BUILDINGS AS AN AGENT OF CHANGE
The Case for Green Retrofits

A design charrette with students from the Faculty of Environmental Studies at York University and Sustainable Buildings Canada
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits</td>
<td>4</td>
</tr>
<tr>
<td>Charrette Participants</td>
<td>5</td>
</tr>
<tr>
<td>About Sustainable Buildings Canada (SBC)</td>
<td>7</td>
</tr>
<tr>
<td>Design for Sustainability Workshop</td>
<td>8</td>
</tr>
<tr>
<td>Workshop Highlights</td>
<td>9</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>11</td>
</tr>
<tr>
<td>Charrette Introduction</td>
<td>14</td>
</tr>
<tr>
<td>How to Organize a Design Charrette</td>
<td>16</td>
</tr>
<tr>
<td>Charrette Objectives</td>
<td>17</td>
</tr>
<tr>
<td>Charrette Invitation</td>
<td>18</td>
</tr>
<tr>
<td>Charrette Agenda</td>
<td>19</td>
</tr>
<tr>
<td>Why Retrofit?</td>
<td>20</td>
</tr>
<tr>
<td>Topic</td>
<td>Page</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Learning from the Experts</td>
<td>21</td>
</tr>
<tr>
<td>Student Research Presentations</td>
<td>23</td>
</tr>
<tr>
<td>The Business Case for Green Retrofits</td>
<td>24</td>
</tr>
<tr>
<td>Heritage and Culture</td>
<td>36</td>
</tr>
<tr>
<td>Interior Retrofits and Adaptive Reuse</td>
<td>41</td>
</tr>
<tr>
<td>Technology</td>
<td>45</td>
</tr>
<tr>
<td>Health and Wellbeing</td>
<td>54</td>
</tr>
<tr>
<td>Emerging Insights</td>
<td>62</td>
</tr>
<tr>
<td>Charrette Photos</td>
<td>64</td>
</tr>
<tr>
<td>Endnotes</td>
<td>65</td>
</tr>
</tbody>
</table>
CREDITS

Editors
Arlene Gould
Allison Evans

Design
Marija Bacic

Photography
Saied Vafa
Ammon Cherry
Marija Bacic

THANK YOU

Charette sponsor: Sustainable Buildings Canada
CHARRETTE PARTICIPANTS

Professional Participants

Tamara Anson-Cartwright: Program Manager, Policy and Research, Heritage Preservation Services, City Planning, Urban Design, City of Toronto

Larry Brydon: VP Business Development, Cricket Energy; Board Member, SBC

Arlene Gould: Course Director, Faculty of Environmental Studies, York University; Board Member, SBC

Bettina Hoar: Health and Wellness Consultant, Sage Living

Sarah Jones: Project Manager, SBC

John Lindsay: Senior Manager, Development, Allied Properties REIT

Tom Ponessa: Architect; Director of Programs, SBC

John Robinson: Professor, Munk School of Global Affairs and Public Policy and the School of Environment, University of Toronto; Board Member, SBC

Michael Singleton: Economist, Energy Policy and Resource Planning; Executive Director, SBC

Jiri Skopek: Architect and Planner; Chair, SBC

Simone Skopek: Sustainability and Productive Workplace Consultant

Michelle Xuereb: Director of Innovation, Quadrangle
CHARRETTE PARTICIPANTS

Student Participants

Design for Sustainability Workshop, Faculty of Environmental Studies, York University

Nadine Abrams
Uduak-Obong Antai
Roxanna Ayenebegy
Marija Bacic
Tristan Brun
Glennis Ch’ng
Shehroze Chaudhry
Ammon Cherry
Nicholas Cicchini
Veronica De Gois
Raquel Dileo
Alexandria Dooley
Allison Evans
Stephanie Ezeude
Ali Ghandour
Wenjing Guo

Minsheng Jiang
Anushka Karmalkar
Kirshok Karunakaran
Daniel Kogan
Benny Koo
Shuai Liu
Lucanu Mateus
Thomas Sword
Pak Tong
Daniel Tsang
Saeid Vafa
HaoXiang Zhang
Yu-Yang Zhang
Zhasmina Zheleva
Binyi Zhu
Sustainable Buildings Canada (SBC) is a non-profit organization and hands-on collaborative of industry partners committed to actively achieving market transformation outcomes. SBC works with government, agencies, utilities and market stakeholders to shape and implement energy and environmental policy. SBC hosts the annual Green Building Festival now in its 14th year.

The organization sponsors graduate student bursaries to help students achieve their educational goals, and in 2019 launched an annual student poster competition.
The Design for Sustainability Workshop course in the Faculty of Environmental Studies at York University was established in 2009 through a Memorandum of Understanding between the World Green Building Council and York University. The objective of this unique, experiential workshop course is to prepare the next generation of graduates to become ambassadors and champions for sustainable building best practices. This course brings together upper year undergraduates and graduate students from Environmental Studies and other faculties. The Toronto Region is a hub for green building expertise and for design and this course connects campus learning and research with these professional communities. Students tour landmark sustainability projects with expert leaders, hear from leading practitioners in the field, and practice the use of design tools such as visualization, mapping, storytelling and design auditing. In the culmination of the course, students are engaged in research and planning for a one day, cross-disciplinary design charrette organized with a community partner. The charrette gives students an opportunity to actively address a real-world challenge, and to collaborate with senior designers, planners and green building experts in exploring potential solutions.
Above: View from the Bergeron Centre, York University green roof, on a tour with Andrew Brown.

Above: Professor Jose Echeverry, York University, talks with the class about solar learning labs.

Below: X marks the spot for sustainable design: Guided tour of the Queen-Richmond Centre West with John Gillanders, Principal, Sweeney&Co. Architects
Above: Walking tour of the rooftop garden at 401 Richmond.

Right: Class trip to Wychwood Barns with Course Director Arlene Gould.

Below: Architect Roberto Chiotti describes the transformative green design of St. Gabriel’s Passionate Parish.
Executive Summary

The design charrette is a helpful tool to engage students in experiential education. Since its launch in 2009, the Design for Sustainability Workshop course in the Faculty of Environmental Studies at York University has integrated a design charrette with experts from the community into the course activities. In the summer of 2019, Course Director, Arlene Gould collaborated with members of the Board of Sustainable Buildings Canada (SBC) to develop a design charrette on the theme of Green Building Retrofits.

The charrette organizing team engaged members of the SBC board and other design and green building professionals to work with the students at the event. In preparation for the working session, students were divided into five groups and each group researched aspects of the charrette theme.

The student research topics were:

- Business Case for Green Retrofits
- Culture and Heritage
- Health and Wellbeing
**Technology**

**Interiors and Adaptive Reuse**

On the day of the charrette, following introductory presentations by SBC Board members and other experts, the student groups shared short summaries of their research findings. They also had questions for the experts. Discussions continued over lunch and then the professionals worked with each of the student groups to answer their questions and provide further insights on each of the research topics. The charrette activities and insights emerging from the group discussions are documented in this report.

**Emerging Insights:**

1. There is a compelling business case for green building retrofits. But the sustainability sector needs to do a far better job of communicating the long-term economic and social benefits, as well as the positive environmental impacts.

2. The preservation of heritage buildings should involve more than merely saving the facades. There are good opportunities for storytelling in these buildings. The projects can communicate the culture stories of the past and the green technology stories of how the structures have been restored and adapted with sustainability in mind.
3. Retrofitting schools and long-term care facilities can provide opportunities to enhance health and wellbeing, creativity and social engagement.

4. There are many different technologies that can be applied to green building retrofits. Decisions on what technologies to use should consider the building typology, geography and climate conditions, incentives and other factors.

5. Extreme examples of repurposing aging buildings can build awareness and attract stakeholders to the more practical opportunities for adaptive reuse.
On June 27th 2019, Students in the Design for Sustainability Workshop course in the Faculty of Environmental Studies at York University participated in a one-day design charrette in collaboration with Sustainable Buildings Canada (SBC). The charrette focused on Green Building Retrofits. We chose this theme because upgrading Canada’s existing building stock is an environmental imperative; a challenge that we must prioritize in the context of sustainability planning for the decade ahead.

In preparation for the design charrette, students in the class were divided into five groups. Each group explored a different aspect of the retrofit challenge. The group research topics were:

- Business case and incentives
- Heritage and culture
- Health and wellbeing
- Technology
- Interiors and adaptive reuse
The students collected information, sourced case studies, and developed short presentations to share their findings with the design and green building professionals at the charrette. Additionally, the students developed a short list of questions for the experts.
HOW TO ORGANIZE A DESIGN CHARRETTE

STEPS IN THE PROCESS

1. DEFINE THE CHALLENGE. What is the purpose of the charrette?

2. SET THE DATE. Leave time for planning. Avoid major scheduling conflicts.

3. CONDUCT RESEARCH. What information do we need to share in advance and on the day?

4. FIND A VENUE. Choose an accessible, adaptable space with room for breakout groups.

5. ENGAGE PARTICIPANTS. Who should be at the table to reflect the Integrated Design Process? Professional experts, community experts, guest presenters.

6. ASSIGN ROLES. Appoint a facilitator. Arrange for guest presenters, note takers, photographers, volunteers for set up and clean up.

7. MAKE SITE VISITS. Introduce the charrette team to relevant projects in advance or during the charrette.

8. PREPARE THE AGENDA. Outline start and end times for all charrette activities. Circulate the Agenda to participants in advance.

9. ARRANGE CATERING. Select simple, healthy foods for breakfast, lunch and snacks. Check dietary restrictions.

10. DECIDE WHAT TO BRING. Source relevant site maps, art materials. Bring name badges, post it notes, note books, brown paper, flip charts.

11. HOLD THE CHARRETTE. Arrange the room for maximum collaboration and interaction. Address the challenge and model possible solutions. Agree emerging recommendations and next steps at the end of the day.

12. DOCUMENT RESULTS. Capture the activities and discussion in notes and images. Prepare a report and/or exhibition to share the insights and recommendations.
Charrette Objectives

1. To step up the conversation and increase momentum for green building retrofits.

2. To engage students in the design charrette process.
Charrette Invitation

You’re invited:
Buildings as an Agent of Change: the Case for Green Retrofits

A Design Charrette with Students from the Faculty of Environmental Studies at York University and Sustainable Buildings Canada

Thursday, June 27th, 2019
10AM to 3PM
University Club of Toronto
380 University Avenue
Toronto, M5G 1R6

rsvp: asgould@yorku.ca
Charrette Agenda

**Morning**
10:00 • Welcome and introductions
10:15 • Guest presentations
11:00 • Student presentations
11:45 • Feedback for the students, general discussion

Lunch – Discussion continues

**Afternoon**
12:45 • Introduction to breakout groups
1:00 • Breakout group work
2:30 • Plenary
3:00 • Thank you’s and close
WHY RETROFIT?

- Conserve energy
- Divert waste
- Preserve heritage and culture
- Increase wellbeing
- Improve Placemaking

“The accumulated building stock is the elephant in the room: Ignoring it, we risk being trampled by it. We cannot build our way to sustainability; we must conserve our way to it.”


BUILDING RESILIENCE: PRACTICAL GUIDELINES FOR THE SUSTAINABLE REHABILITATION OF BUILDINGS IN CANADA
SBC engaged a number of its board members to work with the students. The charrette planning team invited four of the professionals to introduce the charrette with short presentations setting the stage for the class presentations and further discussion on the challenges later in the day.

**Michael Singleton**, Executive Director, SBC presented an overview of “Energiesprong”, a breakthrough retrofit technology for buildings that originated in the Netherlands. SBC has undertaken to develop a net zero energy program platform for the eventual implementation of the “Energiesprong” program in Canada.

**John Robinson**, Professor and Presidential Advisor on the Environment, Climate Change and Sustainability at the University of Toronto, discussed the Sustainable Built Environment Performance Assessment (SBEPA) research network that he leads at U of T. SBEPA uses the campus as a living lab and brings together facilities staff and faculty members from four Faculties to explore performance gaps in the built environment impacted by building, site, human and environmental parameters.
**John Lindsay**, Senior Manager, Development at Allied Properties REIT, discussed Allied’s approach to revitalizing aging building stock in Canada’s major cities. Allied renovates properties to meet the needs of occupants who value flexible floor space, natural light and optimal air quality. At the charrette he demonstrated this approach with a case study of the former Lang Tanning Company in Kitchener, Ontario. He discussed the stages and challenges in the green retrofit process that transformed the central building on the site into a state-of-the-art corporate office now occupied by Deloitte.

In her presentation, **Michelle Xuereb**, Director of Innovation at Quadrangle Architects Inc., explained the meaning of adaptive reuse and described her firm’s transformative and best practice approach to green retrofits. Quadrangle is known for its breakthrough design concepts and model sustainability practices in both new buildings and commercial building renewal. Michelle presented case studies of several landmark projects led by Quadrangle that reflect this approach.
STUDENT RESEARCH PRESENTATIONS
STUDENT RESEARCH PRESENTATIONS

The Business Case for Green Retrofits
STUDENT RESEARCH PRESENTATIONS

The Business Case for Green Retrofits

• Find the balance between commercial development and community wellbeing
The business case group focused on the existing challenges to the retrofit and reuse of old buildings. The group challenged the current development paradigm and support the triple bottom line approach in new construction or retrofit projects.

**Key Findings**

The group identified key challenges and barriers to retrofits. A major challenge is the current development paradigm which focuses on short-term investments. Other barriers include:

- Construction unknowns which are perceived to add cost
- The ‘pioneering costs’ of retrofitting
- Lack of information about successful retrofit financing and energy savings
- Lack of transparency which allow learning from retrofit successes and failures
However, there are emerging strategies for building the case for retrofits and reuse. In a recent study on deep retrofits for office buildings, the authors recommend speaking in a ‘business language’ to developers.¹ The authors’ conceptual model helps build an economic case by prioritizing the aspects of retrofits that are quantified with less difficulty — lowered maintenance costs, increased rental rates, increased asset worth, and levied development charges — before discussing the elements that are more difficult to quantify and less relevant to the business case, such as employee productivity and placemaking.

A second strategy is applying an ecosystem approach to the built environment. Jane Jacobs described economic vitality being achieved through diversity and age-mingling of buildings. Without a diverse age structure and heterogeneity of the built environment, she predicted the local economy would not be as resilient or robust over time. Jacobs said that “new ideas need old buildings” — there is a relationship between old buildings and the economy. While retrofits do not reproduce the aged spaces from her writings, reuse of the existing shell preserves the vernacular architecture and character of a neighbourhood while providing incubation spaces for economic activity.

The environmental costs of new construction are difficult to quantify and are typically left off of balance sheets when planning for new buildings or considering retrofits. A recent Preservation Green Lab study takes up this issue, and findings suggest that the environmental impacts of building construction are reduced through retrofit and adaptive reuse in almost all cases.² The study involved four different cities in the United States, six different popular building typologies, several environmental impact categories, using a life-cycle analysis of 75 years. The key findings of the study build a compelling case for
retrofits: Reuse almost always has fewer environmental impacts than new construction, reuse provides immediate carbon savings, reuse and retrofit produce the greatest emissions reductions, and materials matter. Poor material choices can reduce or negate the benefits of reuse.

Finally, a critical part of the business case is creating incentives and subsidies which lower costs and increase uptake. The upfront costs of sustainable design and technology add anywhere from 5-20% of additional cost, a price that often acts as a deterrent to retrofits. The Rocky Mountain Institute outlines four broad categories of subsidies and incentives that can be used to help pay for retrofits: Tax credits and incentives, grants, rebates, and other financial subsidies, entitlement-related benefits, and subsidized lending. Most are offered by the federal, provincial and municipal governments, but other subsidies, such as grants and rebates, are available from private companies.

“Reuse almost always has fewer environmental impacts than new construction: Reuse provides immediate carbon saving, reuse and retrofit produce the greatest emissions reductions, and materials matter.”
Case Study 1: The Portland Example

Why does reducing emissions matter for the business case? Emissions equate to carbon, and many states are putting a price on carbon. Carbon and its associated costs can be reduced through retrofit and reuse. An example from the Preservation Green Lab study illustrates this point: If Portland reused and retrofitted 1% of its office and residential buildings instead of tearing down and building new over the next decade, it could meet 15% of its county’s carbon reduction targets over ten years! Multiply this carbon savings over the entire country for a substantial environmental benefit!

Link: https://forum.savingplaces.org/viewdocument/the-greenest-building-quantifying

Case Study 2: Considering the Human

Part of the business case is acknowledging the externalities of the built environment. Retrofits can create healthy environments for people and improve human vitality. For instance, absenteeism costs the Canadian economy 16.6 billion per year, and one-third of employees’ sick leave can be attributed to symptoms caused by poor indoor air quality. Improving ventilation via a retrofit can decrease short-term absences by 35%. A recent study found that employees are willing to forego income to work for a firm with a credible sustainability strategy. A deep retrofit and the resulting positive work environment and satisfaction can supplement other efforts to attract top talent, as well as improve retention of key staff.

Link: http://www.rmi.org/retrofit_depot_deepretrofitvalue
Case Study 3: Crossing the Chasm

Another aspect of the business case is communicating a better story about retrofits. Spreading and sharing high-quality information helps increase support for retrofits from the early adopters to a majority of stakeholders. Crossing this chasm can lead to market transformation, which subsequently lowers the costs for retrofits. Wychwood Barns is an extremely successful retrofit project that was transformative in its scope: An abandoned transit repair yard became a vibrant and sustainable urban community and a living lab for retrofit education. The ongoing success of the project illustrates that having a sustainable reputation builds brand recognition, access to capital, community engagement, and company leadership and reputation.


Case Study 4: ‘Retrofication’

Beyond reduced environmental impact and improved human health, retrofit projects can impact community well-being. For example, to prevent the exodus of young people leaving for economic opportunities in the city, the local government of a small village in China rebuilt portions of the downtown business district. This strategy worked for some members of the community, but others were forced to leave their businesses and livelihood behind; displaced as rents and property taxes increased, mimicking the process of gentrification.

Link: http://fuyuan-sh.com/blog/enningroad/
1. How do we make financial and energy information transparent and readily available for analysis?

2. How do we fully implement the triple-bottom line approach to development?

3. How do we make a business case for energy retrofits if energy costs are low?

4. How do we protect vulnerable neighbourhoods from ‘retrofication?’
**Question 1**
The breakout discussion began by seeking answers to the first question regarding the barriers to access to clear financial and energy information for retrofits. Understanding how much money and energy is potentially spent or saved on a retrofit would help promote and expand support for retrofits.

Currently, there is a mandatory data collection and reporting program being developed in the City of Toronto. This gives buildings a scorecard for energy, which is consolidated and openly shared on the platform. Additionally, the Toronto 2030 Project seeks to engage people in energy use by comparing block power usage in the city and providing a useful benchmark for energy use and consumption for various areas of the city.

**Question 2**
When discussing how to implement a triple bottom line approach to development, the various rating standards are examples of industry standards which already consider the people-planet-profit approach, such as LEED and BOMA BEST. However, these ratings are typically only used as marketing tools. The group learned that not all developers are interested in a triple-bottom line approach. However, sustainability helps generate profit, which is good for the business case. According to the experts, green buildings are worth more, the users pay more, and a talented workforce is retained.
Question 3

Forecasting becomes a useful tool to promote retrofits when energy costs are low and dramatic energy savings are not currently achievable. One expert described this situation as containing three scenarios: One where we continue with the status quo, one where natural gas is not cheap, and one where carbon is priced. In each future scenario, energy prices will increase and interventions for energy savings will become popularized and mainstream. Until this time, convincing people to retrofit is a question of personal environmental ethics or financial gain for developers who have mastered the retrofit construction process.

Question 4

The answers to the retrofication question were varied. Design solutions and planning strategies which include retrofits were viewed as one way to preserve existing communities and resist the higher rents often associated with urban renewal strategies. Inclusionary zoning for affordability is one tool to halt displacement in the communities near retrofits. For example, Wychwood Barns offers live-work spaces for artists-in-residence to accommodate the art community in the neighbourhood.
**Recommendations**

**Better Communications**

It was agreed upon that increasing support for retrofits involved improving communications on the business case. However, messaging involves several different scenarios. Messages should be tailored to the audience. For the general public, information should be communicated at a simplified level, without the use of highly technical language—particularly where sustainable technology is concerned. For single family homeowners considering retrofits, an understanding of where energy savings are located should be easily understandable and accessible.

**Transparency**

Information about retrofit success and failures should be shared throughout the industry to facilitate a market shift toward adaptive reuse. Mandatory reporting and benchmarks are necessary to gauge energy and cost savings in retrofit construction. The government must take steps to promote such tools and retrofits at a broad scale. One barrier to transparency is that many private developers view their recipe for financial retrofit success as a proprietary secret—to keep profits within their own businesses.
Retrofication

With the help of the experts, the group identified three actors who should be involved in preventing the retrofication of neighbourhoods:

1. The government should intervene with policy that provides affordable options for existing tenants and community members and provides regulation for the developers.

2. Communities should advocate and lobby the government and developers to ensure they are not displaced, which includes public participation opportunities.

3. Developers should work with government and communities to create policy that promotes retrofits while providing communities the access to incentives and subsidies that prevent displacement of existing residents and businesses.
Heritage and Culture
Transferring Knowledge

Descriptive plaques

Images of past uses

Exhibiting materials and symbolic items from the past

Audio/Visual tours
This group explored a number of key challenges in preserving and revitalizing heritage buildings.

- Budget constraints
- Policies and regulations
- Physical condition of aging buildings
- Engaging stakeholders in the process
- How to integrate green technologies while preserving heritage aspects

Key Findings

Students considered various degrees of heritage preservation and wondered whether merely protecting the façade of a building could truly be considered as heritage preservation. They identified a creative compromise approach seen in Venice, Italy where corporations supported the cost of preservation and restoration of iconic heritage churches and other structures and in return were given permission to advertise on the buildings. Finally, they explored the opportunity for storytelling and education within preserved heritage buildings. These buildings could communicate both the cultural stories of the past and also the green building technology stories of how the structures have been restored with sustainability in mind.
QUESTIONS FOR THE EXPERTS

1. Is keeping just the façade of a heritage building truly “preservation”?

2. Is allowing advertising on heritage buildings in exchange for funding support an acceptable compromise?

3. How can we educate people about green retrofits and the heritage of buildings at the same time/in the same space?
The breakout session with the heritage and green building professionals explored many aspects of this topic including:

1. Are there buildings today that will be designated as heritage in the future?

2. How can we design in a way that will ensure and enable future heritage preservation?

3. How do we preserve the history of a building and ensure that there is no cultural disconnect?

4. What are the opportunities to explain historic and new technology aspects of buildings using virtual reality and social media?
STUDENT RESEARCH PRESENTATIONS

Interior Retrofits and Adaptive Reuse
Office Headquarters – Alicante, Spain

- An old Spanish train station transformed into gorgeous office & event space
- Translucent blue roof filters incoming light through circular aluminium lattice onto walls and floor
- Once dark and dank, it is now transformed into a multi-colored, ever-changing stage
This group explored examples of traditional retrofits and also more extreme examples of buildings and other structures reclaimed for adaptive reuse. They asked: How do we encourage creativity and disruptive design in adaptive reuse? They looked at the Stackt Market on Bathurst Street in Toronto, a collection of re-purposed shipping containers housing retailers, artists and a brewery with 15% of the space dedicated to social enterprise and non-profits.

**Case Studies**

More extreme examples included La Fabrica (the Factory) in Barcelona, Spain, a post-WW1 cement factory that has become a studio home, and a group of fuel tanks in Shanghai, China transformed into an art gallery. Their most extreme example? A highway built straight through an existing office tower: The Osaka Gate Tower Building in Osaka, Japan. These strange cases serve to engage the imagination of stakeholders and increase awareness of the vast potential for adaptive reuse projects.

The group also identified more serious examples of practical building retrofits including a former train station in Alacante, Spain now reborn as a state-of-the-art office and event space and the former Carnegie Library in Washington, D.C. re-purposed as an Apple Store in a spectacular $30m retrofit project.
QUESTIONS FOR THE EXPERTS

1. How can disruptive design help to raise awareness and engage more stakeholders to support green building retrofits?

2. What is the rationale for transforming an iconic heritage building into a commercial space?
Technology
Rain Water Harvesting
Through Retrofitting Commercial Buildings

- What is rain water harvesting?
- Printing facility located in East Scarborough
- RWH is a flexible retrofit
- Hybrid tank system
- Saves approximately $1,1800 per year
The focus of this group was green technologies for retrofits. While there are various ways to approach green retrofits, the group chose three based on their ease of application across different building typologies.

**Key Findings**

Rainwater harvesting in any building is a low-cost retrofit option that collects rainwater to prevent surface runoff and, in many cases, replaces potable water use for watering gardens and lawns. The closed loop system is easily achievable by installing a tank at the end of any rainwater leader. The tank can be buried in the ground or above-ground. Cost varies per installation size and complexity.

Trombe walls collect and store solar energy. The wall itself is a thermal mass which is oriented toward the sun and treated to be highly absorptive of the sun’s rays. Trombe walls reduce energy, consumption, lower heating bills and maintenance costs, reduce carbon emissions, are feasible in many different climates and locations, are low-tech and easy to construct. However, there are issues with trombe walls the experts explained in the breakout session with this group.
Solar water heating uses the sun to heat water for residential use, which results in using less natural gas or electricity to heat water, reduces carbon emissions, and allows homes to be self-sufficient for hot water; thereby reducing energy costs. Solar water heaters can be used for a variety of buildings, are easy to install, and are relatively easy to maintain.

**Case Study 1: Printing Facility in East Scarborough**

Using a hybrid tank rainwater collection system, the facility saves approximately $1,180 per year!\(^5\)

**Case Study 2: Toronto Community Housing Corporation (TCHC)**

In 2010, the Toronto Community Housing Corporation (TCHC) installed trombe walls on two existing apartment buildings as part of the Renewable Energy Initiative retrofit program. The walls reduced carbon dioxide emissions by 85 tonnes annually while also reducing operation and heating and cooling costs.\(^6\)

**Case Study 3: North York Apartment Complex**

An apartment building located in North York installed solar water heating systems using funds available through the federal government’s EcoEnergy Program incentives and have experienced a 21 percent decrease in overall natural gas usage, for a total of 160 tonnes or greenhouse gas diversions.\(^7\)
QUESTIONS FOR THE EXPERTS

1. Why are social housing projects often selected for retrofits?

2. Are federal incentives enough to encourage a switch to renewable energy retrofits?

3. Should the renewable energy industry focus on making products more affordable?
Question 1

Social housing is often selected for large scale retrofit projects because one corporation or the government owns the entire complex, which makes it easier than retrofitting a group of privately-owned homes. Furthermore, social housing is often of a dense and uniform building typology, such as apartment buildings or townhouses, which makes the construction process easier and more cost-effective. In addition, larger-scale projects can access economies of scale, which bring the prices down per unit of, for example, heating and cooling units.

Question 2

Federal incentives cannot fully support a switch to renewable energy sources. The political will must be stronger than offering rebates and instead must take into account future generations and sustainable policy and regulations. Also, governments often terminate subsidy programs if the cost is perceived to outweigh the benefits. For example, solar energy users in California are sustaining their energy use. However, politicians are shutting down the program because it is beginning to lose money for the government.
Question 3

Technology affordability depends on the individual manufacturer and the cost of the technology. For instance, solar panels have decreased in price due to time and saturation of the market. When solar technology was first introduced, it was a novel industry and the technology cost money to produce. Research and development have drastically lowered the costs for solar in today’s market, making access easier to average consumers.
Recommendations

Low-Tech Technology
Wherever possible, use the technology that is free or the least costly, energy-wise. For instance, use natural ventilation in lieu of air conditioning, shading and blinds to reduce solar heat gain. Trombe walls and rain harvesting systems can take up valuable interior square footage and are expensive, respectively. More sophisticated technologies, such as occupancy sensors and smart home monitoring, are other methods to control the environment, but add complexity to the system and can be costly to repair. Other low-tech solutions are replacing old windows or recladding the exterior of the building.

Future Proofing:
Retrofitting can result in building energy savings, which becomes particularly important should energy costs rise. For example, replacing gas-fired furnaces with electric or air source heat pumps helps homeowners transition to a different energy source for potential future savings.
Not a One-Size-Fits-All Solution

Technology that is appropriate in one situation is not necessarily the best choice elsewhere. Geography, building type, climate, and building size and age are all factors essential to understand and consider before undertaking any retrofit.

“Technology is not a one-size-fits-all solution: Geography, building type, size, and age, and climate are all factors essential to understand and consider prior to any retrofit.”
VIRTUAL NATURE: ENGAGE THE RESIDENT THROUGH NON-STATIC IMAGERY

APPLY OR PROJECT ONTO HALLWAY WALLS:
• PROJECTION MAPPING
• MOTION GRAPHICS
• VIDEO

STUDENT RESEARCH PRESENTATIONS
Health and Wellbeing
This group focused on retrofitting schools and long-term care facilities. Particularly, taking an approach similar to 8 80 cities, an organization which believes that if cities are suitable for both eight and 80 year old people, the city is good for everyone. The group wanted to better understand how the young and elderly were considered when retrofitting, and whether funding and support was limited for such projects.

**Key Findings**

A key finding is there is a lack of funding in this sector for retrofits. Many people reside in aging long-term care facilities and there are student populations in deteriorating institutional buildings, and both sectors are faced with shrinking government funds. These facilities may not want to pay the cost to retrofit for wellbeing and use any extra money to provide essential services; therefore, funding is a barrier to retrofits in this sector.

But there are low cost options: art fosters wellness and brings a building to life. This small-scale retrofit is easily and inexpensively achievable and has numerous positive benefits: Art is a positive mood booster, creates pleasure for the viewer, helps people...
connect, creates community, inspires memories, and stimulates endorphins.

Virtual nature is another low-cost, low maintenance retrofit intervention and a feasible solution for retrofitting interior space in existing long-term care facilities. Many long-term care facilities have limited garden space, inoperable windows, limited natural light, and little or no connection to nature in and around the facilities. Virtual nature consists of applying nature art onto walls and other blank surfaces to emulate the natural environment. Projection mapping, motion graphics, and video screens enhance the static paintings to provide an interactive experience.

The group identified several case studies that explored the use of art and design to engage youth and the elderly in retrofit projects.

**Case Study 1: Retrofits for Learning at the St. Philip’s Academy, Newark, NJ**

This case study investigates retrofitting to promote and integrate wellbeing and sustainability education into the curriculum. The retrofit preserved the heritage look of the existing building while adding larger windows, an upgraded heating and cooling system, solar panels, vegetated roof, low VOC finishes, and a composting program. Wellbeing is promoted by improved air quality, ample natural light, and providing delicious organic food for the students from the community garden! Healthy living and sustainability are integrated into a space for learning through a retrofit.

Link: https://www.edutopia.org/green-school-retrofit
Case Study 2: Art in the Baycrest & Bridgepoint Hospitals

Two Toronto hospitals incorporate art as a way to humanize the hospital setting for patients, visitors, staff, and the community. Studies show that viewing art improves the overall wellbeing of patients diagnosed with numerous illnesses. Viewing and interacting with art increases blood flow within the brain, thereby reducing anxiety.


“Studies show that viewing art improves the overall wellbeing of patients diagnosed with numerous illnesses”

Case Study 3: Malton Village Redstone Residences

Many positive changes were implemented in this long-term care facility via the Butterfly Program. The main issue with the space was the time residents spent staring down long, dark beige hallways. The retrofit revived and refreshed the space with bright paint colours, vibrant murals, and natural scenes depicted full-size on the corridor walls.

1. How can we scale up and integrate these ideas into schools and long-term care facilities in our region?
Question 1

In order to implement health and wellbeing retrofits in schools and long-term facilities in the Greater Toronto Area, government policy and funding is a key element for change. As discussed in the key findings, many of these types of facilities face funding cuts and monies are directed toward the vital aspects of operations, maintenance, and staffing requirements.
Recommendations

**Government and Community Initiatives**

Alternatives to the current models of long-term care facilities could improve the funding gaps. Policy and funding for aging-in-place retrofits are options to upgrading entire facilities, which can be a costly exercise. Applying a co-operative housing model to long-term care facilities is another option which gives more power to residents to decide what types of spending activities should be prioritized. Lobbying the government to provide needed funding and creating regulations and policies which recognize the effects retrofits have on quality of life and learning are fundamental to change.

**Use of Space:**

Recognizing that retrofits improve health and wellbeing is a crucial task and identifying the most valuable of these retrofits is vital, particularly when funds are short. The group identified the following as the first tier of any health and wellbeing retrofit: Air quality, hygiene, virtual nature safety, acoustics, and natural lighting can achieve transformation outcomes in facilities for older residents. The second tier is the transformative power of art and art installations as interior retrofits for health and wellbeing, which are often an easily facilitated and low-cash upgrade.
1. There is a compelling business case for green building retrofits. But the sustainability sector needs to do a far better job of communicating the long-term economic and social benefits, as well as the positive environmental impacts.

2. The preservation of heritage buildings should involve more than merely saving the facades. There are good opportunities for storytelling in these buildings. The projects can communicate the culture stories of the past and the green technology stories of how the structures have been restored and adapted with sustainability in mind.

3. Retrofitting schools and long-term care facilities can provide opportunities to enhance health and wellbeing, creativity and social engagement.
4. There are many different technologies that can be applied to green building retrofits. Decisions on what technologies to use should consider the building typology, geography and climate conditions, incentives and other factors.

5. Extreme examples of repurposing aging buildings can build awareness and attract stakeholders to the more practical opportunities for adaptive reuse.
Thank you to all participants!
ENDNOTES


