tr>
<td>72</td>
<td>Murray</td>
<td>Wilson</td>
<td>Enbridge Consumers Gas</td>
<td>500 Consumers Rd.</td>
<td>North York</td>
<td>M2J 1P8</td>
<td>416-753-6269</td>
<td>416-495-6163</td>
</tr>
</tbody>
</table>
Appendix F – Charrette Event Day 1 Plenary Presentations

**Presentations on Top Green Issues in Apartment and Office Buildings**

- MURB Issues and Examples by Duncan Hill, CMHC and Andre Pride, MintoUrban Communities
- Office Building Issues and Examples by Tom Tamblyn, Energy Interface Ltd., Duke Solutions
- Solar Energy Integration by Per Drewes, Sol Source Engineering
Integrated Design Charrettes
For Sustainable Buildings

Multi-Unit Residential Buildings
Issues and Examples

Andrew Pride
MintoUrban Communities
Duncan Hill
Canada Mortgage and Housing Corporation

Agenda

• Sustainable Design – Challenges
• Energy use in Apartments
• Topics for design review
• Looking into the future
• Wrap-Up

Sustainable Design - Challenges

• Capital Cost
  – No cash for “frills”!
  – Will occupant pay a premium?
• Uncertainty
  – Innovation = cost with no reward
  – Contractors don’t understand = Higher Cost
  – Who will be the “test ground”?
• Architects and Engineers
  – Sustainable Design is contrary to “blue print” design

Energy Use in Apartment Buildings

• Most apartment buildings constructed in 1960’s - 1970’s
• poorly insulated, poor sealed building envelopes
• inefficient mechanical-electrical systems

Annual Energy Use

• $1,247 per year per apartment (±$630)
• 20,665 kWh per apartment
• 222 kWh/m2 (±60 kWh)
• 0.04885 kWh/m2/degree-day
Energy Use - 133 bldgs

Average = 238 ekWh/m²/year

Energy Use Trends (per m²)
- Family buildings consume more than seniors
- Older buildings consume more than newer
- Larger buildings consume more than smaller
- Metro Toronto buildings generally consume more than any other type

Where Energy is Used:
- Space Heat: 44%
- DHW: 15%
- Lighting: 15%
- Elevators: 6%
- Cooling: 5%
- Other: 15%

Where the Heat Goes:
- Walls: 16%
- Roof: 5%
- Windows: 31%
- Doors: 4%
- Ventilation: 20%
- Air leakage: 24%

Air Leakage in Multis
Airtightness testing has been done on 23 MURBs:
- 0.83 L/s/m² @ 75 Pa to 10.00 L/s/m² @ 75 Pa
- 1995 NBC Appendix recommends 0.10 L/s/m² @ 75 Pa

BUILDINGS ARE VERY LEAKY!
Well insulated buildings with high efficiency mechanical equipment that are leaky WILL NOT PERFORM

Water Consumption
Average consumption = 182 m³/apartment/year
Where the Water Goes:

- Toilets: 26%
- Showers: 17%
- Faucets: 16%
- Dishwashers: 1%
- Clothes washers: 22%
- Bath: 2%
- Leaks: 14%
- Other: 2%
- Showers: 17%

And another thing.....

Corridor Air Systems are NOT suite ventilation systems.
Delivering fresh air to a suite by a corridor by a constant Volume system defies:

- Physics
- Smoke control efforts
- Occupant expectations for integrity of space

Conventional Ventilation

- Delivering fresh air to a suite by a corridor by a constant Volume system defies:

- Physics
- Smoke control efforts
- Occupant expectations for integrity of space
Integrated Design Charrette MURB ISSUES & EXAMPLES NOV 7, 2001

**Conventional Ventilation**

Duncan to present

---

**Topics of Design Review**

- Building Envelope
  - Systems
  - Orientation
- Mechanical & Electrical
  - Indoor Air Quality versus Energy Use: Make up air
  - Efficiency at source: Heating Plant; Domestic Plant
  - Illumination Levels & Switching: hall & stair lighting
- Consumption Savings versus Operating Cost
  - Fuel Selection
  - Life Cycle (energy & maintenance)

Andrew to present

---

**Air Leakage Control Savings**

- CMHC-Ontario Hydro Study:
  - Building 1: 30 years, 21 storeys, 240 apts
  - Building 2: 29 years, 10 storeys, 95 apts

<table>
<thead>
<tr>
<th>Building</th>
<th>Annual Energy Savings</th>
<th>Peak Load Reduction (kW)</th>
<th>Annual Cost Savings</th>
<th>Retrofit Cost</th>
<th>Payback (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>164,870</td>
<td>85</td>
<td>$9,656</td>
<td>$54,816</td>
<td>5.7</td>
</tr>
<tr>
<td>2</td>
<td>63,340</td>
<td>42</td>
<td>$6,107</td>
<td>$38,000</td>
<td>6.2</td>
</tr>
</tbody>
</table>

Andrew to present

---

**Mechanical Systems**

- Heating Plant Upgrade
  - Convert at source with higher quality Equipment sized appropriately
- Domestic Hot Water Plant
  - Use condensing boiler technology (90%+)
- Automate Common Area Systems
  - Can be done with little – no impact on capital
- Automate Fans & Pumps
  - Use Variable Speed Drive technology & BAS
  - Match Speed to Occupancy/Load

Duncan to present
Mechanical Systems
Considerations for Improved Ventilation Strategies:
1. Incremental cost
2. Aesthetics, noise, envelope penetrations
3. Building Codes

Water
Toilet Conversion & Shower Retrofit
- ASHRAE 90.1 requirements good
Waste water & Storm water Management
- Rainwater collection
- Green Roofs
- Where does the developer benefit?

Electrical Reductions
Lighting Retrofit
- Age old story – new twist
- Relight with higher output product
- Standard 13W CFL is no longer the only way to go
- Relight with emphasis on quality & energy

Looking Into the Future
- Sustainable Sources
  - Fuel Cells
  - Distributed power generation
  - Photovoltaic Power
  - Solar Heat Recovery
- Can these be justified without subsidies?

WARNING:
Complex & Innovative systems
+ Conventional MURB O&M Practices
= Failure, Disappointment, Unrecoverable costs

Wrap up
- Where do we go from here?
- Where can change be influenced?
  - Design?
  - Installation?
  - Commissioning?
- How to create a integrated design team?
Design And Energy

Creating Power Through Energy.

Volatility of Price

%Change:
- Stocks: 10%
- Oil: 30%
- Natural Gas: 50%
- Electricity: 200%

Pessimists: Look what’s happened in other markets!

Optimists: Synthetic & inherent buffers will mitigate volatility during opening years

Unbundled Price of Electricity

<table>
<thead>
<tr>
<th>Year</th>
<th>Actuals</th>
<th>Optimistic</th>
<th>Pessimistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>0.9</td>
<td>1.0</td>
<td>1.2</td>
</tr>
<tr>
<td>1999</td>
<td>0.8</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>2000</td>
<td>0.7</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>2001</td>
<td>0.9</td>
<td>1.0</td>
<td>1.2</td>
</tr>
<tr>
<td>2002</td>
<td>1.0</td>
<td>1.0</td>
<td>1.4</td>
</tr>
</tbody>
</table>

* speculation only

Active Energy Management

Load Management Options
- Data acquisition
- Metering
- Communications
- Data processing
- Data analysis
- Control & dispatch

Supply Market Price Signals

Energy Delivery Chain

Deregulation connects Planning Cycle

<table>
<thead>
<tr>
<th>BUY</th>
<th>CONVERT</th>
<th>USE</th>
<th>DISPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commodity Procurement</td>
<td>Energy Conversion</td>
<td>Care Business</td>
<td>Environmental Management</td>
</tr>
</tbody>
</table>

PRODUCTS
- Water Treatment
- Air Emissions
- Grids Removal
- Raw Materials & Labor

DISPOSE
- Waste
- Compliance
- Emissions
- Insurance
- Regulatory Risk

BUY
- Fuel
- Transportation
- Price Risk
- Administration
- Taxes
- Rate Structures

CONVERT
- Capital Budget
- Labor / Training
- Repair / Maintenance
- Permitting
- Water treatment
- Debt
Example of Dependent Relationship

- Installation of a dimming ballast or non-dimming ballast for lighting
- What will be the “buying” savings for option to shed electrical load when we can buy electricity in an open market????

Planning Issues in Buildings

- Renewal
- Productivity
- Environmental

Building Components Cast A Time Shadow

Renewal Problems

- No reserve funding
- Budget squeeze
- Environmental legislation
- No long range planning for assets
- Deferred maintenance increases capital required

Commercial Building Time Shadow

Productivity

- Energy costs are $2.50 per sq. ft. per year
- Leasing costs are $25.00 per sq. ft. per year
- Knowledge worker payroll is $250.00 per sq. ft/year

A 1% change in productivity equals energy cost
West Bend Productivity Case Study

- Rensselaer University research circa 1992
- Linked productivity to environment
- Measured increase of 15% due to facility
- Minimum of 3% attributed to individual control
- Changes maintained for 3 years after study

Environmental Issues

- Timing of Design Leverage
- Load dependency
- Silo thinking

Design Leverage

![Design Leverage Diagram]

Load Dependency

![Load Dependency Diagram]

Silo Thinking

"I’m sure happy to see that bad tire is on your side of the airplane"
Photovoltaics – renewable, environmentally-friendly power
by Per Drewes, Sol Source Engineering

Solar energy can be utilized to passively heat air and water in buildings as well as providing daylighting that can significantly reduce a building’s lighting requirements. Energy from the sun can also be used as fuel to generate electricity. Photovoltaics (PV) is the technology which generates electricity directly from sunlight. Most people are familiar with PV cells from their consumer product application such as solar powered calculators. People may also be aware of its use as a source of electricity for space satellites. Photovoltaics technology is well established as a source of power for small remote applications. The Canadian Coast Guard has over 5,000 PV installations providing electricity for navigation and communication systems. In 1981, Ontario Power Generation, formerly Ontario Hydro, installed a 2.5 kW photovoltaic power supply to operate an air quality monitoring station near Atikokan. It was the largest system in Canada at that time. Today, there are tens of thousands of PV systems in Canada providing electricity to remote cottages and homes but there are only about 5 MW of grid-connected PV systems.

Photovoltaics has been a very practical source of energy for remote applications for years - the electricity being delivered free of charge by the sun - PV technology uses that renewable, environmentally-friendly source of energy to generate electricity. This direct conversion from sunlight to electricity produces no atmospheric emissions or other unwanted waste by-products. Furthermore, with no moving parts, PV systems should last practically forever. PV is absolutely silent and is generally sited on rooftops where aesthetics are not a major concern. This makes PV suitable for development in high-density areas where it is quickly becoming a reliable and clean source of urban-based electricity supply.
### 1) IDENTIFICATION:

**Take The Customer:** Phone: Ozz Corp.: Vito Mike Casola, P.Eng. Date: 2002-01-17

**OFFICE MURBOZZ CORPORATION**

**Address:** Fax: Larry Brydon File Name: 2002-01-17


### 2) ELECTRICAL PROFILE:

<table>
<thead>
<tr>
<th>Time</th>
<th>Electrical Outpurt Capacity Utilization (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-01-17</td>
<td>63%</td>
</tr>
<tr>
<td>2002-01-17</td>
<td>62%</td>
</tr>
<tr>
<td>2003-01-17</td>
<td>61%</td>
</tr>
<tr>
<td>2004-01-17</td>
<td>59%</td>
</tr>
<tr>
<td>2005-01-17</td>
<td>58%</td>
</tr>
<tr>
<td>2006-01-17</td>
<td>60%</td>
</tr>
<tr>
<td>2007-01-17</td>
<td>63.1%</td>
</tr>
</tbody>
</table>

### 3) ENERGY COSTS:

#### A) ELECTRICAL:

<table>
<thead>
<tr>
<th>Time</th>
<th>Electrical Rate (c/kWh)</th>
<th>Demand</th>
<th>Standby Charge Applicable</th>
<th>Charge per kW / month</th>
<th>Emission Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-01-17</td>
<td>9.00</td>
<td>4.8</td>
<td>1.00</td>
<td>7.2</td>
<td>0.00</td>
</tr>
<tr>
<td>2005-01-17</td>
<td>10.12</td>
<td>4.8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### B) THERMAL:

<table>
<thead>
<tr>
<th>Component</th>
<th>Cost/1000 lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta Border Price</td>
<td></td>
</tr>
<tr>
<td>TCPL Charges (no fuel)</td>
<td></td>
</tr>
<tr>
<td>TCPL compressor fuel</td>
<td></td>
</tr>
<tr>
<td>Fuel Oil</td>
<td></td>
</tr>
<tr>
<td>Natural Gas</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td></td>
</tr>
<tr>
<td>Boiler Chemicals</td>
<td></td>
</tr>
<tr>
<td>Labour</td>
<td></td>
</tr>
<tr>
<td>Maintenance &amp; Labour</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7.00</td>
</tr>
</tbody>
</table>

#### C) EMISSIONS:

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>kg/MWhr</th>
<th>Credit ($/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>907</td>
<td>0.00</td>
</tr>
<tr>
<td>NOx</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

### 4) INFLATION:

#### a) ELECTRICITY (Rate Forecast)

<table>
<thead>
<tr>
<th>Year</th>
<th>Rate 1 (1% low)</th>
<th>Rate 2 (Med.)</th>
<th>Rate 3 (Hi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>2006</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>2007</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>2008</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>2009</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>2010</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

#### b) FUEL OIL

<table>
<thead>
<tr>
<th>Year</th>
<th>Rate 1 (1% low)</th>
<th>Rate 2 (Med.)</th>
<th>Rate 3 (Hi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>2006</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>2007</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>2008</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>2009</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>2010</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

### 5) Cogen Plant Selection & Parameters:

#### a) ELECTRICAL - THERMAL

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>0.65 kW</td>
</tr>
<tr>
<td>Efficiency</td>
<td>40.00%</td>
</tr>
<tr>
<td>Marginal Cost</td>
<td>7.24 cents / kWh</td>
</tr>
</tbody>
</table>

#### b) OPERATING PARAMETERS:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expansion Factor</td>
<td>1.00</td>
</tr>
<tr>
<td>IMO:</td>
<td>0%</td>
</tr>
<tr>
<td>NOPV:</td>
<td>$50,581</td>
</tr>
</tbody>
</table>

### 6) OPERATING SCHEME:

<table>
<thead>
<tr>
<th>Time</th>
<th>Total Days per month (2000)</th>
<th>Available Hours per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Feb</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Mar</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Apr</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>May</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Jun</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Jul</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Aug</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Sep</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Oct</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Nov</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Dec</td>
<td>24</td>
<td>23</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Cogen Plant Operating Hours / day (avg.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>14.9</td>
</tr>
<tr>
<td>Feb</td>
<td>14.9</td>
</tr>
<tr>
<td>Mar</td>
<td>14.9</td>
</tr>
<tr>
<td>Apr</td>
<td>14.9</td>
</tr>
<tr>
<td>May</td>
<td>14.9</td>
</tr>
<tr>
<td>Jun</td>
<td>14.9</td>
</tr>
<tr>
<td>Jul</td>
<td>14.9</td>
</tr>
<tr>
<td>Aug</td>
<td>14.9</td>
</tr>
<tr>
<td>Sep</td>
<td>14.9</td>
</tr>
<tr>
<td>Oct</td>
<td>14.9</td>
</tr>
<tr>
<td>Nov</td>
<td>14.9</td>
</tr>
<tr>
<td>Dec</td>
<td>14.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Electricity Generated (kWh)</th>
<th>Heat Generated (kWh)</th>
<th>Heat Dump (%)</th>
<th>Average Heat Dump (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>1,024</td>
<td>1,002</td>
<td>83%</td>
<td>83%</td>
</tr>
<tr>
<td>Feb</td>
<td>1,024</td>
<td>1,002</td>
<td>83%</td>
<td>83%</td>
</tr>
<tr>
<td>Mar</td>
<td>1,024</td>
<td>1,002</td>
<td>83%</td>
<td>83%</td>
</tr>
<tr>
<td>Apr</td>
<td>1,024</td>
<td>1,002</td>
<td>83%</td>
<td>83%</td>
</tr>
<tr>
<td>May</td>
<td>1,024</td>
<td>1,002</td>
<td>83%</td>
<td>83%</td>
</tr>
<tr>
<td>Jun</td>
<td>1,024</td>
<td>1,002</td>
<td>83%</td>
<td>83%</td>
</tr>
<tr>
<td>Jul</td>
<td>1,024</td>
<td>1,002</td>
<td>83%</td>
<td>83%</td>
</tr>
<tr>
<td>Aug</td>
<td>1,024</td>
<td>1,002</td>
<td>83%</td>
<td>83%</td>
</tr>
<tr>
<td>Sep</td>
<td>1,024</td>
<td>1,002</td>
<td>83%</td>
<td>83%</td>
</tr>
<tr>
<td>Oct</td>
<td>1,024</td>
<td>1,002</td>
<td>83%</td>
<td>83%</td>
</tr>
<tr>
<td>Nov</td>
<td>1,024</td>
<td>1,002</td>
<td>83%</td>
<td>83%</td>
</tr>
<tr>
<td>Dec</td>
<td>1,024</td>
<td>1,002</td>
<td>83%</td>
<td>83%</td>
</tr>
</tbody>
</table>

### Financials:

**Total Cost Maintenance:** 5.0% of capital cost: $0.00 (estimate)**
OFFICE / MURB HEATING SYSTEM - PROJECTED THERMAL LOAD PROFILE

Natural Gas Thermal Load: MURB (2005)

Natural Gas Thermal Load: Office (2001)

Thermal Output of Cogen Plant

HEAT DUMP

MONTH JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

<table>
<thead>
<tr>
<th>Total Natural Gas Consumption, mmBTU</th>
<th>(For details refer to Gas Data Sheet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>1,258 1,047 754 376 143 70 69 72 97</td>
</tr>
<tr>
<td>MURB</td>
<td>1,598 1,378 1,131 607 246 124 118 118 169</td>
</tr>
<tr>
<td>BOTH</td>
<td>2,856 2,425 1,885 984 388 194 186 190</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equivalent Total Thermal Load in Million BTU</th>
<th>(assuming existing boiler plants are 80% efficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>1,258 1,047 754 376 143 70 69 72 97</td>
</tr>
<tr>
<td>MURB</td>
<td>1,598 1,378 1,131 607 246 124 118 118 169</td>
</tr>
<tr>
<td>BOTH</td>
<td>2,856 2,425 1,885 984 388 194 186 190</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cogeneration Plant Thermal Output in Million BTU</th>
<th>(based on 1 cummins/wartsila CW12V220 @ 651 kW output)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal output from cogen plant following the estimated year 2005 electrical load</td>
<td>1,024 922 1,002 960 1,054 1,035 1,151 1,130</td>
</tr>
</tbody>
</table>

DATA: from Spreadsheet provided by

FILE: C:\Data \ GENySYS \ .... \ 0ZZ \ PRHC \ Design Charrettes Analysis.xls Sheet: Thermal Load Profile Page: 1 of 1
ANNUAL ELECTRICAL DEMAND PROFILES

DATE: NOV. 2001  PROJECT: Office / MURB: PROPOSED COGENERATION PLANT

---

**Estimate Facility Consumption in MWhr (Year 2005)**

<table>
<thead>
<tr>
<th></th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>217</td>
<td>195</td>
<td>210</td>
<td>198</td>
<td>220</td>
<td>211</td>
<td>239</td>
<td>234</td>
<td>190</td>
<td>197</td>
<td>187</td>
<td>202</td>
</tr>
<tr>
<td>MURB</td>
<td>104</td>
<td>94</td>
<td>104</td>
<td>102</td>
<td>110</td>
<td>114</td>
<td>122</td>
<td>120</td>
<td>109</td>
<td>106</td>
<td>101</td>
<td>104</td>
</tr>
<tr>
<td>BOTH</td>
<td>321</td>
<td>289</td>
<td>314</td>
<td>301</td>
<td>330</td>
<td>324</td>
<td>361</td>
<td>354</td>
<td>300</td>
<td>303</td>
<td>288</td>
<td>306</td>
</tr>
</tbody>
</table>

**Estimated Peak Demand in kW (Year 2005)**

<table>
<thead>
<tr>
<th></th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>625</td>
<td>617</td>
<td>680</td>
<td>805</td>
<td>931</td>
<td>797</td>
<td>796</td>
<td>755</td>
<td>729</td>
<td>689</td>
<td>590</td>
<td>631</td>
</tr>
<tr>
<td>MURB</td>
<td>214</td>
<td>216</td>
<td>229</td>
<td>247</td>
<td>251</td>
<td>268</td>
<td>293</td>
<td>287</td>
<td>255</td>
<td>237</td>
<td>221</td>
<td>214</td>
</tr>
<tr>
<td>BOTH</td>
<td>838</td>
<td>833</td>
<td>908</td>
<td>1,052</td>
<td>1,182</td>
<td>1,065</td>
<td>1,088</td>
<td>1,042</td>
<td>984</td>
<td>926</td>
<td>811</td>
<td>844</td>
</tr>
</tbody>
</table>

**Average Load in kW**

<table>
<thead>
<tr>
<th></th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>292</td>
<td>290</td>
<td>282</td>
<td>275</td>
<td>296</td>
<td>293</td>
<td>321</td>
<td>315</td>
<td>265</td>
<td>265</td>
<td>260</td>
<td>272</td>
</tr>
<tr>
<td>MURB</td>
<td>139</td>
<td>139</td>
<td>140</td>
<td>142</td>
<td>148</td>
<td>158</td>
<td>163</td>
<td>161</td>
<td>152</td>
<td>142</td>
<td>140</td>
<td>139</td>
</tr>
<tr>
<td>BOTH</td>
<td>431</td>
<td>430</td>
<td>422</td>
<td>418</td>
<td>444</td>
<td>450</td>
<td>485</td>
<td>476</td>
<td>416</td>
<td>408</td>
<td>400</td>
<td>411</td>
</tr>
</tbody>
</table>

* The Electrical Profile for 2005 is an estimate based on a 0% load increase from the current load & consumption levels at the present building.

**Cogeneration Plant Output Capacity (kW)**

<table>
<thead>
<tr>
<th>Option</th>
<th>651</th>
<th>651</th>
<th>651</th>
<th>651</th>
<th>651</th>
<th>651</th>
<th>651</th>
<th>651</th>
<th>651</th>
<th>651</th>
<th>651</th>
<th>651</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 2</td>
<td>803</td>
<td>803</td>
<td>803</td>
<td>803</td>
<td>803</td>
<td>803</td>
<td>803</td>
<td>803</td>
<td>803</td>
<td>803</td>
<td>803</td>
<td>803</td>
</tr>
</tbody>
</table>

---

**DATA:** from Spreadsheet provided by
ANNUAL ELECTRICAL CONSUMPTION PROFILES

DATE: NOV. 2001 PROJECT: Office / MURB: PROPOSED COGENERATION PLANT

Total Consumption in MWhr (Year 2005)
(from Spreadsheet provided by)

Office
217 195 210 198 220 211 239 234 190 197 187 202

MURB
104 94 104 102 110 114 122 120 109 106 101 104

BOTH
321 289 314 301 330 324 361 354 300 303 288 306

* The Electrical Profile for 2005 is an estimate based on a 0% load increase from the current load & consumption levels at the present building.

Cogeneration Plant Monthly kWhr Output
(based on gensets running 24hrs per day 100% output)

Option 1
484 437 484 469 484 469 484 484 469 484 469 484

Option 2
597 540 597 578 597 578 597 597 578 597 578 597

DATA: from Spreadsheet provided by
FINANCIAL ANALYSIS for Proposed Office / MURB Cogen Plant

Date: January 17, 2002

TECHNICAL AND OPERATING ASSUMPTIONS:

CAPITAL COST ASSUMPTIONS:

<table>
<thead>
<tr>
<th>OPTION No.</th>
<th>Description</th>
<th>Tax Class</th>
<th>000s CDN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PRICING ASSUMPTIONS:

<table>
<thead>
<tr>
<th>PRICE PARAMETER</th>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OPTION No.:

- Foundations & Equipment Installation
- Recuperating Engine / Generator Set
- Steam Producer - Steam Generator
- Heat Recovery - Hot Water
- Mechanical Ties to existing plant
- Electrical Protection, Controls & Tie-ins
- Componcy
- Engineering and Permits
- Oil (SAE 40W) Cost per Liter

TECHNICAL AND OPERATING ASSUMPTIONS:

- Proposed Genset Model: cummins/wartsila CW12V220
- Heat Recovery - Steam Generator
- Electrical Power Rating: 651 kW
- Oil Consumption: 1.05 L/hr

OPERATING COSTS:

- Class 43 Investor? Y
- Hospital Electrical Expansion Factor 1.00
- Load Increase Total Project Cost (used for sensitivity analysis)

YEAR 2000 PROJECTIONS:

- DAYS per month: 31 28 31 30 31 30 31 31 30 31 30 31
- TOTAL MONTHLY EXPENSES

COSTS:

- Gas Consumption
- Fuel Oil Consumption
- Labour (Operating Engineers)
- TOTAL MONTHLY UTILITY COSTS

RESULTS:

- Discounted Payback
- Net Present Value (before tax)
- Pre-Tax Equity IRR
- Net Present Value (after tax)
- After-Tax Equity IRR

CASHFLOW:

<table>
<thead>
<tr>
<th>ELECTRICAL (MW)</th>
<th>THERMAL (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.65</td>
<td>0.64</td>
</tr>
</tbody>
</table>

CUGEN PLANT OUTPUT:

<table>
<thead>
<tr>
<th>TOTAL MONTHLY EXPENSES</th>
</tr>
</thead>
</table>

REMAINING COSTS:

- Additional Electrical Purchases
- Additional Gas Purchases
- Additional Cost Gas
- Labour (Operating Engineers)
- Admin, Leases, Insurance, etc.

TOTAL MONTHLY EXPENSES


Additional Marginal Cost / kWh:

- $72.36 / MWh

File: C:\Data \ GENySYS \ ... \ OZZ \ PRHC \ Design Charrettes Analysis.xls Sheet: CASHFLOW
## FINANCIAL ANALYSIS for Proposed Office / MURB Cogen Plant

### 20 YR. CASH FLOW PROJECTIONS

**ALL FIGURES are in 1000's of Canadian Dollars**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Without Cogen Generation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity Charges</td>
<td>$385.7</td>
<td>$406.3</td>
<td>$418.5</td>
<td>$414.3</td>
<td>$410.2</td>
<td>$410.2</td>
<td>$414.3</td>
<td>$420.3</td>
<td>$426.4</td>
<td>$432.6</td>
<td>$438.8</td>
<td>$445.2</td>
<td>$451.7</td>
<td>$458.2</td>
<td>$464.8</td>
<td>$471.6</td>
<td>$478.4</td>
<td>$485.4</td>
<td>$492.4</td>
<td></td>
</tr>
<tr>
<td>Gas Charges</td>
<td>$101.7</td>
<td>$104.2</td>
<td>$109.9</td>
<td>$105.9</td>
<td>$112.3</td>
<td>$116.1</td>
<td>$117.9</td>
<td>$120.9</td>
<td>$123.9</td>
<td>$127.0</td>
<td>$130.2</td>
<td>$133.4</td>
<td>$136.6</td>
<td>$140.2</td>
<td>$143.7</td>
<td>$147.3</td>
<td>$151.0</td>
<td>$154.8</td>
<td>$158.6</td>
<td></td>
</tr>
<tr>
<td>Fuel Oil Charges</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
</tr>
<tr>
<td>Labour (Operating Engineers)</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
</tr>
<tr>
<td><strong>Total Costs without Cogen</strong></td>
<td>$487.4</td>
<td>$510.6</td>
<td>$525.4</td>
<td>$523.8</td>
<td>$522.4</td>
<td>$525.2</td>
<td>$532.2</td>
<td>$541.2</td>
<td>$550.3</td>
<td>$559.6</td>
<td>$569.0</td>
<td>$578.6</td>
<td>$588.4</td>
<td>$598.4</td>
<td>$608.5</td>
<td>$618.9</td>
<td>$629.4</td>
<td>$640.1</td>
<td>$651.0</td>
<td></td>
</tr>
</tbody>
</table>

### With Cogen Generation

**Savings / Revenues:**

- **Displaced Gas Savings:** $55.3 \(\times\) 20 YR.
- **CO2 Credit:** $0.0 \(\times\) 20 YR.
- **NOx Credit:** $0.0 \(\times\) 20 YR.

**Operating Expenses:**

- **Electrical Standby Charges:** $17.4 \(\times\) 20 YR.
- **Cogen Gas Consumption:** $202.0 \(\times\) 20 YR.
- **Oil Changes:** $36.0 \(\times\) 20 YR.
- **Genset Maintenance Contract:** $43.2 \(\times\) 20 YR.
- **Additional Electricity:** $19.3 \(\times\) 20 YR.
- **Operating Labour:** $0.0 \(\times\) 20 YR.

**Total Operating Expenses:**

- $343.9 \(\times\) 20 YR.

**Total Costs with Cogen:**

- $343.9 \(\times\) 20 YR.

**Net Savings (Operating Cash Flow):**

- -$1,200 \(\times\) 20 YR.

**Present Value (Net Savings):**

- $-1,200 \(\times\) 20 YR.

**Net Present Value:**

- $201 \(\times\) 20 YR.

**After-Tax Cash Flow Schedule**

- **Net Income Before Tax and Depreciation:** $143 \(\times\) 20 YR.
- **CCA Depreciation (see schedule below):** $7 \(\times\) 20 YR.
- **Allowable CCA Depreciation for Tax Purposes:** $1 \(\times\) 20 YR.
- **Taxable Income:** $0 \(\times\) 20 YR.
- **Federal Income Tax:** $28.00\% \(\times\) 20 YR.
- **Federal Surtax:** $4.00\% \(\times\) 20 YR.
- **Total Income Tax Payable:** $5 \(\times\) 20 YR.
- **Available Surtax Credit Against Large Corporations Tax:** $0 \(\times\) 20 YR.

**Net Cash Distribution:**

- $143 \(\times\) 20 YR.

**Present Value (Net After-Tax Cash Flows):**

- $-1,200 \(\times\) 20 YR.

**Net Present Value:**

- $51 \(\times\) 20 YR.

**After-Tax Rate of Return (20-Years):**

- 7.30\% 

**Depreciation Schedule**

- **Equivalent First Year Tax Credit:** $201 \(\times\) 20 YR.

**Discounted Payback Calculation**

- **Cumulative PV Cashflows (after tax):** $143 \(\times\) 20 YR.
- **Discounted Payback:** 20.00 \(\times\) 20 YR.
Transforming your Practice – Integrated Design Charrettes for Sustainable Buildings

Participant Questionnaire: to be completed at the end of the sessions

Name: ____________________________________________
Occupation: _______________________________________
Organization/Firm: ____________________________________________
Address: ________________________________________________
Email: ________________________ Tel: ____________________ Fax: ________________________

How would you rate your knowledge of IDP prior to attending this workshop?

________________________________________________________________________

How would you rate your knowledge of green design prior to attending this workshop?

________________________________________________________________________

How would you evaluate the workshop overall?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>Met some expectations</td>
<td>Met most expectations</td>
<td>Met my expectations</td>
<td>Went beyond expectations</td>
</tr>
</tbody>
</table>

Did you gain insight or knowledge that would be useful for your work?

________________________________________________________________________

What improvements would you like to see in future workshops?

________________________________________________________________________

What was your experience in your team charrette? What would you like to see improved in the future?

________________________________________________________________________

Part of your commitment in attending this charrette was to use the Integrated Design Process in your practice. Will you use the IDP in your next design projects?  Yes ( ) No ( )

________________________________________________________________________

Will you use whole building energy simulation in your future projects? If not, why not?

________________________________________________________________________

Have you experience or expertise with LEED, Breeam/Greenleaf or other green design guidelines or tools?

________________________________________________________________________

Have you ever participated in an integrated design charrette previously?  Yes ( ) No ( )

Do you use integrated design techniques in your regular practice?  Yes ( ) No ( )

If yes to the above, please describe the process you use and identify the key players:
Transforming your Practice – Integrated Design Charrettes for Sustainable Buildings

Participant Questionnaire – to be completed at the end of the sessions

Have you ever used whole building energy simulation:
- in building design? Yes ( ) No ( )
- in building performance audits? Yes ( ) No ( )

If yes to either of the above, have you performed these tasks with:
- in-house staff? Yes ( ) No ( )
- hired consultants? Yes ( ) No ( )

Have you submitted any projects for the Commercial Buildings Incentive Program (CBIP) grants? Yes ( ) No ( )
If yes, how many?
- one or two ( )
- just the best ones? ( )
- What percentage? ___%

Have you ever used the CBIP Screening Tool? Yes ( ) No ( )
If yes, where did you first hear of it? ________________________
Do you use it:
- regularly ( )
- only on projects with an energy design focus ( )
- infrequently ( )

Have you ever used the ASHRAE 90.1 Energy Cost Budget approach for compliance with that standard? Yes ( ) No ( )

Have you (or your consultants) ever done detailed energy simulations for a project using the following (Circle the programs used in the past):
Carrier HAP  Trane TRACE
DOE-2.1 PowerDOE, VisualDOE, PC DOE or other variants not including EE4.CBIP
Merriweather  BLAST  TRNSYS  Other ________________________

Have you ever done whole building energy simulations using EE4.CBIP? Yes ( ) No ( )
Do your consultants do EE4.CBIP whole building energy simulations? Yes ( ) No ( )

Who does design and document coordination in your office?
- Principal in charge? Yes ( ) No ( )
- Project Architect/Engineer? Yes ( ) No ( )
- Job Captain / Sr. Technologist? Yes ( ) No ( )

Do you have any quality assurance processes to demonstrate consultant design and document coordination? Yes ( ) No ( )

Any other comments or suggestions? ____________________________________________
Appendix I – Written testimonials

Developer: Alex Speigel, Context Development Inc.

Energy/HVAC Specialist: Larry Brydon, OZZ Corporation

Note-taker: Arran Timms
The following are the written testimonials received from developer, Alex Speigel of Context Development Inc., resource specialist on energy/HVAC, Larry Brydon of OZZ Corporation, and note-taker for MURB Team A, Arran Timms.

Developer, Alex Speigel, Context Development Inc.

“From the beginning, I was intrigued by the concept of charrette based on a “real life” scenario—especially on a project that was in its formative stages of design.

As a developer with a strong interest in green design strategies, I often encounter resistance from my other associates in the firm, from marketing people or from the design team regarding the value of designing green buildings. Since the builder/developer is not the long term owner of the project, investment in design improvements cannot simply be justified based on life-cycle costing or payback periods as they can in owner-occupied projects. As a result, the economics of residential condominium development generally tends to focus on the selling price of the unit and not its operating costs, which produces a barrier to providing greener design solutions.

As purchasers become better educated about these issues and start asking questions about energy and operating costs, indoor air quality, health and comfort issues and environmental responsibility, developers will respond with greener buildings in order to gain a competitive advantage. To begin the process, however, developers must start to lead by example.

To encourage this shift to more sustainable buildings, critical analysis of various design strategies is required. What could be better than to have a group of committed and creative professionals from diverse disciplines focusing on a real project on a real site, offering their collaborative design skills to improve the quality of the project design?

I welcomed the opportunity to participate in this integrated design approach to explore practical greener design solutions that could actually be implemented. It was particularly useful to have the energy simulation people on each team to advise on the impacts of each design decision as they were being discussed.

Since many aspects of the project were already designed and commitments made to purchasers (approximately 50% of the units are already sold and the rezoning already approved), the scope for major design changes was somewhat limited. As a result, I think that the approach of creating three different teams to look at various levels of intervention was quite useful. Although I understand the educational benefit of adding an office building to the “theoretical” program, it was obviously the work on the residential component of the exercise that interested me the most.

The work of Team A, in particular, was most useful. In maintaining the parameters of building shape and orientation, the interventions proposed were of real interest, and I hope to be able to incorporate some of the suggestions into the building design. The architectural, mechanical and structural consultants who are actually working on the project all attended this session and were wholly engaged in the process. It is a tribute to
the collaborative spirit of the group that the design discussions were embraced by the consultants and not treated as a criticisms to which they might otherwise have responded defensively. The team leader was particularly skilled in both technical knowledge and in guiding the group dynamics. His final presentation was clear, focussed and convincing.

The design work of Team B, in exploring more aggressive approaches, was of less practical use for this particular project, but was nevertheless educational in highlighting a wider range of measures. It is interesting to note that, in the end, this group maintained the original shape and orientation of the building although their mandate allowed them to question this aspect of the design. Although I found the work of the group very informative, the presentation of the work was rather vague and not nearly as convincing as that of Team A. Some of the presentation also seemed to focus unnecessarily on number crunching. Nevertheless, lessons learned from this group will be useful in informing work on future projects.

Team C, of course, got to have “all the fun”, with its wider ranging parameters. Its work was, by definition, more theoretical, but was also useful in exploring the boundaries of the possible. The group’s presentation was more of a vision than a design, but as an educational process provided a strong statement of the direction that projects should strive to go in order to be truly sustainable.

Generally, I thought the organization of the event into the three distinct groups was quite useful. In working with a range of “givens”, the solutions offered ranged from immediate suggestions that could certainly be implemented in this project, as well as providing some more general directions that will inform future projects that are in a more formative stage of design.

I think the size of the groups was good—not too large to be cumbersome, but with enough people to provide an array of professional advise. The central location was convenient and accessible.

I thought the event could have been more widely publicized, especially within the architectural community. I don’t think the lists available through the RAIC, OAA or TSA were used; they could have generated a larger turnout. Although a larger event may have been more cumbersome to organize, it would have provided the benefit of exposing more architects and owners/developers to the integrated design approach.

I would like to thank the entire team who organized the event for including Context Development and for using the Radio City site as the base for the charrette. In directing the green agenda to a very practical level, the charrette has provided me with “do-able” solutions for the Radio City project as well as with innovative suggestions for other projects in the immediate future.”

---

1 Correspondence from Alex Speigel of Context Development Inc., to Seema Varma of IndEco Strategic Consulting Inc., November 14, 2001.
Energy/HVAC specialist, Larry Brydon, OZZ Corporation

“OZZ Corporation, through our CSE Energy group has been in partnership with the BBP since nearly it’s inception and has been represented at most workshops and design charrettes sponsored wholly or in part through the City of Toronto, Enbridge, Union Gas and Hydro One. OZZ Corporation Inc. provided the Client for the most recent charrette.

A common and recurring theme, the reference to “ talking heads “ and “ preaching to the converted “ was conspicuously absent at the most recent design charrette sponsored by CMHC, NRCan BBP and Enbridge.

In this charrette, unlike those in the past, a “ real world “ approach was taken. An actual site, a building to be constructed, a curious developer, a skeptical design team and a cynical marketing department all came together to meet with the brightest and best in the energy efficiency business.

A true win-win-win scenario emerged. For those in the business, it was an opportunity to network, meet the builder and his designers, and demonstrate their products and crafts. For the developer, a $ 60,000 cash incentive was available, along with tens of thousands of dollars worth of consultancy fees (had he hired these experts). An enlightening experience for the design teams, who saw the simulated, real-time impact of the various changes one discipline can have on the other, and the substantial impact an integrated design process can have on overall energy efficiency and social impact. Marketing people, usually skeptical of any thing “ green “, came to recognize that improved occupant comfort, individual control and productivity are just as “ sellable “ as a panoramic view.

The real winner however is the City of Toronto and the BBP partnership. From this exercise, a framework to deliver on the energy efficiency mandate within the new construction, multi residential marketplace can be defined.”

---

2 Excerpt from correspondence prepared by Larry Brydon of OZZ Corporation to the City of Toronto, December 2001.
**Note-taker, Arran Timms**

“I found most of the workshop very instructive, even though I already had a good understanding of the issues from both a design and resource management perspective.

The workshop benefited greatly from:

a) the depth of knowledge of each respective participant on my team, in addition to the various experts "on call", and

b) its practical focus on a real case study development project.

I also think that our group was able to focus quickly on problem solving as a result of the very pragmatic design restrictions we faced. It was an added benefit to have the real world developer/builder present to comment on our ideas. Finally, the ability to produce drawings such as building details from existing design documents was essential, in my opinion.

Unfortunately, I thought many of the final group presentations were difficult to follow (often for the simple reason that you couldn’ t hear or see the content) and, in a few cases, proved to have disappointing findings or at least those were not effectively demonstrated. Audio-visual technology could have been better deployed.

I highly recommend that you make an attempt to repeat the charrette on a periodical basis. Perhaps a keynote address by an architect or developer of a successful and high profile "green" building in North America or Europe could add more substance to the program.”

---