Future Proofing Report

LA CITÉ RÉSILIENTE: A DECADE IN TRANSITION

July 02, 2020

La Cité FRANCOPHONE

ASK*

REVOLVE ENGINEERING

LARSEN ENGINEERING INC

JUST POWERS

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INTRODUCTION

La Cité Résiliente: A Decade in Transition is a grass-roots community energy transition project based in Edmonton's Bonnie Doon neighbourhood, organized by those who live and work in the area to think about what they want from and for the future.

La Cité Résiliente began by assessing how the world-renowned La Cité Francophone building (home to 38 community organizations, a popular neighbourhood cafe, and a beloved theatre space) could model climate and energy resilience in line with global climate targets. However, meeting those targets requires cooperation and collaboration. La Cité Résiliente invited neighbours, local business owners, landlords, community organizations, and area users to join the conversation and guide the project forward.

La Cité Résiliente invites community members to take action by creating and implementing plans to achieve the futures they imagine while radically reducing their climate impacts over the next 10 years and beyond. In order to align with the commitments we've made as a country -- and to our fellow global citizens -- we must think forward to achieving net-zero energy consumption by 2050.

Between November 2019 and March 2020, hundreds of people who work, live, or recreate in Bonnie Doon/Quartier Francophone participated in one or more of the 10 community workshops and outreach initiatives hosted before the COVID-19 pandemic. As we write this report to the community in June 2020, the La Cité Résiliente project is still ongoing, though it looks a little different than we had imagined.

We are taking this moment to report back about what we have learned so far and to reset as we collectively envision what community energy transition looks like with mandatory social distancing measures through the coming months/years.

BACKGROUND

On December 12th, 2015 the United Nations Framework Convention on Climate Change (UNFCCC) introduced the Paris Agreement, which was signed by almost 200 nations (including Canada!) who agreed to work together to keep global warming to 1.5°C above industrial levels. Just three years later, when nations were failing to act as quickly as the climate crisis demands, the Intergovernmental Panel on Climate Change (IPCC) published its 2018 report warning that the global population only had 12 years, until 2030, to make radical changes before tipping past the 1.5°C mark and beyond. These changes require not only the international collaboration of governments around the world, but the action of every citizen.

"Acting on climate means halving our energy consumption by 2030 and halving it again every decade until, together as a community, we achieve net-zero by 2050."

Dr. Sheena Wilson

In Canada, Alberta and Edmonton, governments responded in a number of ways. Federally, the Paris Agreement was ratified in 2016. At the city scale, Mayor Iveson and Council not only signed the Edmonton Declaration but in 2018, they stewarded this agreement that has now been signed onto by almost 3400 North American municipalities working at the city-scale to keep global warming to 1.5 degrees celsius. A year later, in August 2019, the City of Edmonton joined the almost 1500 other jurisdictions in declaring a climate emergency. Since the vote for climate emergency was passed, the City of Edmonton has been updating its Energy Transition and Climate Resilience strategies. **Modelling shows that it is possible for us to meet our climate commitments but it will take the cooperation of all Edmontonians to achieve these goals that are still just barely within our reach.** To that end, all of these levels of government have been creating granting programs to stimulate energy transition and climate resilient measures at the grassroots and community levels. One such grant is the EcoCity Edmonton Infrastructure Acceleration Grant -- offered by the City of Edmonton in partnership with Edmonton Community Foundation, and Alberta EcoTrust -- that was awarded to the La Cité Résiliente: A Decade in Transition in 2019, and that has funded this first phase of the project. More programs are being created, as part of forthcoming economic stimulus plans that merge climate commitments with post-COVID recovery goals.

La Cité Résiliente was spearheaded by Dr. Sheena Wilson, (Faculté Saint-Jean) her Just Powers research project -- in particular, research coordinator Danika Jorgensen-Skakum and and Public Outreach Coordinator Laurence Mailhiot -- and La Cité francophone's Executive Director, Daniel Cournoyer. However, since La Cité is an important anchoring hub for not only the Bonnie Doon/Quartier Francophone community but the francophone community of Western Canada, the original leadership team wanted to ensure that any conversation about energy transition and climate resilience aligned with the vision of users and stakeholders, as well as the best-available professional expertise.

Net-zero/positive energy and carbon neutral specialist architect Shafraaz Kaba and his ASK for a Better World team were contracted for technical leadership, along with Mechanical Engineer Jacob Komar (Revolve Engineering) and Trina Larsen (Larsen Engineering Inc). All of these team members played an important role in ensuring that La Cité Résiliente responds to the Paris Agreement and the IPCC "2030" report, building citizen capacity to make local changes with big international impact.

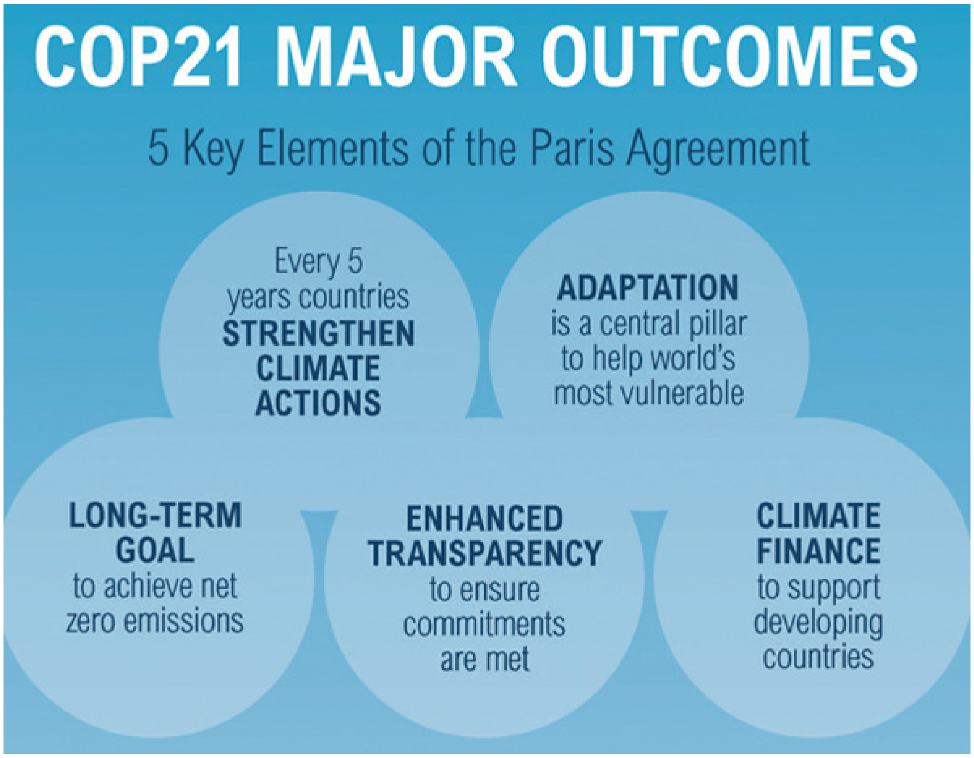
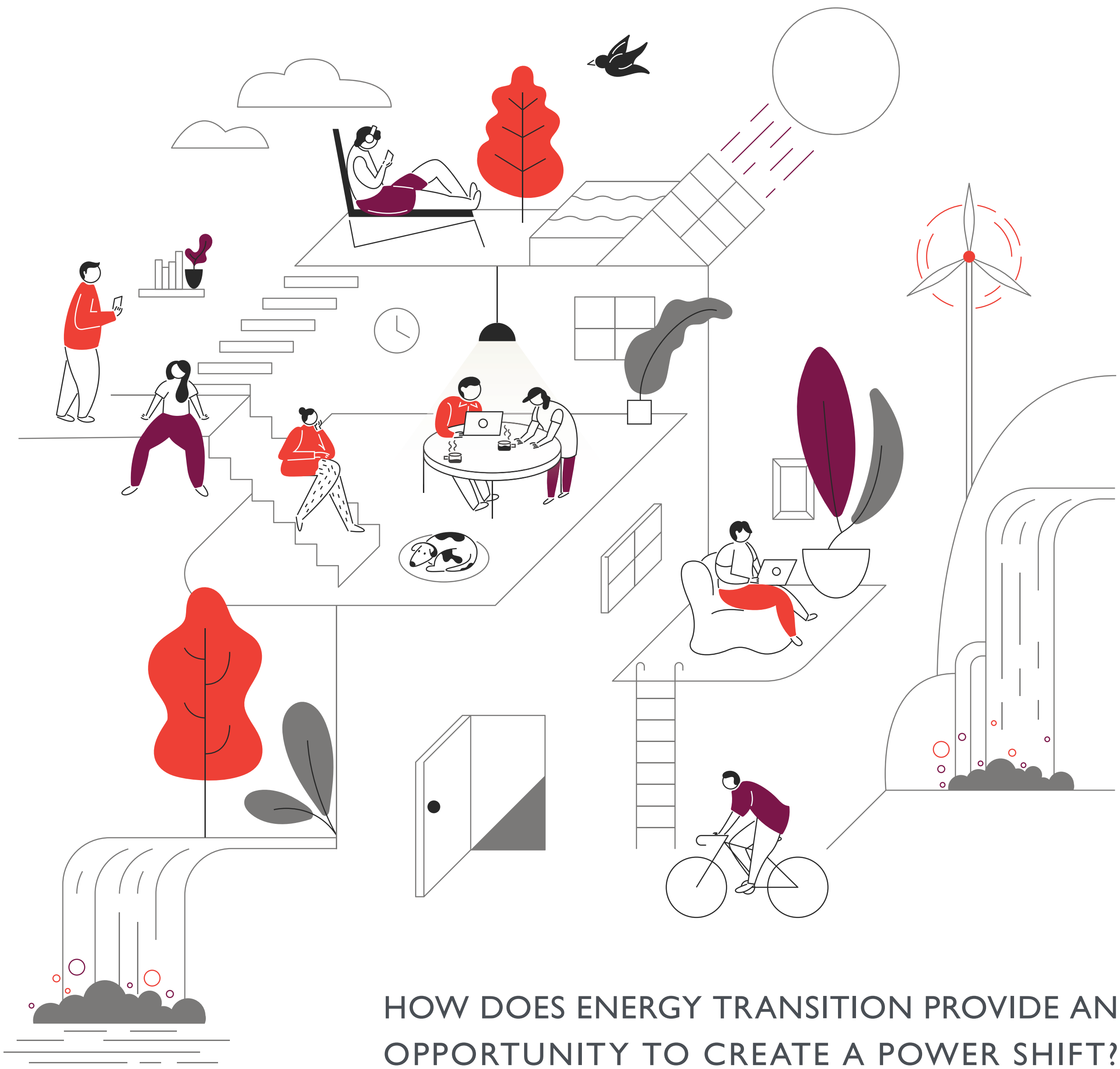


Photo source: World Resource Institute



HOW DOES ENERGY TRANSITION PROVIDE AN OPPORTUNITY TO CREATE A POWER SHIFT?

Illustration credit: Mariah Barnaby-Norris (Kobot)

FUTURE PROOFING

Demanding Action on Climate Change

What is clear from the workshops, meetings and outreach initiatives to date is that **people in the Bonnie Doon/Quartier Francophone area want to take action on climate change, but aren't always sure how to move forward on their own**. In coming together, however, participants realized that it's easier to make changes as a whole community, learning from each other along the way. Neighbours unearthed many types of knowledge and professional expertise among themselves, and were excited to discuss how to complete energy retrofits in their homes or businesses, what choices to make when building new infills, and how we might network around shared energy systems.

These are all examples of "future-proofing," or merging savvy infrastructure upgrades with community energy education and climate adaptation to prepare for an uncertain future. But it isn't so much about what technology we adopt to meet our climate targets; what is really important are the relationships we build by getting involved, and the types of relationships between people, place, and environment that our future community will support and nurture based on the collaborative decisions we make now. **People want many of the same things from and for their future community, but together we must figure out how to get there.** In conversation, some participants with little to no experience in energy retrofits or green community practices offered to share other skills, like translation or composting, and this type of skill-sharing can also be a form of future-proofing, bringing us together around climate and energy resilience and building the necessary social infrastructure to make us truly resilient. After all, sustainable initiatives are not driven by one or two energetic and passionate people; they require a shared sense of mutual investment supported through shared and multi-level governance structures with different community leaders stepping up and stepping aside as the need arises.

Some of the results from these community conversations are captured below in an overview of the recurring topics that came up throughout the initial phase of the La Cité Résiliente project when participants were asked about their vision for the future of the neighbourhood. **For more detailed information on the points shared by community members at each event or meeting, please see Appendix III: Community Engagement Strategy.**

By 2030, La Cité and Bonnie Doon are:

Safe, Accessible + Just

- Communal spaces welcome people across generations, socio-economic, linguistic, and cultural groups to gather (without spending money)
    - Accessible regenerative design means everyone can enjoy the area
    - Playgrounds and recreational infrastructures are safe and welcoming for all
- Community flourishing means schools are full to capacity with room for learning and close ties among the community
- Community decision-making is intergenerational, including everyone from youth to older adults
- Community affordability across linguistic, ethno-cultural groups, and income levels is ensured through diverse building design, greater density, and stable energy costs (resulting from early investment in renewable infrastructure)
- Community decolonization and Indigenization--as a result of concerted efforts to respond to the Truth and Reconciliation Commission's Calls to Action, as well as collaboration with urban Indigenous organizations--mean that people working and living in Bonnie Doon, whether Indigenous or non-Indigenous, understand themselves as treaty people and live in generous regenerative relationship to one another, the land, and other species within these ecologies.

Green and Regenerative by Design

- Community gardens are spaces that produce local food, as well as relationships/relationality
- More greenery on boulevards and in open spaces as a way to capture carbon, purify the air, mitigate noise pollution, and beautify the community
- Community water-capture and composting programs to help reduce waste and enrich locally supported food and shared soil

Built for the Future

- Community anchors, like La Cité, act as hubs for active transportation with easily accessible and free public transportation, bike lock-up options, access to car-share and more
- Begin a conversation about changing building codes, policies, and community development plans to ensure that all homes have either south-facing roofs with solar panels, or reinforced roofs that can host rooftop gardens
- Streets are no longer filled with parked vehicles, and the streets have been reclaimed for community connections – bike lanes, low-traffic areas where children can play street games, or other ecological uses
- Value systems guiding the project prioritize healthy communities and individuals, not just "business-as-usual" economics
- Bonnie Doon/Quartier Francophone becomes "the place to be," or an exciting destination community for users, residents, and business-owners
- Bonnie Doon/Quartier Francophone becomes leader in revising (and helping other communities revise) bylaws, building codes, policies and community guidelines so that new builds and infrastructure projects are energy efficient and climate resilient.
- Community and monetary incentives exist for energy efficient upgrades/ retrofits
- Community-driven energy (district energy, micro-grids, co-generation) fully established
- Radical reduction in personal vehicle use/ownership and associated savings have been reinvested into local co-operative programs and other community benefit initiatives
- New just transition plans (between 2025-2030) are decided upon, in order to continue to reduce energy usage by 50% each decade, every decade until net-zero is achieved (according to national-international climate commitments) by 2050

Proposed Pathways

So how do we move forward? Post-COVID 19 pandemic, several levels of government will be ramping up stimulus funding for shovel-ready projects reinforcing Energy Efficiency Alberta's mandate to lower greenhouse gas emissions (GHGs). In this still-developing new energy economy, we must consider implementing some of the energy conservation measures that will help La Cité and the Bonnie Doon/Quartier Francophone neighbourhood become more financially stable, but also more energy and climate resilient. Importantly, many of these measures also speak to the shared neighbourhood visions outlined in the section above.

Some opportunities might include:

- Participating in the pilot project for the Clean Energy Improvement Program (CEIP):

https://www.edmonton.ca/city_government/environmental_stewardship/public-engagement-on-ceip-pace-program.aspx

- Participating in the Green Loan Guarantee Program with Energy Efficiency Alberta and the Alberta Treasury Branch (ATB Financial)
- Reapplying for the EcoCity Edmonton Infrastructure Acceleration Grant
- Emissions Reduction Alberta or the Municipal Climate Change Action Centre (MCCAC)
- Now that the ASHRAE Level audit is complete, La Cite is eligible for the Building Energy Retrofit Accelorator (BERA) Incentive.
- NAIT has funding throught a program called Distributed Energy Management Initiative

Post-pandemic, more engagement with decision-makers in organizations, businesses, and homes -- including the La Cité board -- will be necessary. However, there is already enough information available to support La Cité and its neighbours in making climate and energy resilient infrastructure and economic choices as needs and opportunities present.

What is clear is that communities, organizations and people who act now, will be best positioned in the energy future. Economic modelling out of Vancouver predicts that energy transition/retrofit investments now will get about 8 times the return on the dollar relative to waiting until 2030. La Cité currently has a $9M mortgage now, adding a million could mean that in 10 years the mortgage will be paid off. But, if we wait, we'll pay our $9M down and then have to take out $8M in 2030, effectively doubling our mortgage.

We know from global and local climate modelling that the question is no longer if we make significant energy and climate resilient retrofits, but when. The choice now is whether we make these changes on a proactive basis -- for example, when systems require regular maintenance or replacement -- or whether we wait until other governing bodies (like the City of Edmonton or the Province of Alberta or the Canadian government) mandate them through policy and legislation, or taxation.

Energy transition and climate change are social issues. Transition, therefore, requires community-driven pathways and the governance structures to implement those plans. In what follows in this section, then, and in the appendices, are a series of possible pathways forward -- both in terms of how we might govern the changes of the coming decade and what technologies might support our move to reduce our carbon footprint in half by 2030, halving it each decade thereafter until we achieve net-zero by 2050, in alignment with the international commitments ratified by our federal Canadian government (2016) and our municipal government through the Edmonton Declaration (2018) and its declaration of a climate emergency (2019). La Cité Résiliente: A Decade in Transition takes up these same commitments at the community level, by working together as neighbours and citizens, to decide what we want from our post-carbon futures and working to design pathways to get us there. The ideas and suggested pathways laid out in this document are taken directly from the La Cité Résiliente project's community engagement work, and are provided as recommendations only, based on the best information available at this time. They are working documents meant to enable us, as citizens and as a community, to be more prepared for the changing environmental conditions and new energy economy that is coming over the next decade, as well as to be able to take advantage of new programs, grants, subsidies, and opportunities to retrofit our lives and neighbourhood infrastructure. They reflect the summarized list of participant visions for the Bonnie Doon/Quartier Francophone future above, and further discussions detailed in Appendix III: Community Engagement Strategy.

RECOMMENDED NEXT STEPS

For La Cité: A Decade in Transition, and the Community District/Networked Energy Project

Governance Body	Possible Areas of Focus	Resources
Community Committee (Focused on district/ community energy initiatives and preparing the wider Bonnie Doon/ Quartier Francophone neighbourhood for climate and energy resilience in line with socially just, equitable, and accessible community design.)	Name/brand the community/networked district project to indicate that it is focused on a comprehensive neighborhood strategy (indicates separation from the La Cite: A Decade in Transition project).	
	Apply for grants to support ongoing project management	
	Define youth and community engagement strategies	YESS, Institut Guy Lacombe, Francophone School Board, Edmonton School Board
	Connect with urban Indigenous organizations and the Truth and Reconciliation Commission's Calls to Action as they pertain to this project	Friendship Centre of Alberta
	Establish membership for the cooperative energy project and create memorandums of understanding	
	Coordinate with utilities providers to navigate the complexities of crossing throughways for the purposes of district/shared energy	EPCOR, ATCO, Direct Energy

Governance Body	Possible Areas of Focus	Resources
Community Committee (Focused on district/ community energy initiatives and preparing the wider Bonnie Doon/ Quartier Francophone neighbourhood for climate and energy resilience in line with socially just, equitable, and accessible community design.)	Investigate opportunities for cooperative and commoning projects that help not only transition to new forms of lower carbon energy, but that help businesses and residents better understand energy efficiency (how to reduce energy wastage), and reduce energy demands by taking up a number of low-cost habits and initiatives (from working flex hours or partly from home, to buying local, to composting to water capture to installing energy use trackers	For more ideas, see https://changeforclimate.ca/action
	Building frameworks on intergenerational education initiatives, specifically focusing on re-skilling	FAFA, Club de l'amitié St-Thomas
	Explore local currency linked to energy transition and community resilience	
	Support other businesses in the neighbourhood who want to go after the EcoCity Edmonton Infrastructure Acceleration Grant	
	Host community events	Bonnie Doon Community League
	Share all research, successes, struggles, and information	
La Cité Committee (Internal to La Cité francophone, focused specifically on furthering the climate and energy resilience of La Cité as a community anchor in partnership with other neighbours and organizations)	Might investigate collaborative opportunities -- including internships and shared labour agreements -- with other organizations to help sustain projects (like living walls, compost, garden beds, Incredible Edibles program, permaculture plans, etc.) within the building and beyond	Bonnie Doon Community League, University of Alberta, Rutherford School, Permaculture Society, YESS
	Share all research, successes, struggles, and information	

Photo source: Google Maps
This is Bonnie Doon in 2020, imagine how it will look in 2050!
Better yet, get involved and help design the future of your neighbourhood.

CONCLUSION

The time to act is now. Scientists around the world have declared that we must take immediate and comprehensive action on climate change. Taking heed of their warnings, cities around the world have declared climate emergencies -- including the City of Edmonton, which declared a climate emergency in August 2019.

As phase one of this project draws to an end, we are sharing with our neighbours and stakeholders a piece of the shared future we are designing together through the decisions we make now. La Cité Résiliente: A Decade in Transition project was initially supported through an EcoCity Edmonton Infrastructure Acceleration Grant." (emphasize "we are sharing with our neighbours and stakeholders a piece of the shared future we are designing together through the decisions we make now.

Attached to this document is a set of appendices in which we share what we have learned so far. We encourage you to read and share them, as they reflect the expertise of many professionals and community members. Ideally, these will inspire other community members to initiate similar projects for their own homes and places of work, and to come together with their own neighbours to create district/network energy systems.

As such, these appendices are living documents. To learn the latest available information and to keep this project alive and sustainable, please get involved. To tackle the wicked problems of the 21st century, including energy transition and climate change, diverse knowledge sets are necessary. **Everyone has something to contribute.**

To connect with us, and for more information on how to get involved with one of our committees, please follow us at @ Cité Résiliente on Twitter or contact justpowers@ualberta.ca

APPENDIX 1

Recommended Timeline and Actionable Items

Policy and Community Action Timeline

	Recommended Action	Recommended timeline
ONGOING	Assess project's compliance* with the TRC's Calls to Action and engage urban Indigenous organizations * Reassess on an ongoing basis	N/A
	Roll out new outreach and educational programs that reach different audiences and engage people in a variety of ways	N/A
	Assist other communities and neighbourhoods in following similar initiatives, programs, and grant applications	N/A
SHORT TERM	Formation of two committees: One internal to La Cité and the other focused specifically on the wider community.	Summer 2020
	Accessibility study initiated	Summer 2020
	Original La Cité Résiliente leadership team meets with interested parties and presents final report from initial phase	Summer 2020
	Investigate additional grants and the possibility of hiring a full-time employee to coordinate educational initiatives and further grant writing	Fall 2020
	Continue conversation with key stakeholders and interested parties about district energy	Fall 2020
	Recycling and compost infrastructure implemented at larger anchor sites (like La Cité) and other locations/residences	2021

Policy and Community Action Timeline

	Recommended Action	Recommended timeline
MEDIUM TERM	Investigate potential partnership with Infill Development in Edmonton Association (IDEA) to establish parameters for low-cost housing to attract younger families and more diverse density, in addition to implementing building guidelines/policies/bylaws that address mandatory space for solar power, green roof design, and/or other energy efficient builds and retrofits	2021
	Roll out communications plan, including comprehensive visual and educational outreach strategies (perhaps participation in the Quartier's community flag program)	Early 2021
	Launch a tiered certification sign display program for community members to declare their engagement with low-carbon initiatives and to invite their neighbours to take part ("I <3 Just Energy Futures," "Ask Me About ____") -- similar to Front Yards in Bloom, or Block Parent	2021
	Multiple organizations, businesses, and residents participate in Clean Energy Incentive Program (CEIP)	2021+
	Laneways are being repurposed, informed by distributive design principles and regenerative economics (focusing on layering returns and benefits to the community beyond just monetary payback)	2021+
	Area connects to bicycle network	2021+
	Rent and utility costs stabilized for La Cité user groups	2022

Moving Forward

With La Cité Future-Proofing

After compiling results from the community workshops, a building audit, and ASHRAE Level 2 modelling, our team reviewed energy conservation measures and greenhouse gas reducing strategies for the building to work towards a lower carbon and lower energy cost future.

These are the actionable items recommended for La Cité francophone. Most need to be started immediately in terms of implementation or planning. They are ranked according to short, medium and long term timelines based on how quickly they will pay back in terms of current economic business-model understandings. However, as policies, granting programs, and other shifts occur over the next decade, these timelines may be considerably shortened or launched earlier.

For example, La Cité currently has no plans to redesign office space, which is one of the long-term strategies for laying out the building in more energy efficient ways. However, following social distancing requirements associated with the COVID-19 pandemic, it may be necessary for some organizations in the La Cité building (and beyond) to provide employees with more distance from one another. If office redesign begins now for these reasons, this energy audit and community strategic plan can ensure that regenerative design principles inform any future-proofing initiatives in the building.

Building Retrofit

Energy Conservation Measures + Carbon Reduction Opportunities

Immediate First Actions (2020-2022) to meet 2030 climate targets

Items necessary for building longevity and/or provide high Return on Investment according to current economic business-model understandings

ITEM	BUDGET	GHG Reduction Impact	TIMELINE	POTENTIAL Funding Source or Community Partner
Fix weatherstripping and seals around windows and doors	$1,000	Low	2020	Operational Budget, City of Edmonton Building Energy Retrofit Accelerator (BERA).
Install main door vestibule or revolving door	$30,000	Low	2021	Mortgage Financing, BERA Incentive
Programmable thermostats	$2,100	Low	2020	Operational Budget, BERA Incentive
Repair gaps / failed seals in curtainwall	$5,000	Low	2020	Operational Budget, BERA Incentive
Replace/Install faucet aerators	$150	Low	2020	Operational Budget, BERA Incentive
Install water cooler plug timers	$500	Low	2020	Operational Budget, BERA Incentive
Provide radiant space heaters for cold office locations	$6,400	Low	2021	Operational Budget, BERA Incentive
Demand control kitchen ventilation for Cafe Bicyclette	$20,000	High	2021	BERA Incentive, Create bundle of projects for Green Loan Guarantee Program. Some design time required.
Install bee hives	$500	N/A	Spring 2021	Operational budget.
Install Multibin receptacles for recyclables, compost, landfill materials	$2,500	N/A	2020	Operational budget.

Immediate First Actions (2020-2022) to meet 2030 climate targets

Items necessary for building longevity and/or provide high Return on Investment according to current economic business-model understandings

ITEM	BUDGET	GHG Reduction Impact	TIMELINE	POTENTIAL Funding Source or Community Partner
Create a Compost area on site (purchase ready-to-use compost bins)	$2,000	Low	Spring 2021	Operational budget. Cafe Bicyclette can help reduce waste (and operating costs) by redirecting food scraps to the compost area.
Revisit the electrical rate/ contract with the utility provider. Renegotiate power purchase agreement	$0	N/A	ASAP	Administration staff time.
Lighting Retrofit / Bulb replacement where possible without electrical upgrades	$5,000	High	ASAP	Operational Budget, BERA Incentive
Install Electric car charging station(s)s)	$5,000 per stall	High	2021	Mortgage Financing, City of Edmonton EV charger rebate https://www.edmonton.ca/city_government/environmental_stewardship/electric-vehicles.aspx

Medium-Term Actions (2022-2025) to meet 2030-2040 climate targets

When funding / financing is available, items that are recommended for building longevity and/or provide sufficient return on investment or high GHG reductions

ITEM	BUDGET	GHG Reduction Impact	TIMELINE	POTENTIAL Funding Source or Community Partner
Recommission Building Systems	$10,000	High	2021	Mortgage Financing, BERA Incentive
Complete Lighting Retrofit	$426,000	High	2022	Green Loan Guarantee Program
District/Community Energy System Feasibility (Technical) Study	$50,000	High	Spring 2021	EcoCity Grant Federation of Canadian Municipalities https://fcm.ca/en/funding
New attempt to grow Micro-greens**	$2,000	Low	2021	Cafe Bicyclette Operational budget / tenant sponsors. ***Need operational staff, dedicated resources for ongoing maintenance. Potentially a partnership opportunity with UofA Office of Sustainability/Bonnie Doon.
Permaculture / landscape naturalization	$25,000	N/A	Spring 2022	Mortgage Financing

Medium-Term Actions (2022-2025) to meet 2030-2040 climate targets

When funding / financing is available, items that are recommended for building longevity and/or provide sufficient return on investment or high GHG reductions

ITEM	BUDGET	GHG Reduction Impact	TIMELINE	POTENTIAL Funding Source or Community Partner
Convert parking stalls to raised garden beds	$500/stall	N/A	Spring 2022	Cafe Bicyclette Operational budget / tenant sponsors
Living Wall for curved hallway between cafe and atrium	$50,000	Medium	2023	Mortgage Financing / EcoCity
On-site Rainwater Capture and storage	$10,000	Low	2023	Mortgage Financing / EcoCity
Develop a bike share program	$5,000	High	Winter 2021	Bike Edmonton
Seek car share partnership with Communauto (formerly Pogo)	$1,000	High	Winter 2021	Administration staff time to negotiate with Communauto
Install solar PV modules where feasible (rooftop)	$87,500	Medium	Summer 2024	Mortgage Financing, Green Loan Guarantee Program

Longer-Term Actions (2025-2030)

Longer-Term Actions (2025-2030) to meet 2050 climate targets

ITEM	BUDGET	GHG Reduction Impact	TIMELINE	POTENTIAL Funding Source or Community Partner
Incorporate Energy Recovery Ventilation (ERV)	$170,000	Medium	2025	Mortgage Financing, Green Loan Guarantee Program
Replace Variable Air Volume (VAV) system with Low Temperature Heat Pump* To be paired with office re-stack/replan.	$750,000	Medium	2030	Green Loan Guarantee Program (this should be done simultaneously with "restack"/ replan of the office spaces.)
Restack / replan office areas for "co-working"	$750,000	N/A	2025	Scope and timeline dependent on Tenant fit-up
District/Community Energy System	$5,000,000	High	2027	Cost to be shared with community partners. Encourage the City of Edmonton to act as "local utility" for the district system (similar to the Downtown District Energy System). NAIT Distributed Energy Management Initiative
Replace all windows with higher performance glazing.	$1,000,000	High	2029	Green Loan Guarantee Program
Replace older Boilers	$50,000	High	2030	Mortgage Financing, BERA incentive
Re-plumb greywater (waste water) for reuse within	$100,000	Low	2029	Green Loan Guarantee Program.
Upgrade boilers	$50,000	Medium	2030	BERA Incentive, create bundle of projects for Green Loan Guarantee Program

Smart Start Workshop, post-it-notes brainstorm of community interests

Conclusions

La Cité Future-Proofing

By our calculations, "Immediate First Actions" are ~$51,360, "Medium Term Actions" are ~$667,000, and "Longer Term Actions" are ~$3,870,000 not including the district energy system of approximately $5M, which would be a shared cost and depend on La Cité's percentage. * Some of the items (like replacing windows which is the biggest ticket item in this category asidefrom the district energy project) will have to be done as part of building maintenance at some point before 2050, in any case. The earlier this is done, the more energy efficiency will be achieved. There may be subsidies to make even the general maintenance more affordable.

In short, at current market rates, all of the "Immediate First Actions" and "Medium Term Actions" would cost approximately $713,360 now, but with estimates that these same actions will cost 8Xs more by 2030, they will cost closer to $6M ($5,745,880) by 2030. Currently, all of these actions (excluding the district energy system) could be achieved for less that (approximately $4,588,360).

APPENDIX 2

Historic Timeline of the La Cité Résiliente Project

2015

- December 12, 2015: Paris Agreement signed by 196 countries

2016

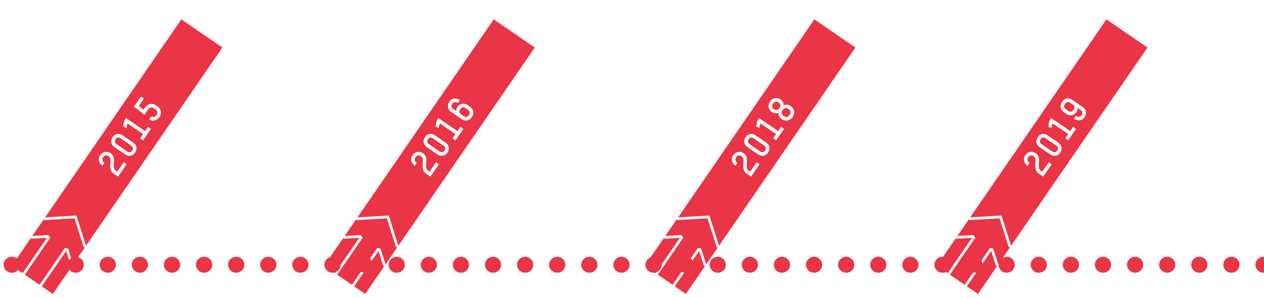
- October 2016: Canada officially ratifies Paris Agreement

2018

- November 2018: IPCC Report launched and global headlines warn of 12 remaining years (until 2030) to take drastic climate action before we tip past into a devastating level of global warming (hence, the project title La Cité Résiliente: A Decade in Transition)

2019

- EcoCity Edmonton Infrastructure Acceleration Grant awarded Summer 2019
- Fall 2019: Project planning begins
- Communications strategy launched
- November 23, 2019: Project Launch + Learn
- December 5, 2019: Energy Fair/ Foire de l'énergie



2020

- Communications Intern Laurence Mailhiot arrives from Sherbrooke University and provides an intensive communications strategy audit, revises project title in consultation with Dr. Sheena Wilson from La Cité: A Hub for Climate Resilience to La Cité Résiliente: A Decade in Transition
- January 30-February 1, 2020: Outreach and Education at Flying Canoë Volant
- February 18, 2020: SMART Start Workshop
- March 3, 2020: Workshop with FAFA
- March 3, 2020: Presentation to the La Cité Francophone Board
- March 10, 2020: Building Systems Integration Workshop
- Podcast series on La Cité Résiliente and other local community energy initiatives recorded and launched with the Just Powers Podcast
- Summer 2020: Governance structure established for two committees -- one internal to La Cité, and one committed to district-wide projects

APPENDIX 3

Community Engagement Summary

1.0 Summary of Workshops

A crucial part of establishing the future plans for La Cité Résiliente is to understand who the suportive community members are, how the community wants to be involved, and how the community can move forward working together towards a common goal. These workshops were focused on building an understanding of these things through first explaining the issues in the Launch and learn, getting the word out at the Flying Canoe Volant festival, finding out what the markers of success will be in the smart start workshop, and finally figuring out how we can work together to create and achieve long term goals in the building intergration workshop. The end product of this engagement is to bring together a group of passionate people, clarify the scope, and develop a long term plan with actionable items.

Community engagement is an essential part of the La Cité Résiliente project, which is designed to bring neighbours together around climate change resilience and adaptation.

To date, the project has engaged user groups and neighbours through a series of public workshops, outreach events, and multimedia strategies meant to bring people together, encourage conversation, clarify the scope of the project, and determine a long-range plan with actionable items.

Launch + Learn | November 23, 2019

Climate Resilience Project Launch + Learn

This initial workshop was the introduction to the exciting changes happening at La Cité and how local residents could be involved

Energy Fair/Foire de l'énergie | December 5, 2019

At this multigenerational event, students from Campus Saint-Jean Media and Communications classes presented their final multimedia projects on energy and the future of the Bonnie Doon/Francophone Quartier community.

Flying Canoë Volant | Jan 30 - Feb 1, 2020

The Flying Canoe Volant Festival is a successful, established and well attended event that was used this year as a platform to inform community members about the upcoming goals of La Cité Resilient and to introduce ideas of building science, technology and climate mitigations.

Smart Start Workshop | February 18, 2020

This session was community wide, and it's purpose is to define and confirm project goals and, once the session is complete, the project team is made aware of key challenges and opportunities for this project.

Workshop with FAFA | March 3, 2020.

In collaboration with the FAFA and the Club de l'amitié St-Thomas, this workshop was organized as one way to engage with local francophone older adults.

Presentation to the La Cité francophone Board | March 3, 2020

In order to share project findings and engage the La Cité board, Dr. Sheena Wilson, Daniel Cournoyer, and Shafraaz Kaba delivered a special presentation to members.

Building Systems Integration Workshop | March 10, 2020

The Building Integration Workshop is to recognize Energy Efficiency opportunities and Energy Conservation Measures, as well as Building Systems Opportunities. This will lead to identifying easily attainable "wins", medium term goals, and long term goals.

Podcast Series

Building on the success of the Just Powers Podcast, Dr. Sheena Wilson's Just Powers team produced a series on several community projects taking place across Edmonton, including those in Bonnie Doon/Quartier Francophone, Westmount, Blatchford, and Riverdale.

Communications Strategy

The team rolled out a comprehensive communications strategy to garner community engagement, using radio profiles, postering, and multiple other points of outreach.

NOTE:

Additional town hall meetings to take initial findings back to the community were scheduled for March 19 and 21, along with plans for future workshops that would allow for greater input from school-age children, Indigenous and urban-Indigenous leaders, workshops co-hosted with Youth Empowerment Support Services, universal accessibility assessments and more. However, these were postponed due to the COVID-19 pandemic.


Future-Proofing La Cité Francophone
ASK*

1.1 Launch + Learn

Introduction

La Cité Résiliente's Launch + Learn event provided an introduction to the project and background information on community-based energy projects. The MLA for Edmonton-Gold Bar, Marlin Schmidt, brought greetings from the province, in addition to Dr. Sheena Wilson, Just Powers Research Coordinator Danika Jorgensen-Skakum, La Cité Executive Director Daniel Cournoyer, and ASK Architectural Lead Shafraaz Kaba.

The Solar Power Investment Cooperative of Edmonton (SPICE) then provided a half-day workshop series on solar power in Alberta; an introduction to solar technology, applicable regulations and procedures, culminating in a multi-table discussion on forming a community coalition.

NOTE:

Community Benefit Agreements are contracts between investors and community groups that require any investment project (such as solar panel installation) to give back to the community, maybe directing a percentage of earnings toward community initiatives, or funding infrastructure projects like playgrounds.

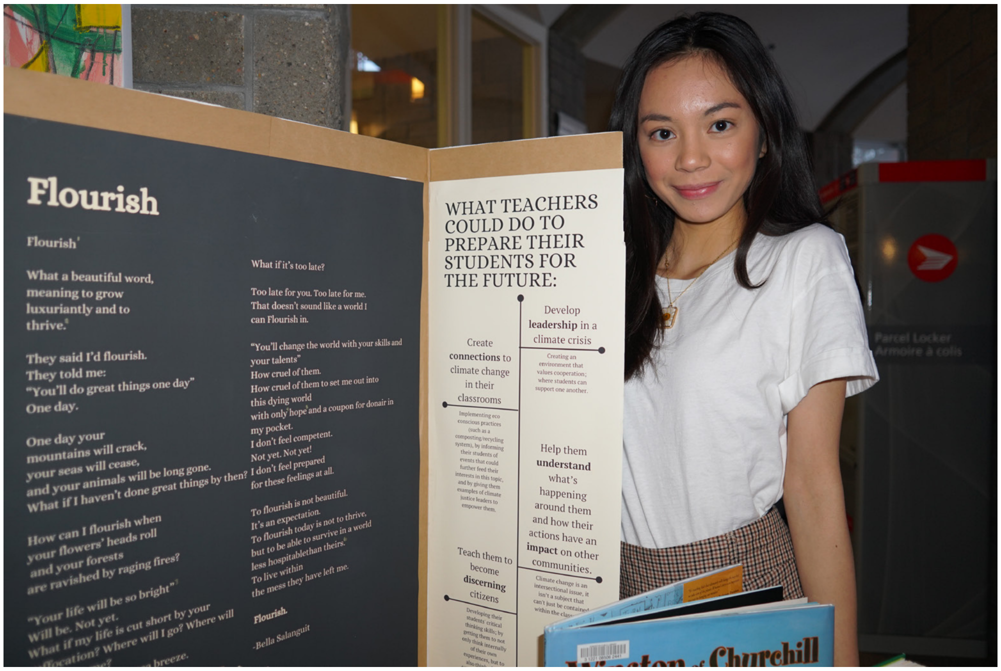
Attendees Included:

- Marlin Schmidt, MLA for Edmonton-Gold Bar
- Members of the La Cité francophone community interested in taking action on climate change
- Approximately 30 residents interested in solar power options and community solar projects
- Supporters of local impact investing

Topics Covered:

- Introduction to solar power
- Residential and community solar projects
- Applicable regulations
- Provincial government incentives
- Community Benefit Agreements

For more information on community benefit agreements and community energy projects in Alberta, see joinspice.ca



Campus St-Jean, A few student projects from the Energy Fair.
Credit: Valerie Miller, Future Energy Systems.

1.2 Energy Fair/Foire de l'énergie

Introduction

Fifty-seven students from Campus Saint-Jean Media and Communications classes held an exhibition in the atrium of La Cité just before the holiday season. Originally this event had been planned by their instructor, Dr. Sheena Wilson, as a means to showcase their final multimedia projects; however, on the heels of a semester of intensive youth-led climate marches, students began referring to this event in terms of climate action and used the exhibition as an opportunity to share their thoughts on climate change and the post-carbon future of Bonnie Doon/Quartier Francophone with members of the public, government and university officials, and individuals from La Cité's various businesses and user groups — all of whom were invited to mingle with the students and learn with them while enjoying curated music, spoken word poetry, and hot chocolate.

Attendees Included:

- Marlin Schmidt, MLA for Edmonton-Gold Bar
- Dean Pierre-Yves Mocquais, Campus Saint-Jean
- Community Service-Learning partners who had been paired with students for the semester: Fédération des aînés franco-albertains (FAFA), Radio Cité, the Solar Power Investment Cooperative of Edmonton (SPICE) and Just Powers
- Campus Saint-Jean students
- Various individuals from La Cité's resident businesses and user groups
- Members of the public

Topics Covered:

- Poster presentations on reducing home energy consumption
- Photo displays on the possible future of the Bonnie Doon/Quartier Francophone neighbourhood
- Songs written to raise awareness about the urgency of energy transition

1.3 Flying Canoë Volant

Introduction

Flying Canoë Volant is Edmonton's most popular winter festival, attended by more than 60,000 people. The La Cité Résiliente team set up an interactive engagement course at the 2020 festival, introducing visitors to the project and elements of building science, technology, and climate change resilience.

Festival attendees were invited to "find the fire monsters" (distinctive metal sculptures placed at various strategic sites, including a children's area) by visiting each of the following poster stations mapped out on an information packet. After discussing their interest in the La Cité Résiliente project and their desires for the neighbourhood with a team member, attendees received a stamp at each destination. A completed stamped packet was exchangeable for a free hot chocolate.

Attendees

- 60,000+ visitors at the 2020 Flying Canoë Volant festival

Discussion Topics

- **Exterior Building** poster focused on how building envelopes prevent moisture and mould in addition to maintaining building air pressure, quality, and temperature.
- **Interior Comfort** poster focused on heating, cooling, and lighting — elements created through design, passive systems or mechanical systems.
- The **Kids Station** poster communicated the basics of home energy and renewable energy — where energy comes from, and where waste goes.
- **Climate Resilient Show Home** poster showcased the website resource climateresilienthome.com, which provides information to homeowners on retrofitting for climate change.
- The posters on the **City of Edmonton's Change for Climate** campaign reiterated statistics on local climate change and energy costs and Edmonton's plans to adapt over the next decade.

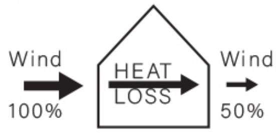
Images source:

1.3 Flying Canoë Volant
CONTENT PRESENTED AT FESTIVAL

Please feel free to reproduce these posters for educational purposes, or contact us for higher-resolution images.

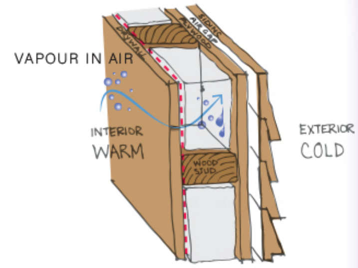
FRESH AIR

AIR TIGHT
A building envelope must be as close to air tight as possible otherwise it will loose up to 50% of its heat through cracks, bad weatherstripping and broken air barriers



CONTROLLED FRESH AIR
Toxins let off by interior environment in an air tight building means a heat recovery ventilator is necessary. People, household items and materials let off toxins

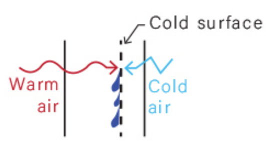
HOLE IN AIR BARRIER



Main take-away: Buildings need to be air tight to prevent heat loss, but they also need to breath through passive or mechanical systems. A hole in the air barrier is another way that mould can grow in your wall.

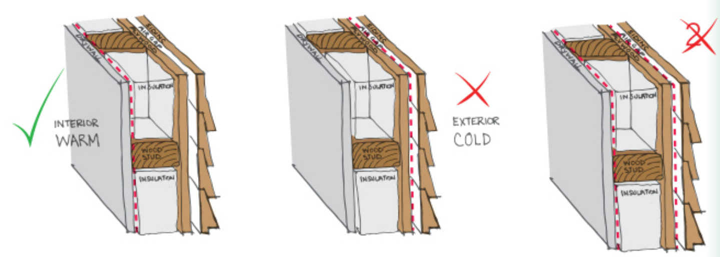
NO MOULDY WALLS

Condensation
The moisture in the air is called vapour. Warm air holds more moisture than cold air. When warm air hits a cold surface it cools down quickly and turns into liquid water



LOCATION OF VAPOUR BARIER

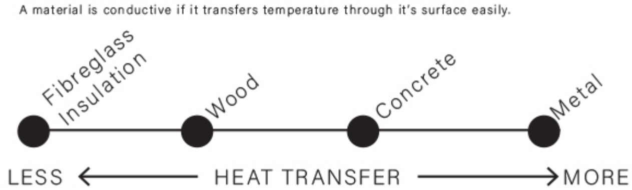
ONLY ONE VAPOUR BARRIER

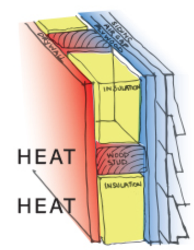


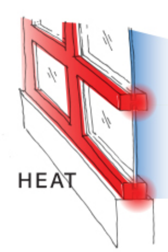
Main take-away: there can only be one vapour barrier and it goes on the warm side of the insulation. Vapour barriers prevent moisture from condensing inside the wall, creating mould.

KEEP WARMTH INSIDE

CONDUCTIVITY OF MATERIALS
A material is conductive if it transfers temperature through it's surface easily.







Main take-away: fibreglass or rock wool insulation is not very conductive, this is why it is used to stop heat loss through the outside walls. Metal and glass are highly conductive, which means a lot of heat escapes through windows.

RAIN STAYS OUT
THE SIDING ALONE ISN'T ENOUGH

NO MOULDY WALLS
WHY WE NEED A VAPOUR BARRIER

KEEP WARMTH INSIDE
INSULATION AND MATERIAL CONDUCTIVITY

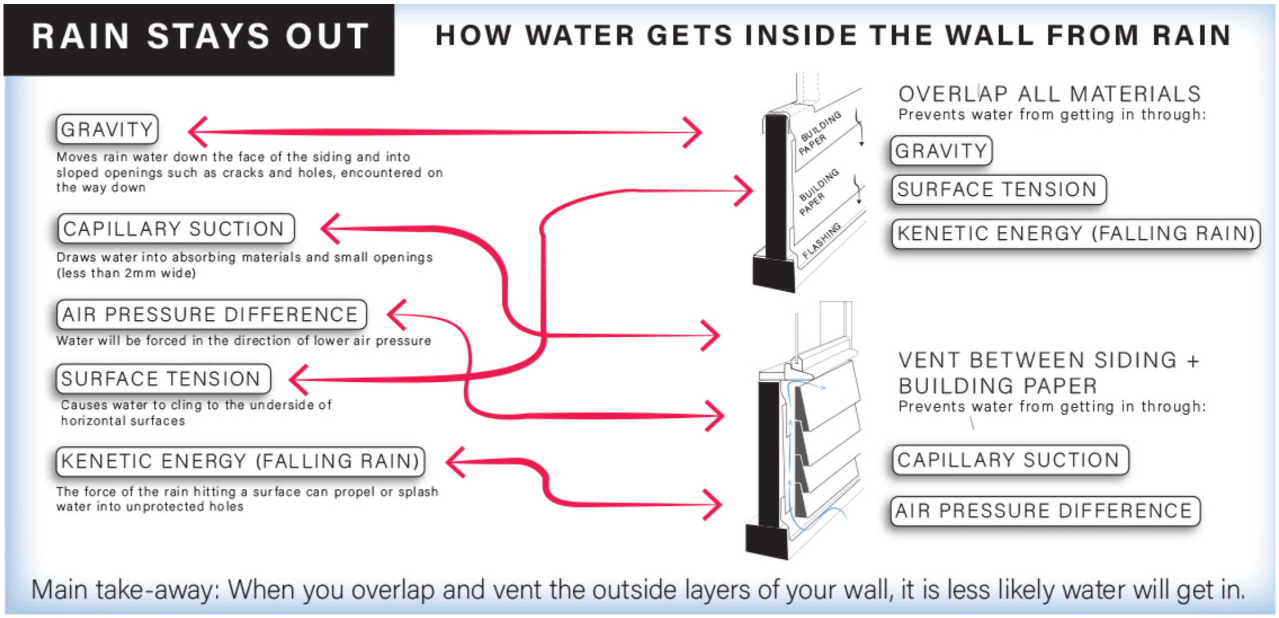
FRESH AIR
CONTROLLING THE INSIDE ENVIRONMENT

EXTERIOR BUILDING

The exterior building is the physical separator between the inside and outside of the building.

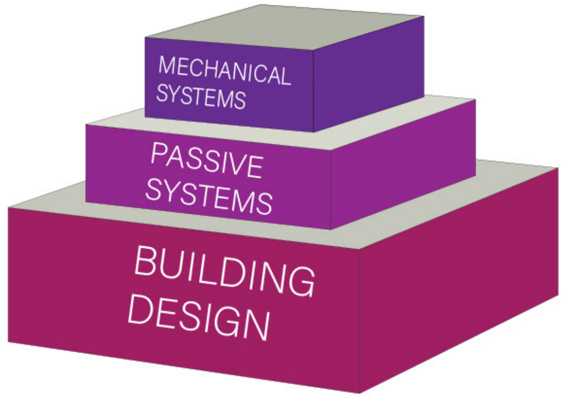
Why the Exterior Building envelope is important:

A building with a good exterior envelope requires less energy for heat and cooling, better withstands wear, and is more resilient against extreme weather conditions.



80%

of energy consumption can be reduced by building design and passive systems



From *Heating, Cooling and Lighting*

INTERIOR COMFORT

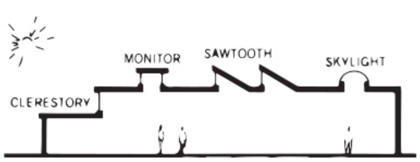
The basic interior comfort of a building is determined by how it is heated, cooled, and lit

The Key to Sustainable Interior Comfort

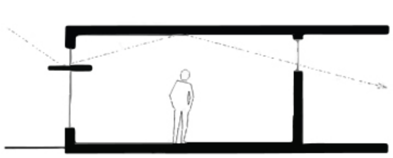
Buildings designed with environmental factors in mind, utilizing passive systems, require much smaller mechanical systems. Diagrams from Interior Comfort posters were adapted from the textbook "Heating, Cooling and Lighting" by Norbert Lechner.

LIGHTING

PASSIVE SYSTEMS

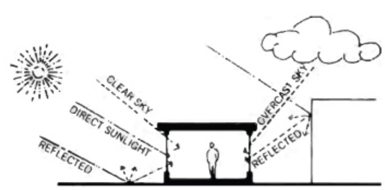


SKYLIGHTS + CLERESTORIES

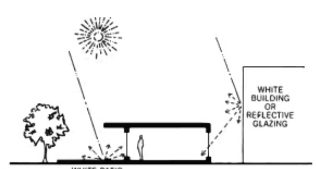


LIGHT SHELVES

BUILDING DESIGN



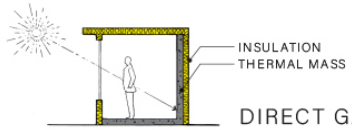
WINDOWS AND GLAZING TYPE



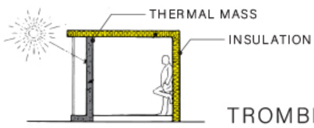
LIGHT OR REFLECTIVE FINISHES

HEATING

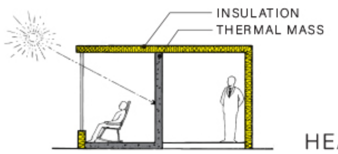
PASSIVE SYSTEMS | BUILDING DESIGN



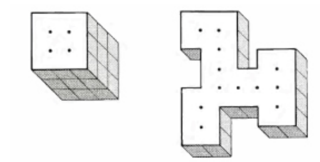
DIRECT GAIN



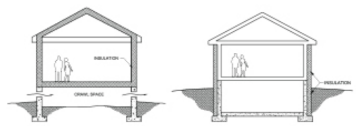
TROMBE WALL



HEAT RETENTION



60% MORE SURFACE AREA SAME SQ. FT. = **more heat loss**
Surface area to volume

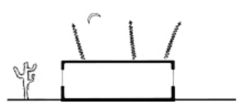


TWO WAYS TO PROPERLY **INSULATE** KEEP HEAT INSIDE

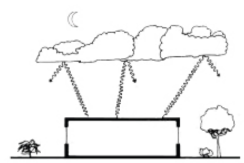
25% OF TOTAL BUILDING HEAT CAN BE LOST THROUGH AIR TIGHTNESS WITHOUT A PROPER AIR BARRIER

COOLING

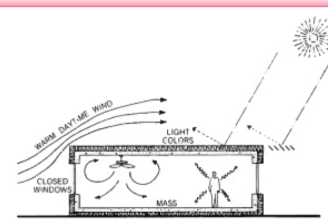
PASSIVE SYSTEMS | BUILDING DESIGN



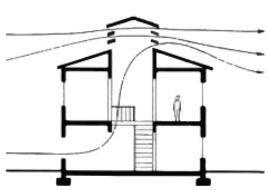
EVAPORATIVE NIGHT COOLING



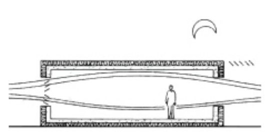
EVAPORATIVE NIGHT COOLING BLOCKED BY HUMIDITY/CLOUDS



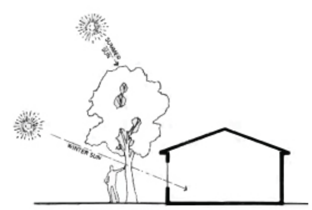
LIGHT COLOURS, INSULATION EXTERIOR SHADING



CROSS VENTILATION
(THROUGH WINDOWS THAT OPEN)



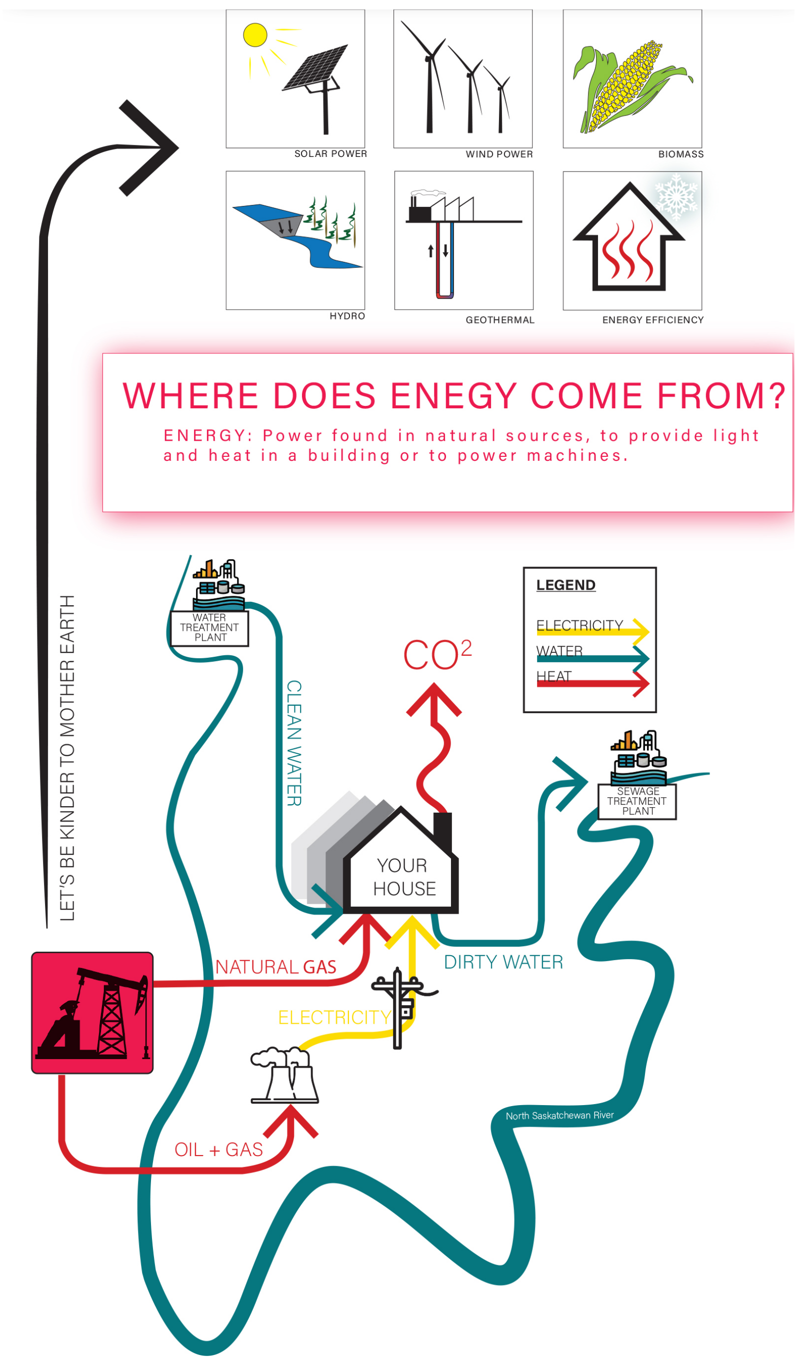
NIGHT FLUSHING



EXTERIOR SHADING

Addressing Children and Youth

The most effective way to get kids involved was for them to begin to think about where the light, heat and water comes from in their house and where it goes, and to remind them of some forms of renewable energy.



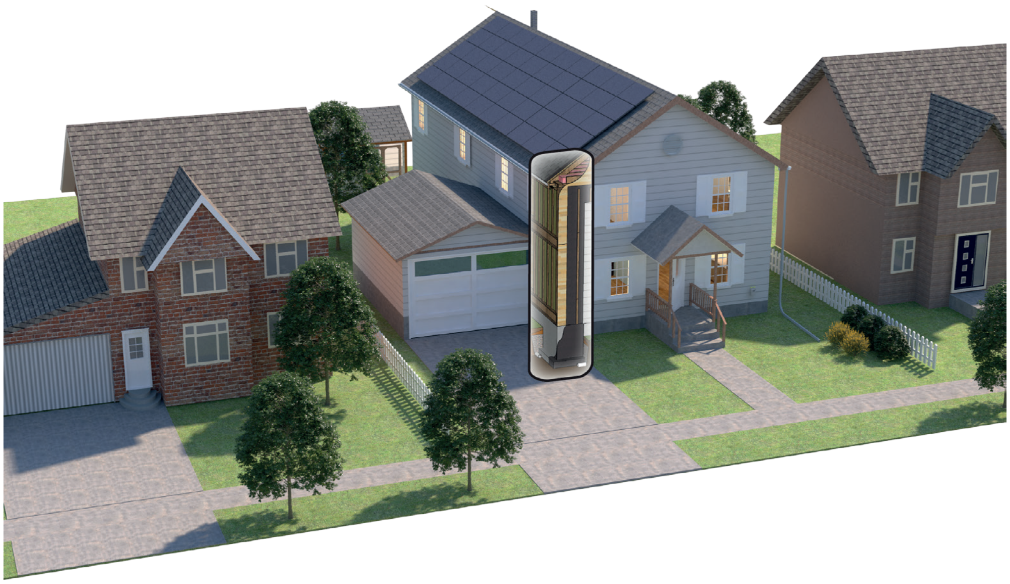
How to Make Your Home Resilient

This was the poster created for the climate resilient home website in hopes that if people are interested in upgrading or rebuilding their home they will use this resource.

Maison modèle résiliente
Climate Resilient Showhome

La maison modèle à l'épreuve du climat est une ressource Web gratuite accessible à tous gratuitement. Le site fournit de l'information aux propriétaires soucieux de rendre leur maison plus résiliente face aux épisodes de météo extrême.

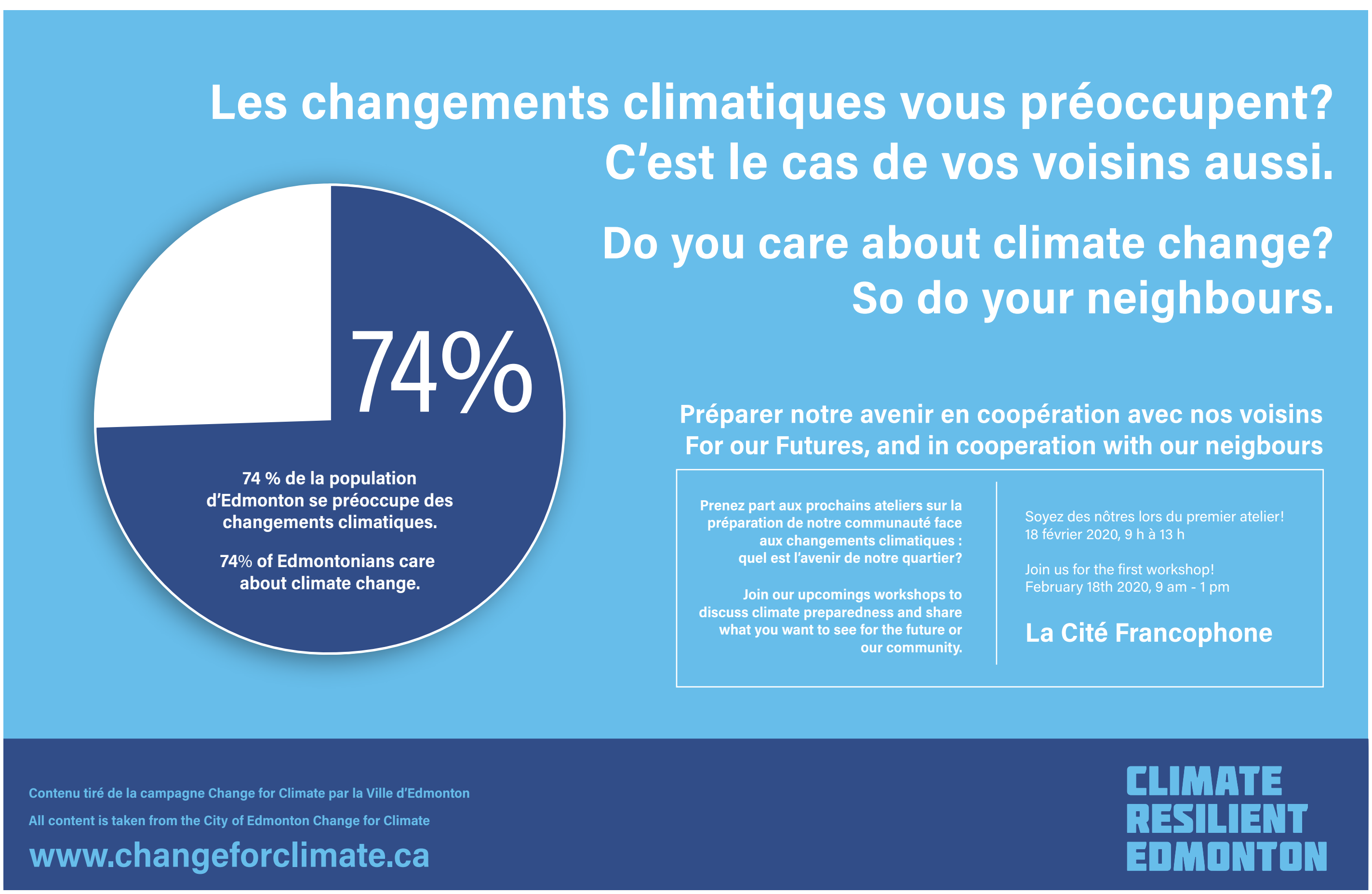
The climate resilient show home is a web based information database available to every-one for free. The database provides information on how to make your home more resilient to extreme weather



www.climateresilienthome.ca

The City of Edmonton Climate Transition Strategy

The following images are the posters created from the City of Edmonton Climate Tranisition strategy that were put up areound La Cité to peak peoples interest and give them a resource to find out more.



Des phénomènes météorologiques extrêmes en évolution
Changing Weather Extremes

Prenez part aux prochains ateliers sur la préparation de notre communauté face aux changements climatiques : quel est l'avenir de notre quartier?

Join our upcomings workshops to discuss climate preparedness and share what you want to see for the future or our community.

Soyez des nôtres lors du premier atelier!
18 février 2020, 9 h à 13 h

Join us for the first workshop!
February 18th 2020, 9 am - 1 pm

La Cité Francophone

Phénomène météorologique extrême Extreme Weather Event	Évolution de la fréquence Trend in Frequency of event
Feux de forêt | Wildfire	En augmentation | Increasing
Rivière à bas débit | Flow in River	En augmentation | Increasing
Pluie sur neige | Rain on Snow	En augmentation | Increasing
Pluie verglaçante | Freezing Rain	En augmentation | Increasing
Vents forts | High Winds	En augmentation | Increasing
Tempêtes de neige | Heavy Snow	Inconnu | Unknown
Blizzard	Stable | Unchanged
Grêle | Hail	Inconnu | Unknown
Éclairs | Lightning	En augmentation | Increasing
Tornade | Tornado	Inconnu | Unknown

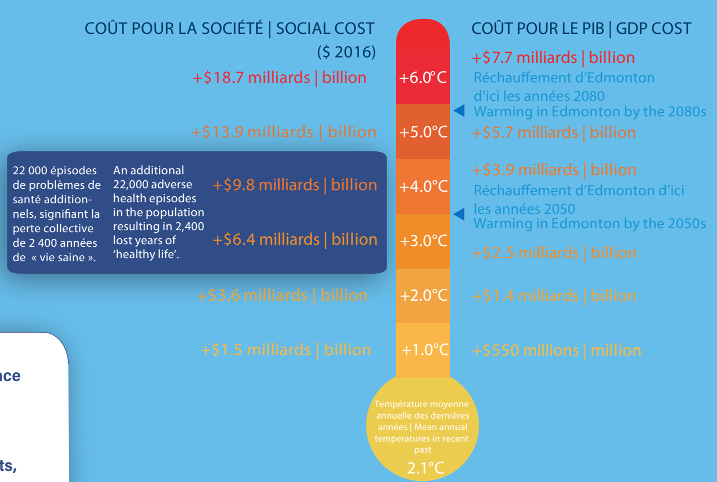
Contenu tiré de la campagne Change for Climate par la Ville d'Edmonton
All content is taken from the City of Edmonton Change for Climate
www.changeforclimate.ca

CLIMATE RESILIENT EDMONTON

Quels impacts auront les changements climatiques sur l'économie?
How will climate change affect our economy?

Les changements climatiques vont :
- Compromettre la sécurité alimentaire
- Ralentir la croissance économique
- Compliquer la réduction de la pauvreté

Climate-change will:
- erode food security,
- slow down economic growth and
- make poverty reduction more difficult



Solution :
Investir dans des solutions de résilience climatique afin de :
- Mitiger les risques climatiques
- Diminuer les coûts pour le PIB et pour la société
- Augmenter la confiance des investisseurs

Solution:
Investment in climate resilience which reduces exposure to:
- climate risks,
- lowers social and GDP costs,
- improves investor confidence

Contenu tiré de la campagne Change for Climate par la Ville d'Edmonton
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CLIMATE RESILIENT EDMONTON

Quels impacts auront les changements climatiques sur notre santé et notre bien-être?

How will our health and wellbeing be affected by climate change?

L'augmentation des canicules et des feux de forêt annoncent un plus grand risque de blessure et de décès.

A greater likelihood of injury and death is expected due to more intense heat waves and wildfires.

Il est projeté que les risques pour la santé causés par les maladies transmises par l'eau ou les organismes comme les insectes augmenteront mondialement en raison des changements climatiques.

As well it is projected that health risks from waterborne and vector borne diseases will increase globally because of climate change.

On anticipe 22 000 épisodes de problèmes de santé additionnels par an d'ici les années 2050.

An additional 22,000 adverse health episodes are anticipated annually by the 2050s

Prenez part aux prochains ateliers sur la préparation de notre communauté face aux changements climatiques : quel est l'avenir de notre quartier?

Join our upcomings workshops to discuss climate preparedness and share what you want to see for the future or our community.

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CLIMATE RESILIENT EDMONTON

Le temps vous paraît-il sec? Is it feeling dry out there?

On prévoit que les températures plus chaudes dans la région d'Edmonton auront un impact sur la fréquence des sécheresses.

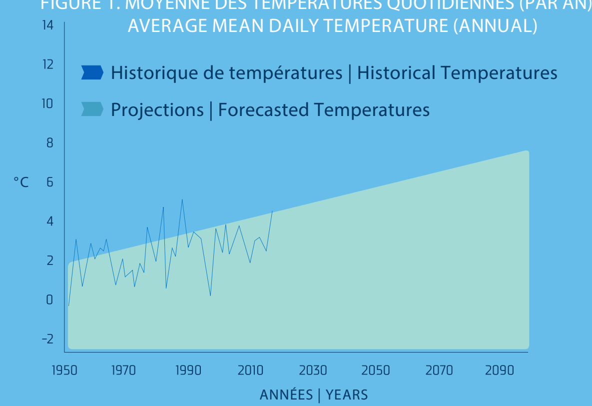
Increasing temperature in the Edmonton region is expected to have an impact on drought conditions.

2071–2099 +5.9°C

1961–1990 2.1°C

2041–2070 +3.5°C

FIGURE 1. MOYENNE DES TEMPÉRATURES QUOTIDIENNES (PAR AN)
AVERAGE MEAN DAILY TEMPERATURE (ANNUAL)



1961–1990 +30°C 1 JOUR | DAY que le point de référence from baseline

2041–2070 +30°C +15 JOURS | DAYS que le point de référence from baseline

2071–2099 +30°C +33 JOURS | DAYS que le point de référence from baseline

Le nombre de « jours » correspond au nombre de journées affichant plus de 30 degrés celcius au termostat dans l'année.

A "Hot Day" is defined as the annual number of days with maxiumum daytime high temperatures over 30 degrees.

Contenu tiré de la campagne Change for Climate par la Ville d'Edmonton

All content is taken from the City of Edmonton Change for Climate

www.changeforclimate.ca

CLIMATE RESILIENT EDMONTON

Quels impacts auront les changements climatiques sur nos infrastructures?

How will climate change affect our urban infrastructure?

- Accélération de la rouille
- Conditions favorables à la moisissure
- Augmentation du stress sur les infrastructures en raison d'une neige plus abondante et de vents plus forts
- Risque de bris du système de traiment de l'eau en raison des inondations

- Metal will rust more quickly
- Mould will grow more readily
- Heavier snow and wind will create more stress on structure
- Changing precipitation that leads to urban or river flooding, affects water treatment system

Le système énergétique collectif de Blatchford
Blachford district energy sharing system

Solution :
Des projets d'infrastructures comme un système énergétique collectif contribuent à la résilience des quartiers face aux conditions météorologiques extrêmes.

Solution:
Infrastructure developments such as district energy can make neighbourhoods more resilient to extreme conditions

Contenu tiré de la campagne Change for Climate par la Ville d'Edmonton

All content is taken from the City of Edmonton Change for Climate

www.changeforclimate.ca

CLIMATE RESILIENT EDMONTON

Communautés résilientes
Resilient Communities

Connaître son voisin et lui faire confiance, en ayant une vision commune de notre quartier

People know one another, trust one another, Have a shared vision of the neighbourhood

Les qualités d'une ville résiliente (Source : 100 Resilient Cities)

L'INTROSPECTION :
Les citoyens et les institutions font preuve d'introspection et tirent des leçons du passé qui informent et aident les processus décisionnels.

LA SOLIDITÉ :
Les éléments construits de la ville sont conçus, fabriqués et entretenus en prévision d'évènements climatiques extrêmes.

LA REDONDANCE :
La ville est construite en intégrant une marge de manœuvre en cas d'interruption ou d'augmentation dans la demande d'énergie. Il s'agit aussi de répondre à un besoin de multiples manières.

LA FLEXIBILITÉ :
Il s'agit de notre volonté et de notre capacité à adopter des solutions de rechange en réponse à un contexte de changement ou à des crises. Les nouvelles connaissances et technologies peuvent soutenir la flexibilité des villes.

LA CONNAISSANCE :
Les citoyens et les institutions ont conscience des risques climatiques et sont en mesure d'absorber les chocs. La ville peut répondre rapidement à un environnement en changement.

L'INCLUSION :
Une posture inclusive dans la prise de décisions nécessite la présence de multiples voix et points de vue afin de proposer une vision commune et de favoriser un sentiment de partage des communs dans la création d'une ville résiliente.

L'INTÉGRATION :
Des processus dits intégrés rassemblent et unissent les différentes agences municipales afin de promouvoir une cohérence dans les décisions et les investissements. Le partage des informations entre les composantes de l'appareil municipal permet un travail collaboratif et des solutions rapides.

Qualities of a Resilient City (100 Resilient Cities)

REFLECTIVE:
People and institutions reflect and learn from past experiences and leverage this learning to inform decision making.

ROBUSTNESS:
Urban physical assets are designed, constructed and maintained in anticipation of high-impact climate events.

REDUNDANCY:
Spare capacity is built into the system to account for disruptions and surges in demand. It also involves multiple ways of fulfilling a need or function.

FLEXIBLE:
Refers to the willingness and ability to adopt alternative strategies in response to changing circumstances or sudden crises. This can be achieved through new knowledge and technologies.

RESOURCEFULNESS:
Citizens and institutions are aware of climate risks, able to adapt to shocks and stresses and can quickly respond to a changing environment.

INCLUSIVE:
Inclusive processes emphasize the need for broad consultation and many views to create a sense of shared ownership of a joint vision to build city resilience.

INTEGRATED:
Integrated processes bring together and align city systems to promote consistency in decision making and investments. Exchange of information between components of the system enables them to function collaboratively and respond rapidly.

PAGE 2

Contenu tiré de la campagne Change for Climate par la Ville d'Edmonton

All content is taken from the City of Edmonton Change for Climate

www.changeforclimate.ca

CLIMATE RESILIENT EDMONTON

1.4 Smart Start Workshop

Introduction

La Cité's neighbours and community user groups were invited to this community-wide workshop hosted by La Cité Résiliente and led by Shafraaz Kaba and the ASK team, to discuss what community members want from the neighbourhood where they work and/or live. The SMART Start Workshop produced an extensive and insightful outline defining the parameters of project success. The conversation, facilitated in part through brainstorming activities and breakout activities between table participants and in larger groups, clarified common core values and explored various partnership opportunities.

It quickly became clear that participants conceived of energy transition and resilience quite broadly, moving beyond technical definitions to focus on social and cultural resilience and the infrastructures — like green spaces — necessary to support a healthy and engaged community. Safety, for instance, became a central issue, as residents hoped the Bonnie Doon/Quartier Francophone neighbourhood would become a safe space for all the community's diverse user groups — youth from Youth Empowerment Support Services, residences from the Schizophrenia Society's permanent supportive housing, and so on. Participants also considered whose voices were missing from the room, including Indigenous communities and youth representation.

Attendees

- Marlin Schmidt, MLA for Edmonton-Gold Bar
- Neighbouring businesses and community groups
- Individuals from La Cité's resident businesses and organizations
- Representatives from local schools

Discussion Topics

(**S**pecific, **M**easurable, **A**ttainable, **R**elevant, and **T**imebound) workshop goals included:

- Define the success factors of the project;
- Define the key stakeholders;
- Identify and classify risks that may emerge;
- Define mitigations for each risk; and
- Define the schedule for those deliverables.

1.4.1 Engagement

Who is Already Engaged?

- La Cité (including many building occupants)
- Just Powers
- Provincial government (MLA)
- Bonnie Doon Community League
- Local residents
- Bonnie Doon Mall
- Edmonton's French Quarter (Business Improvement Association)
- City of Edmonton
- Iris Court (Schizophrenia Society of Alberta)
- Campus Saint-Jean/University of Alberta
- Rutherford School/Edmonton Public School Board
- Effect Homes
- Youth Empowerment Support Services (YESS)

Who Needs to be Engaged?

- Indigenous communities
- More representatives from newcomer communities
- More residents
- Federal government
- Investors, developers, businesses, and more community partners
- Representatives from the Pembina Institute and/or other energy experts
- Persons with disabilities and disability advocates
- Transportation specialists
- Food security specialists and community gardeners
- Local churches

1.4.2 Success Factors Summary

Financial

- Record of financial metrics
- Reduced utility costs
- A sustainable financial plan for the community and any resilience measures
- Businesses and other community members working together to ensure long-term partnership

Environmental

- Abundance of green and garden spaces
- Safe environment where all community members can thrive
- Maintain diversity of recreation options, like the Mill Creek swimming pool and playgrounds/equipment for all ages
- Healthy environment with pollution control plans and systems
- Reduced energy consumption — net-zero or net-positive
- Right to solar access
- Greater sense of awareness about climate change resilience, energy use, and sustainability

Community

- Greater sense of community connection — a place where everyone is included regardless of age, status, or other factors
- Networks established or strengthened (ex. Community League) for sharing ideas, cultivating energy literacy, and sharing resources
- Infrastructure promoting community ties, like walking paths, mixed-use buildings and common areas
- Community-owned power system

Metrics and Targets

- A replicable model that can be used in other Edmonton neighbourhoods and beyond
- Clearly defined and monitored goals
- Regular and ongoing reporting of process, tracking successes and challenges
- Exceed municipal climate and carbon targets

Education

- Training neighbours for the maintenance of community infrastructure
- Inspire next generation of leaders (youth action)
- Looking to community organizations for leadership
- Share information on project for replication in other neighbourhoods
- Promote energy literacy and climate resilience and adaptation education

1.4.3 Tools

- Energy retrofitting and climate resilience modifications to La Cité
- Micro-grid and/or community-owned district energy infrastructure
- Residential and business solar investment
- Zero waste or waste reduction, including compost access and water barrels/wastewater collection
- Pedestrian- and bicycle-focused developments
- Gardens, indigenous plants and green spaces
- Shareable common spaces

Major Milestones from Smart Start Workshop

2020

- Define youth engagement strategy
- Define safety parameters
- Engage community
- Develop the co-op
- Solar panel workshops for residences/support home-owners
- Intergenerational educational initiatives
- Support/retrain energy workers
- Educate more people about saving water
- Community strategy
- Create a collective use of green space
- More reasons to walk around and in winter too
- Acknowledge climate change (and act)

2025

- Track improvements of community
- Stabilize rent and utility costs
- Connect area to the bike network
- Have a sustainable source of funding – Green Fund – reallocating funding from one source to another
- Co-ops created and operational
- Increased density – laneway housing that encourages families / young families
- Reimagine the laneway, itself… second part of the community that is pedestrian-oriented
- Increased density – Bonnie Doon Mall is now built up for condos – with condos for families
- Integrate O&M strategy
- Pedestrian roads

- Standards of construction with environmental obligations
- Residential houses all have green roofs
- More classes on suitable exterior spaces
- Engage women
- Stronger and closer neighbourhoods and communities
- Recycle and compost infrastructure
- Mixed-use buildings - add diversity
- Walkable neighbourhood
- Shift consumption attituded (reuse, reduce and then recycle)

2030 + BEYOND

2030

- Make bonnie Doon "the place to live"
- Share all research, success, struggles information - avoid isolation
- Stable and consistent fun activities
- More communication between groups - community coalition
- New development around LRT
- All new builds meet energy efficiency community guidelines
- Schools continue to be full to capacity
- Completed bicycle corridors with E-bike charging stations
- Walkable networks developed
- Energy Use Intensity 50% lower than 2020 (whole community)
- Community is neutral for electricity usage – generates what it uses
- Off fossil fuels
- New city master plan
- Circular economy
- Shift community mindset
- Resilient community
- Creating networks
- All designs for ecological living and not for car
- Fewer days worked per person
- Tax rebate for green homeowners
- Community driven energy (district energy, micro-grids, co-generation)
- Maintain buildings with efficiency forefront
- Common spaces (not just private spaces)
- Green transit
- All new builds must be net-zero

1.5 FAFA Workshop

Fédération des aînés franco-albertains (FAFA)

Introduction

This workshop was organized in collaboration with FAFA and the Club de l'amitié St-Thomas to engage francophone older adults in the La Cité Résiliente project. Held at Paroisse St-Thomas d'Acquin, the day began with an introduction to the project and its aims. The 25 participants were then asked two questions:

- What would you like the future of Bonnie Doon/Quartier Francophone to look like?
- How can you contribute?

In working groups, the participants had 15-20 minutes to compile their answers on a large sheet, followed by an around-the-room presentation from each group, supplemented by robust dialogue. Coffee and snacks were provided by the Club de l'amitié during the break, giving the opportunity for participants and organizers to chat and get to know each other, before regrouping for another hour of collaborative work. These older adults bring a lifetime of knowledge about more sustainable ways of living. The sessions generated a lot of creativity, laughter, and even potential slogans. One woman said we need to fix the problems of unsustainable living which she called "jette pi achète" (throw away and buy new). They also shared what skills they have and are willing to teach to other community-members, namely youth, and they discussed what they want from their community(ies) at this stage in their lives.

With a high percentage of older adult women participating in the workshop, they had a clear interest in improving the conditions of women -- particularly the lives of daughters, daughters-in-law, and granddaughters -- who now work and carry more of the burden of domestic responsibility. What was also very clear is that unlike the generational divisions fomented by mainstream media -- which often paint older adults with one brush, as the conservative post-war generation that ushered in climate change -- the reality is that many of these older adults have lived lives with much lower footprints than the average Canadian now, following the geopolitical advent of extreme globalization starting in the 1990s. Like the youth and Canadians from all walks of life, older adults are ready to take action on climate change.

Attendees

- 25 older adults recruited by FAFA and the Club de l'amitié St-Thomas

Topics

- What would they like the future of Bonnie Doon/Quartier Francophone to look like?
- How can they contribute?

FAFA Community Opportunities Summary

Transportation

- Improved public transit service and affordability
- Link all bike paths
- Electric Vehicles
- Promote walking as a form of transportation
- Prohibit idling
- Encourage carsharing

Alimentation (Food)

- Community gardens
- Eat seasonally
- Meal delivery services
- Balcony gardens
- Community-shopping to benefit from wholesale
- Indoor gardening like herbs
- Community cooking to prevent food waste
- Promote cooking at home
- Use the kitchen at Campus St-Jean for community kitchen initiatives
- Use Campus Saint-Jean café (Café Univers) for older adult women's gatherings
- Avoid waste at the Club de l'amitié

Accessibilité et sécurité (Accessibility & security)

- Share the road and include all transport modes
- Older adult-friendly public transit
- Snow removal on sidewalks (because current sidewalk conditions raise the risk of injury by falling, and inhibit mobility for those who already have mobility issues)
- Increased security on the LRTs and in the River Valley. This might include the presence of more security officers or simply better lighting and other design features that make it safer for older adults to access the river valley.

Attitudes et comportements (attitudes & behaviours)

- Individual commitment (e.g. switch lightbulbs)
- Give without expecting return
- Take part in the discussions
- Share our spaces
- Beware of individualism
- Listen to every voice, share our experience
- Take our time
- Avoid overconsumption
- Embody the change personally
- Encourage other communities to follow our path
- Popularize ideas
- Limit flights
- Set an example for children and grandchildren

Gestion des matières résiduelles (Residual Materials Management)

- Recycling
- Buy in bulk
- Partner with community league for a community compost
- Prohibit plastic bags and plastics straws
- Avoid disposable tableware

Vie sociale et vie de quartier (Social Life & Neighbourhood Life)

- Promote intergenerational contact
- Crafts workshops for the community (like knitting)
- Make the Bonnie Doon Mall a public space
- Condominiums for older adults with activities
- Nearby businesses
- Retain the francophone culture of Bonnie Doon/Quartier Francophone
- Community centre and kitchens for francophone older adults
- Get to know our neighbors for community cohesion
- Avoid parking in the streets, integrate parking with houses

Conservation de la nature (Nature Conservancy)

- Protect the ravine
- Protect the green spaces at Campus Saint-Jean
- Green roofs
- Organize community activities on ecology
- Make the ravine an educational site
- Keep the soil healthy before building

Énergie (Energy)

- Better built housing
- Retrofit before building
- Building insulation (tax credits)
- Invest and research in renewable energy
- Encourage people to use clotheslines
- Reduce light pollution
- Reduce energy consumption
- Limit the usage of christmas lights

1.7 Building Systems Integration Workshop

Introduction

Building on the momentum of the SMART Start Workshop, this workshop was targeted more specifically to business owners and executive leaders/decision-makers. Participants were asked to discuss the possibilities of moving toward a collective community building energy system. Topics raised included System Synergies (Arch/Mech/Elect/+), district energy, renewable energy, La Cité's PV study, and resiliency plans. They were asked to consider the barriers to these topics, clarify their interest, and think through solutions to some of the challenges raised. Shafraaz Kaba (ASK) led the meeting along with Dr. Sheena Wilson and Laurence Mailhiot (Just Powers), Daniel Cournoyer (La Cité), Jacob Komar (Revolve Engineering) and Trina Larsen (Larsen Engineering Inc.).

Atendees

- Utilities and maintenance representatives from Edmonton Public School Board
- Facilities and operations representative from the University of Alberta
- Many executive leaders from La Cité's building occupants
- Iris Court (Schizophrenia Society)
- Representatives from the City of Edmonton
- Local business owners
- Local leaders, including representatives from Edmonton's French Quarter (Business Improvement Association)

Discussion Topics

- Community Opportunities and Challenges
- Synergies and Systems to explore
- Actions to take
- Resiliency Hub; do you want to be a part of it?

NOTE
Power purchase agreements are contracts between producers and buyers of energy.

District / Neighbourhood Partners

During design and community workshops, there was always an underlying idea that energy can and should be shared amongst the larger buildings around La Cité . The Solar Power Investment Cooperative of Edmonton (SPICE) presented the possibility of district and community-generated electrical power and/or thermal energy at the Launch and Learn in November 2019. This presentation inspired the possibilities of tieing La Cité to the Campus Saint Jean, Rutherford School, St Thomas Seniors and other buildings together to share energy in this manner.

Partnering to create a district system will require a concerted effort amongst all the building owners and local utilties as well the City of Edmonton. Regulations for a Community-based energy system are defined under the Small Scale Generation Regulation as part of the Alberta Electric Utilities Act. This will require negotiation and further exploration with the Alberta Utitlies Commission. The good news is there is already precedent in creating community scale generation nearby as it is being used in Christenson Developments project in Hazeldean.

In order to meet commitments of the Edmonton Declaration and the Paris Climate agreement, staying within a 1.5 degree temperature increase, La Cité should aim to be connected to a zero carbon emission district energy system by 2050. This provides two decades to coordinate amongst local neighbours and district energy partners to design, develop and implement this system. It is hoped that within a decade, there will also be carbon and financial incentives to ensure this is a cost effective path. An alternative solution to a neighbourhood district energy system may include an "all electric" building heating, air conditioning and ventilation as well as hot water heaters that would be powered by solar/zero emission electricity.

Benefits

- Save space in building design, as buildings no longer require independent mechanical and electrical rooms
- "Greening" the grid with reduced dependence on coal fired power plants

Challenges

- Crossing utility right-of-ways and property lines complicates how utilities companies would charge for distribution and transmission
- May require buying out existing utility contracts for natural gas and electricity
- Proactive engagement with Alberta Utilities Commission may be necessary
- Power purchase agreements are complicated and may require the service of an Energy Advisor

Community Opportunities

In a plenary discussion, stakeholders identified the following opportunities and possible directions:

- Review existing district or community energy projects, including the Downtown District Energy and Metis Nation of Alberta Cogeneration projects
- Create a Bonnie Doon Improvement Strategy with Edmonton's French Quarter (Business Improvement Association)
- Consider "green bonds" or other financing opportunities with the Solar Power Investment Cooperative of Edmonton (SPICE)
- As a number of local buildings consider redevelopment, investigate opportunities for collaboration:
    - Possibilities for collaboration on 30-year redevelopment plan with the Bonnie Doon Mall Vice President of Development and Morguard
    - Possible collaboration with Iris Court (Schizophrenia Society of Alberta), whose building was constructed in the 1980s and will require system upgrades in the near future
    - Review Manoir St Thomas' recent Alberta Infrastructure condition assessment for possible collaborative opportunities
    - Rutherford School (built in 1911, upgrades in 1995) does not have any upgrades or retrofits planned, though roof replacement may be necessary in 10 years
    - Bonnie Doon Community League (and ice rink) is nearby
- Some unutilized land in the northeast corner of Rutherford School may be available for community garden space
- Rutherford School and Youth Empowerment Support Services (YESS) interested in further educational opportunities regarding energy resilience
- Youth Empowerment Support Services (YESS) may also be interested in upskilling/training opportunities for their youth
- Old site of Imperial Gas Station (82 Avenue/Rue Marie-Anne Gaboury) may be opportunity for solar installation
- Opportunity for Edmonton's French Quarter (Business Improvement Association) to show leadership in climate resilience and adaptation
- Communicate with Edmonton Climate Hub and create a sharing opportunity
- Reach out to local faith organizations, including Central Baptist Church, for possible partnerships
- Build on support from local politicians (MLA Marlin Schmidt, Ward Councillor Ben Henderson, Mayor Don Iveson)

Who was Present?

Simon Williams	Principal	Rutherford Elementary School
Lisa Dockman	Energy Transition Project Manager	City of Edmonton
Rocky Feroe	Board member	Solar Power Investment Cooperative Edmonton (SPICE)
Étienne Alary	Conseil de développement économique de l'Alberta	CDÉA
Jason Yuzyk	Utilities Data Analyst	University of Alberta
Dale Rott	Project Manager	Effect Home builders
Roch LaBelle	Building Manager	Societe des Manoirs - Manoir St. Thomas
Nivedita Kunjur	Marketing Director	Morguard Development (Bonnie Doon Mall Development)
Tammy Abbott	Manager	Bonnie Doon Mall
Darryl Kaminkski	Energy Consultant	Edmonton Public School Board
Trueman Macdonald	Director	Schizophrenia Society
Denise Lavallée	Board Member	La Cité Francophone
Sheena Wilson	Associate Professor	Campus Saint-Jean

1.6 Presentation to the Board

Introduction

In order to provide an in-depth update to the board of La Cité, Dr. Sheena Wilson (also of the board) and Shafraaz Kaba presented on the La Cité Résiliente project and findings from the recently completed energy audit. .

Attendees

- 12 members of the La Cité board

Topics

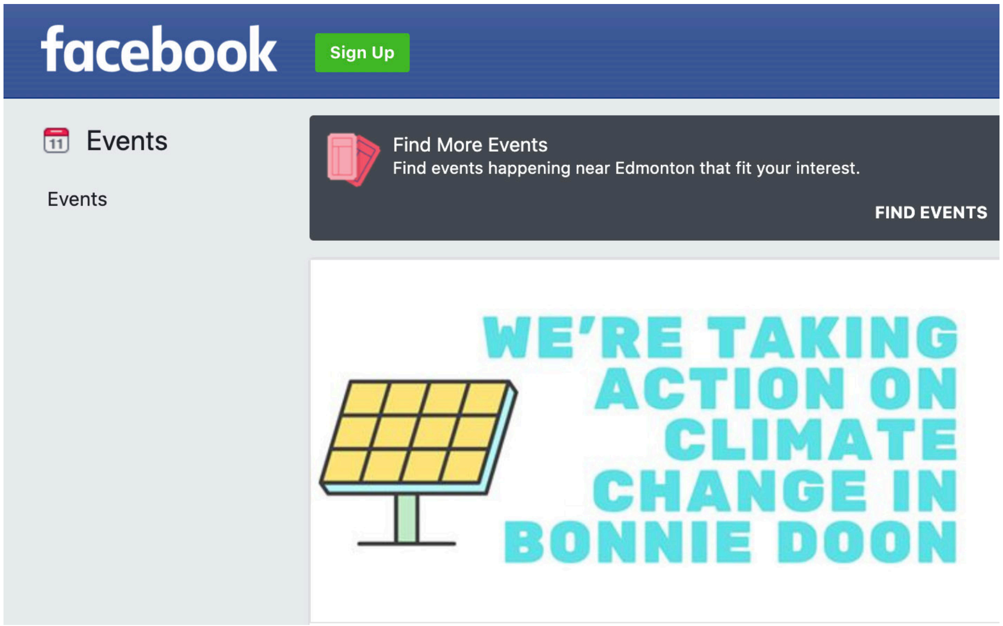
Board members expressed their support of the La Cité résiliente project, and there is some indication that members may participate in a future committee focused on moving forward sustainability initiatives at La Cité francophone. The possibility of this committee was followed up on in a subsequent meeting. There are also many opportunities to utilize the expertise of various board members, who specialize in a range of professional trades and services. The project seemed financially feasible, especially after considering the research on financial incentives -- including the Clean Energy Improvement Program (CEIP), which is expected to launch in Edmonton in Fall 2020.

1.8 Communications Strategy

Introduction

A key component of any modern community engagement strategy is the thoughtful use of media and communications platforms. La Cité Résiliente reached out to key stakeholders through a variety of channels, including Twitter; Facebook; Eventbrite; posters and handhelds placed throughout the community; listserv distribution; and profiles with local radio stations.

By receiving funding from the Young Canada Works youth employment program, the La Cité Résiliente project retained a Sherbrooke University co-op student, Laurence Mailhiot, from January to April 2020. Laurence, a Communications student, continued a robust bilingual outreach platform initiated by Just Powers research coordinator Dani Jorgensen-Skakum, and helped rebrand the project from La Cité: A Hub for Climate Resilience to La Cité Résiliente: A Decade in Transition. This name change was intended to open the project beyond the timeline of the EcoCity Infrastructure Acceleration grant, even as it recognizes La Cité as an organizing cornerstone and central community hub. While this branding will continue to be relevant to the La Cité project proper for the next decade, we fully expect that the larger community energy project (that seems to be developing out of the La Cité initiative) will need to be branded separately to represent neighbourhood partnerships.



APPENDIX 4

Results of Energy Audit and Assessment of Existing Conditions at La Cité francophone

PART 4.0 INTRODUCTION

EXISTING CONDITIONS

PART 4.1 ARCHITECTURAL

PART 4.2 MECHANICAL

PART 4.3 ELECTRICAL

PART 4.4 BUILDING SYSTEMS INTEGRATION

4.4.1 ARCHITECTURAL OPPORTUNITIES

4.4.2 MECHANICAL OPPORTUNITIES

4.4.3 ELECTRICAL OPPORTUNITIES

4.0 Appendix 4 Introduction

The La Cité Résiliente project seeks to inspire La Cité's building users and the Bonnie Doon/Quartier Francophone neighbourhood to make meaningful future-proofing changes over the coming decade. Working together is essential for climate and energy resilience. As such, La Cité Résiliente hopes to cultivate a network of opportunities to create shared energy sources and systems, and to share knowledge: Completing the future-proofing energy audit was the first step, and the results will be presented back to the community in order to determine the future direction of retrofits and energy upgrades at La Cité. The energy audit is also to be used as a model for future community initiatives and applied as much as possible for energy literacy education. Readers who consider the findings presented here may want to reflect on their own home and business energy use, and how both simple and large-scale modifications may prepare them for a future affected by climate change.

A number of partnerships have emerged through the La Cité Résiliente project in the pursuit of shared preparedness and future-proofing. Edmonton's French Quarter has expressed interest in possibly working together with local businesses to pursue shared energy systems or solutions, and the Bonnie Doon Mall is interested in collaborating as well. Additionally, there are several other organizations in the area with supportive individuals who hope to continue the growth of this project beyond its current end-date.

ASK*

Definition:
Architecture generally refers to building design and structure, focusing on the building envelope or the building's resistance to outside conditions — heat, cold, moisture, and so on — and the building's maintenance of inside conditions, such as heat and cooling.

4.1.0 Background - La Cité francophone

La Cité francophone is a hub for Francophone culture, community, and commerce. It is known not only for its beautiful design, but also as a symbol of the resilience of this linguistic minority community; strong social/political organizing and fundraising made this centre possible. La Cité is situated across the street from the Francophone faculty of the University of Alberta and is a cornerstone of Edmonton's French Quarter. The relationship between Campus Saint-Jean and La Cité is built on historical resilience and working together across linguistic lines and cultures. This same resilience can be harnessed to collectively imagine a post-carbon future.

4.1

ARCHITECTURAL

4.1 Architectural Existing Conditions

The design team observed how La Cité Francophone currently operates and where there were challenges for occupant comfort that signals the need for improvements that can be made to building envelope, mechanical heating, cooling, ventilation, air conditioning and lighting and controls. For this work, the architectural team did a thorough walk-through of the entire building and reviewed the building envelope and interior conditions. A meeting with Nordic, the building operator, was essential to understand maintenance and operational challenges.

Building systems usually have a life of 25 to 50 years. The architectural and building envelope review considers what parts of the building that needs to be repaired or replaced as a matter of course. These items are then reviewed in context with mechanical and electrical systems to see how upgrades can be approached systematically.

4.1.1 Architectural History and Context

La Cité francophone was built in two phases. The original atrium and south tower (Phase I) were designed in 1995 by Barry Johns Architects Ltd. Phase II was designed and constructed in 2008 by Tardif Architecture Inc. Durable exterior materials — split-face concrete block, aluminum-framed curtain walls, and metal cladding — were used in both phases. The exterior surfaces include brick pavers and poured-in-place concrete, centred around a terraced and landscaped atrium.

As a central community hub and neighbourhood meeting place, La Cité is home to a number of businesses, organizations, and amenities. In addition to L'Unitheatre popularly used for Fringe stage productions and other community theatre productions, La Cité also features a health centre, daycare, café, radio station, and numerous offices that provide a wide range of services.

Typically, building systems have a 25-50 year lifespan. To assess the integrity of La Cité's building envelope and interior conditions, the architecture and engineering team completed a comprehensive systematic building walkthrough and met with the building operator, Nordic Mechanical, to understand any maintenance and/or operational challenges. The auditing architecture and engineering team, led by ASK for a Better World, also inquired about challenges to occupant comfort, which often reveal deficiencies in the building envelope, mechanical heating, cooling, ventilation, air conditioning, and/or lighting controls.

4.1.2 Architectural Walk Through + Thermal Camera Survey

The audit team completed the building walkthrough on December 18, 2019. All areas interior, exterior (including roof areas) were reviewed and observations of building systems were made. The building is generally in good shape, with qualitative signs that point to it being well-maintained. Some wear and tear issues have been observed and various locations are noted for repair. Below is a summary of issues visually observed over during several site visits.

The northern portion of Phase II was constructed in an arc with an office block to the east. This arc protects the sunken outdoor courtyard space, creating Café Bicyclette's year-round patio.

Image: Arc Design on Phase 2

Image: Main Atrium Doors from the Inside

La Cité's main atrium doors are a major source of energy loss (heat in the winter, cooling in the summer), especially when they are propped open for entrance and exit during major events (like Flying Canoë Volant). A vestibule or revolving door are recommended.


Image: Main Atrium Doors from the Outside

Image: Flashing Damage

Many locations of exterior flashing atop the brick upstand in the atrium require repair or replacement. Typically this type of flashing damage leads to water damage in the wall behind.

Image: Thermal Camera Image showing Heat Escaping out of the Hole

Image: Interior Wall where Hole was Found

A hole was found at the top of the split-face concrete block wall on the north corner of the building. This hole, likely caused by a bird or insect, goes directly outside and can be easily repaired with a metal enclosure panel and the addition of spray foam.

Image: Insect/Animal Damage in Hole

Image: Leaky Window

Some evidence of moisture penetration were observed at curtain wall glazing units. Window seals should be checked and repaired where necessary. A few glass units were also observed to have failed seals (showing a cloudy or foggy state).

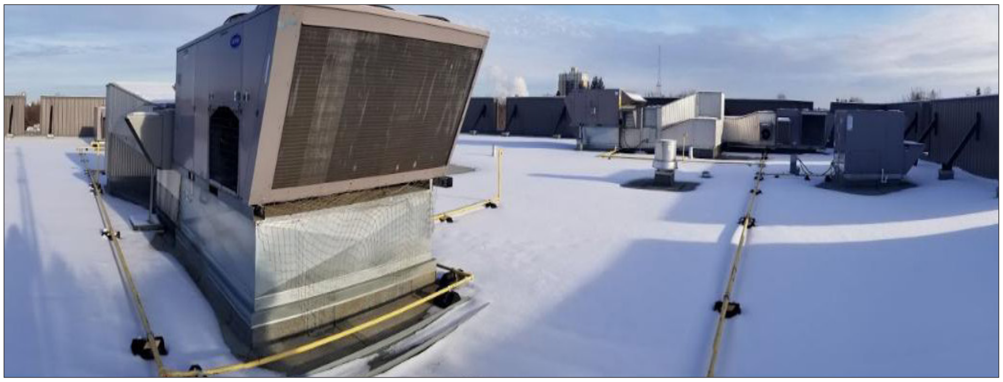


Image: Bituminous Membrane Roof

Although the roof was covered in snow, exposed areas revealed a modified bituminous membrane roof in good condition.

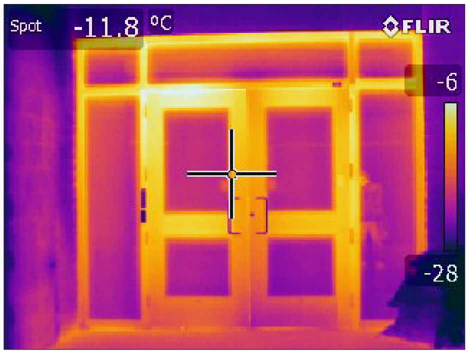
Image: Air/Vapour Membrane

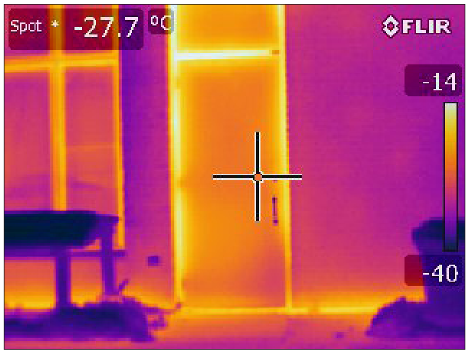
The "peel-and-stick" air/vapour membrane was damaged in several locations of the building's exterior. Insulation at these sites also appear to be compromised.

Image: Aluminum Doors

Image: Thermal Camera Showing Heat Escaping

Aluminum doors and windows are very energy conductive. Doors with insufficient or damaged weatherstripping will glow in bright, lighter colours in a thermal scan as visible in these images of La Cité's exterior.





Thermal scans reveal challenges with doors and weatherstripping and the highly conductive materials that doors and frames are made from (aluminium or steel).

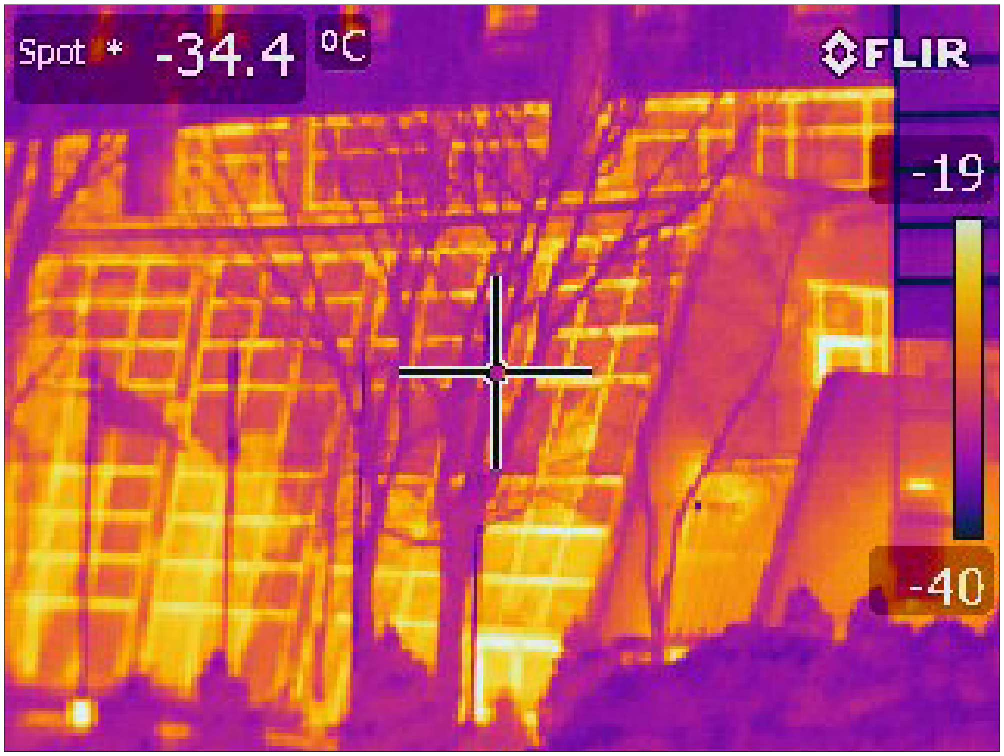
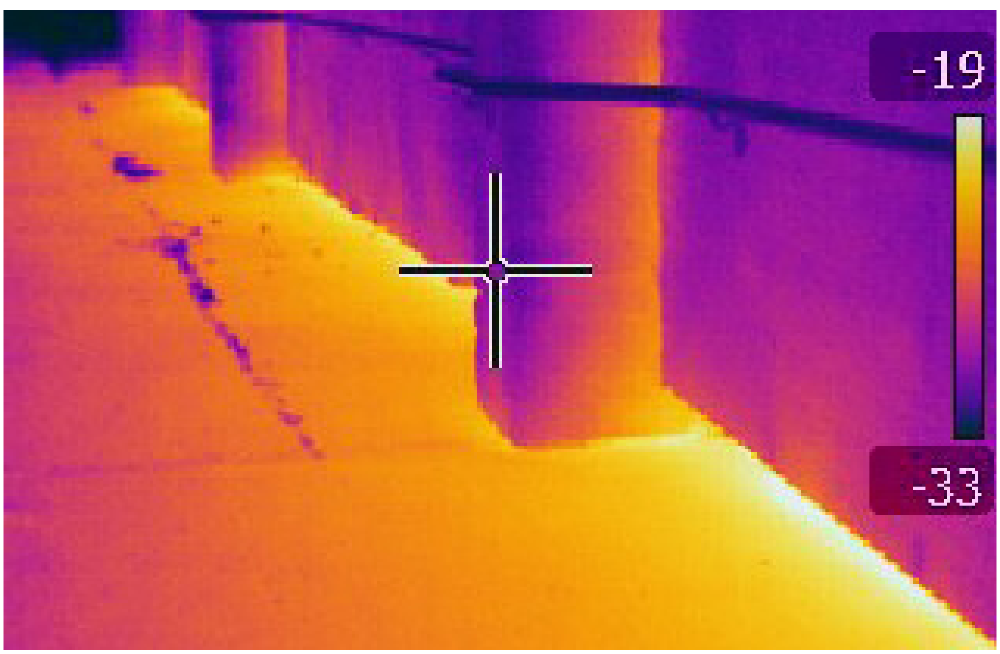


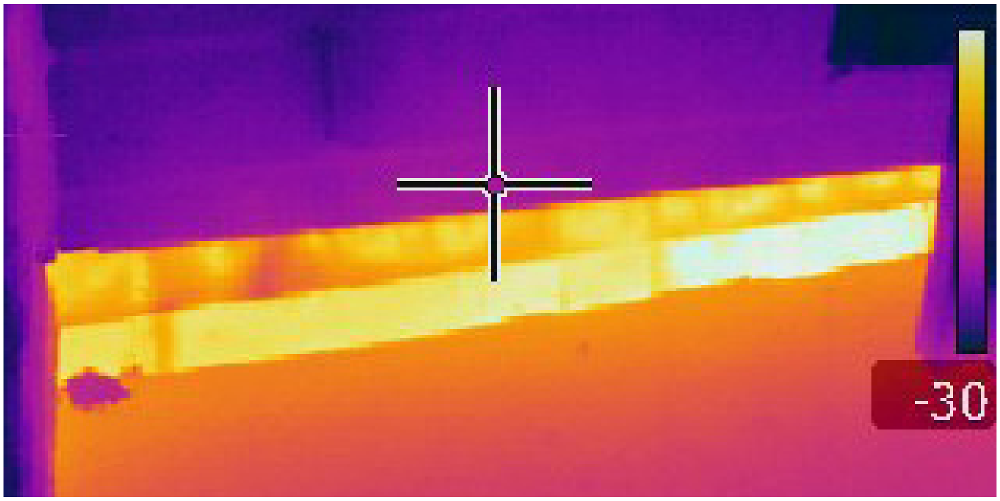
Image: Thermal Camera Showing Curtain wall glazing shows the ease of heat conductivity in cold weather through aluminium window frames

Images: Parkade to Building Transition, and Resulting Heat Loss



Heat loss was also observed at the transition between the parkade level exterior wall and foundation.

Image: Damaged insulation at exterior wall base.

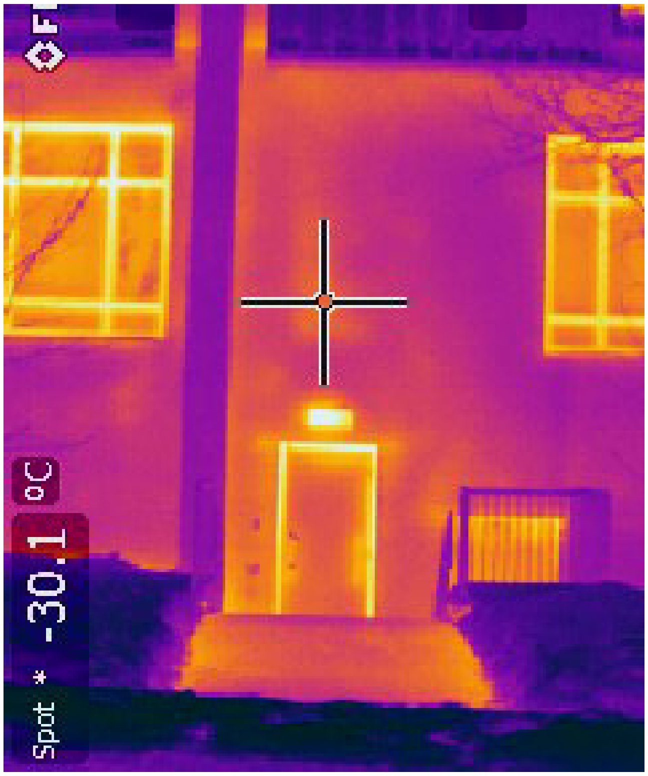


Thermal camera scan reveals heat loss at wall/foundation transition points where insulation is lacking.


Spot * -38.0 °C
FLIR
-24
-40


Spot * -39.3 °C
FLIR

Windows showing bright edges/hotspots with the thermal camera scan should be checked for proper seal installation. Foam gaskets or caulking may require reapplication to stop air leakage.



REVOLVE ENGINEERING

Definition:

Mechanical engineering relates to a building's mechanical systems — elements such as heating, ventilation, air conditioning, and plumbing systems.

4.2 MECHANICAL

4.2.1 Mechanical Existing Conditions

La Cité has 17 rooftop units (RTUs) for distributed variable air volume (VAV) boxes. Variable air volume boxes are generally part of heating, and/or ventilation systems. The Four of the RTUs, located on the roof of Phase I, were replaced recently and have a nominal efficiency of 81%. (Nominal efficiency refers to the highest possible measure of the unit's efficiency, and does not necessarily mean that the unit is 81% efficient.) According to the serial number, they were manufactured in August 2018 and likely installed in 2019. It appears that the remaining 13 RTUs were manufactured in 2009 and have nominal efficiencies of 80%, though it was not possible to confirm the age of all RTUs due to unreadable labels.

RTU-15, manufactured in 2009, located on Phase 2 roof

RTU-6, manufactured in 2018, located on Phase I roof

The RTUs manufactured in 2009 will no longer be operating at 80% efficiency due to normal wear and degradation. It is estimated that their present-day efficiency will be in the range of 70-75%, depending on how well they have been maintained.

Typical Thermostat in La Cité

Thermostats:

Thermostats, located throughout the building, are set to 22-23°C during occupied hours and 16°C during unoccupied hours. Most offices have access to a wall-mounted thermostat, which allows occupants to control the temperature within 1-2°C of the setpoint.

Water Heating:

Water heating equipment includes an 80% efficient 70-gallon natural gas storage tank heater in Phase 1 and two 88% efficient 100-gallon condensing natural gas storage tank heaters in Phase Two. Café Bicyclette also has a small electric boiler used for dishwashing purposes.


Phase 1 water tank

Phase 2 water tank

NOTE:

Depending on the price of natural gas, natural gas heaters are usually cheaper than electric boilers. They generate heat through combustion. Electric heaters use either infrared technology or an electric coil system (similar to traditional stovetops!) to produce heat, and are generally more energy efficient.

Boilers:

There are two boilers used to heat some hallways, vestibules and some unoccupied rooms (mechanical rooms, electrical rooms, etc.).

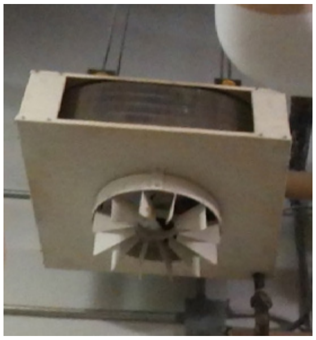
The Raytherm boiler in Phase I is approximately 24 years old. When it was new, it was likely 80% efficient. Today its efficiency is estimated at 63% due to normal degradation.

The Raytherm boiler in Phase II was manufactured in 2017. Its nameplate efficiency is 85%; its efficiency today should be close to 85%.

Phase I boiler

Phase 2 boiler

NOTE:
Boilers heat water or other fluids and then distribute that heat through a system of pumps and pipes to provide building heating.



Boiler-fed fan coil terminal unit
in mechanical room

Boilers Continued:

The hot water from the boilers is fed via circulation pumps to terminal units throughout the building. The boilers also provide hot water for the parkade ramp's snow-melting system.

Radiator terminal units for heating curved hallway

Personal Heaters:

Many employees working in the building use personal electric convection space heaters, most of which are rated to 1500 watts. There are between 60 to 120 personal space heaters located throughout the building (not all spaces were checked; an exact number is not known).

NOTE:
Space heaters may actually make the room or building temperature even colder! While they give off more heat in a particular area, nearby thermostats read a higher temperature and send out less heat.

Four of the eight air conditioner units along south side of building

Air Conditioner:

Air conditioning is provided either by the 17 RTUs or by the bank of air conditioning (AC) condenser units located along the north edge of the building. There are also mini-split AC units used for cooling rooms in Phase I.

NOTE:
Condenser units work through heat exchange, taking in heat and releasing it to the outside while refrigerant cools the air returned to the interior. They often have a duct system, which allows for heat loss as the air flows toward the condenser unit. Mini-split AC units usually work without ducts, and therefore in smaller spaces.

Café Bicyclette:

Café Bicyclette's commercial kitchen uses a significant amount of the building's energy with its freezers, refrigerators, food warmers, dishwashers, fryers, ovens, ranges, grills, ice maker, walk-in fridge, walk-in freezer, and so on.

Old Refrigerator

Commercial ovens

Additionally, commercial kitchens typically vent a large volume of air, replacing exhaust with air from the outdoors. This results in significant natural gas energy use, as the outdoor air must be conditioned (cooled/heated) before entering the kitchen.

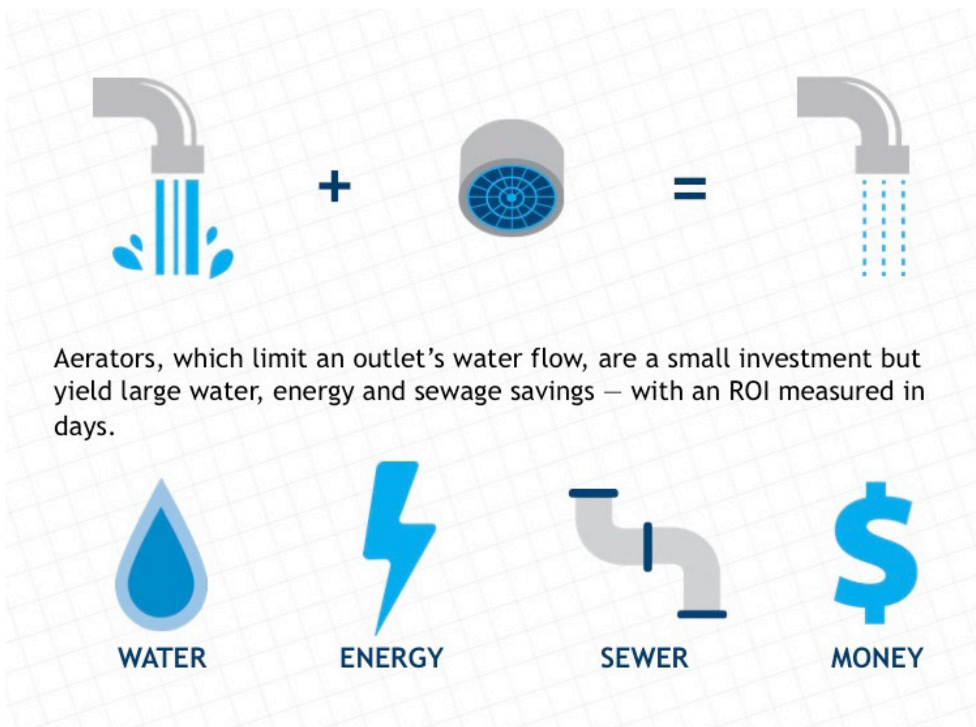
Food Warmers

Commercial Dishwasher

Commercial kitchen natural-gas deep-fryers

Ranges

NOTE:
Paying attention to the flow rates of your faucets and the water use of your toilets can make a big difference in building energy consumption!



Water Fixtures:

Kitchen sink without aerator

Washrooms for visitors are located through the building, in addition to those located within most offices for employee use. Most offices also contain a small kitchen with a kitchen sink. Some also have their own dishwashers. Flow rates for some washroom faucets were measured and ranged from 1.7 Litres Per Minute (LPM) to 3.4 LPM. Many of the faucets within the building are fitted with standard 8.3 LPM aerators, which could easily be replaced by low-flow, 1.9 LPM aerators to reduce both water and natural gas consumption (when hot water is used).

Some kitchen sinks lacked aerators, resulting in excessive water use and wasting both water and natural gas (when hot water is used).

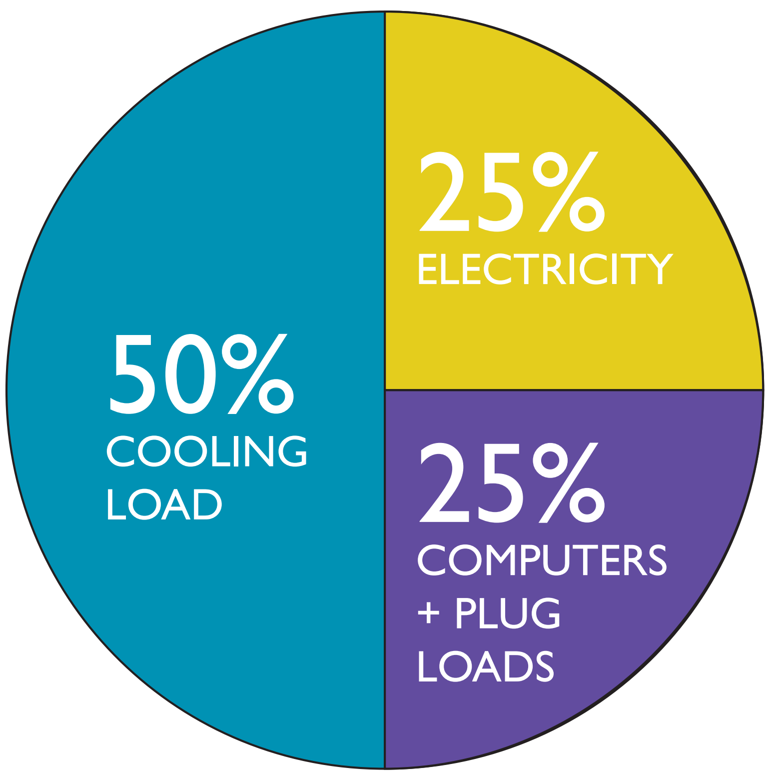
Urinals within the building have flow rates of 3.8 Litres Per Flush (LPF). Flow rates for toilets were not fully itemized, however several were noted to have rates of 6.0 LPF; others were dual-flush 3.0/6.0 LPF.

Energy Star rated urinals use half the water of those found in the building — 1.9 LPF opposed to 3.8 LPF. Waterless urinals are also available. Energy Star rated toilets use 4.8 LPF.

LARSEN
ENGINEERING INC

Definition:
Electrical engineering relates to a building's electrical systems, which may include power distribution, lighting, electrical outlets, emergency exit signs, security systems, information technology (networks and servers), and so on.

How electrical energy is used at La Cité :



4.3 Electrical

4.3.1 Electrical Summary

La Cité Francophone utilizes around 1.5 Million kWh of electricity each year, costing the facility over $210,000 per year. The electricity rates have increased from an average of 9 cents per kWh in 2017 to 15 cents per kWh in 2019, and the expectation is that the rates will continue to increase, particularly in the transmission and distribution side , as that side has remained flat over the prior three years.

The facility is a summer peaking facility, with more power use during the summer, from air conditioning load, than in the winter. From the data, it appears that the cooling and mechanical load is approximately 50% of the consumption, while lighting makes up approximately 25% of the electrical energy use. The remaining 25% is a mix of computers and other plug load. This is a normal split for a facility of this type.

The first principle of energy is to **reduce its use at the source**. As such, reducing the cooling load is a key first step. One method of doing that is to also reduce the lighting load, as lighting creates heat. As a summer peaking building, the energy savings attributed to lighting are both the direct lighting savings and the indirect cooling savings (which are partially offset by an increase in heating in the winter.) The lighting consumption can be reduced by over 60% through a redesign of the lighting towards full LED technology, and the installation of controls, allowing the lights to be used where needed, when needed. Lighting upgrades have **a return on investment in the order of 14%**.

Further electrical savings are identified in the mechanical report, with power reductions from the incorporation of VFDs.

One interesting element that can help La Cité Francophone show leadership, is to incorporate solar PV on the roof of the building. Unfortunately, the building is not overly well suited towards PV, as the roof has many pieces, rather than being one continuous level. From our analysis, the building can create up to 38,000 kWh of power, on three different roof areas. There are a couple of other roof areas that could also have power generation potential, in smaller amounts – likely in the order of 43,000 kWh across the entire building, or less than 5% of the building requirements. The payback is good, however, as all the power produced on the building can be utilized, **with a return on investment in the order of 10%.** When the glass needs to be replaced on the curved curtainwall, consideration could be given to a building integrated photovoltaic system for replacement of some the glass units, thereby helping the building from overheating too.

4.3.2 Existing Electrical Conditions

Main Power System

La Cité francophone uses around 1.5 million kWh of electricity each year, costing the facility over $210,000 per year. Electricity rates increased from an average of $0.09/kWh in 2017 to $0.15/kWh in 2019. Rates are expected to increase further, particularly in transmission and distribution — cost areas that have remained unchanged over the past three years.

The building's energy use peaks in the summer with air conditioning — more than in the winter with heating. From the data, it appears that the cooling and mechanical load is approximately 50% of the consumption, while lighting makes up approximately 25% of the electrical energy use. The remaining 25% is a mix of computers and other elements related to plug load.

Power Distribution

The main distribution system is rated for 1200A, 600V, 3phase, 4 wire, located in the Phase 1 main electrical room (Room #036).

Panelboards are located throughout the facility, at 347V and 120/208V, to serve the various loads in the building.

Power utilization is typically as follows:

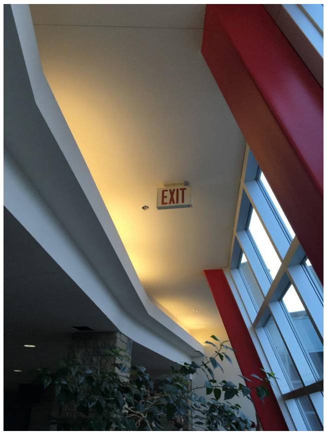
- Fluorescent Lighting 347V
- Incandescent Lighting 120V
- LED Lighting 120V
- Convenience Receptacles 120V
- Motorized loads up to and including .37kW (1/2 hp) 120V
- Motorized loads greater than .37kW (1/2 hp) 600V (3 phase)

Interior Lighting

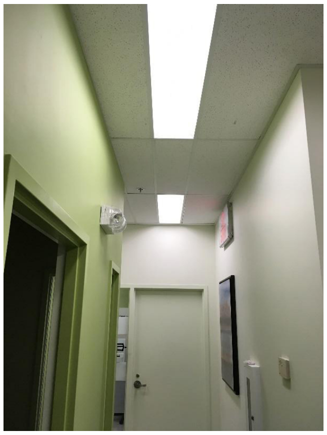
The existing lighting is a mixture of various sources, types and styles. In Phase 1, the majority of lighting was T12 fluorescent, except in the leased space where T5 fluorescent is utilized. Most of the downlights were various types of compact fluorescent lamping. In Phase 2, the majority of lighting was T8 fluorescent, with various types of compact fluorescent downlights. The theatre has a mixture of incandescent and LED sources, as is suited to the theatrical environment to obtain full range of dimming.

Fluorescent lighting is typically operating at 347V, with some 120V lighting noted from the panelboards. A Douglas Relay Control System is in place to reduce the quantity of line voltage 347V switches.

Generally, lighting was turned off in unutilized spaces, which indicates the community utilizing the space takes ownership of the spaces, since the switching was all manual switching. The main atrium lighting and corridor lighting was on, despite the ample daylight.



Corridor adjacent to Glazing - Lights were on


Corridor lighting in leased space


Back Stage Theatre Lighting

Egress and Emergency Lighting

Due to the bilingual nature of the facility, there is a mixture of egress lighting present. From unilingual "EXIT" signage to a variety of types and sizes of "EXIT / SORTIE" signage. The majority of signage appears to be LED, but not all were operational, and in some cases the LEDs were older style retrofits, which did not effectively illuminate the signage.

Bilingual Signage, Small Size (Unilluminated)

Bilingual Signage, Large Size

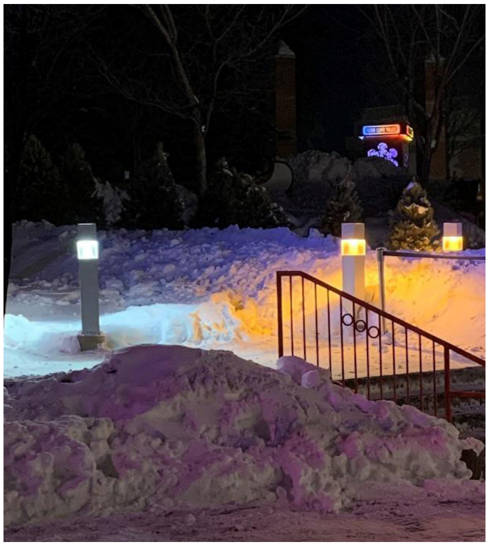
Unilingual Signage Retrofit Kit (Bottom Illuminated)

Exterior Lighting

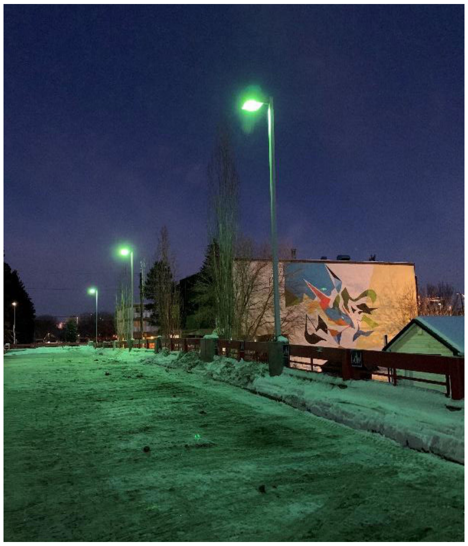
The existing lighting is a mixture of various sources, types and styles. There are metal halide and high pressure sodium lights, along with a mixture of colour temperatures within bollards in the main central gathering area. Bollards, wall packs, parkade lighting and pole lighting make up the majority of exterior lighting.

During the daytime walk-through on 18 December 2019 the bollards in the central gathering space were on, along with some of the pole lights.

NOTE:
Lighting upgrades offer a 14% return on investment.



Exterior Bollards (note the two illumination colours – HPS and Metal Halide or Colour Corrected HPS)



Parking Lot Pole Luminaires (Metal Halide Lamping)

Plug Loads

The following plug load devices were found throughout the building (though this is not an exhaustive list):

- Personal space heaters (many)
- Computers (many)
- Water coolers/heaters
- Photocopiers
- Televisions
- Coffee makers
- Mini refrigerators (many)
- Full size refrigerators
- Vending machines (two)

Reduce Energy Use at the Source

The first principle of energy efficiency is to reduce energy use at the source. As such, reducing the cooling load is a key first step. Reducing the lighting load would make a significant difference, as lighting generates heat. Changes to lighting would result in energy and cost savings from reduced lighting and cooling costs. Lighting consumption could be reduced by over 60% through a lighting redesign with full LED technology and the installation of controls, which would allow lights to be used where and when needed.

4.3.3 Roof Review for Photovoltaic Analysis

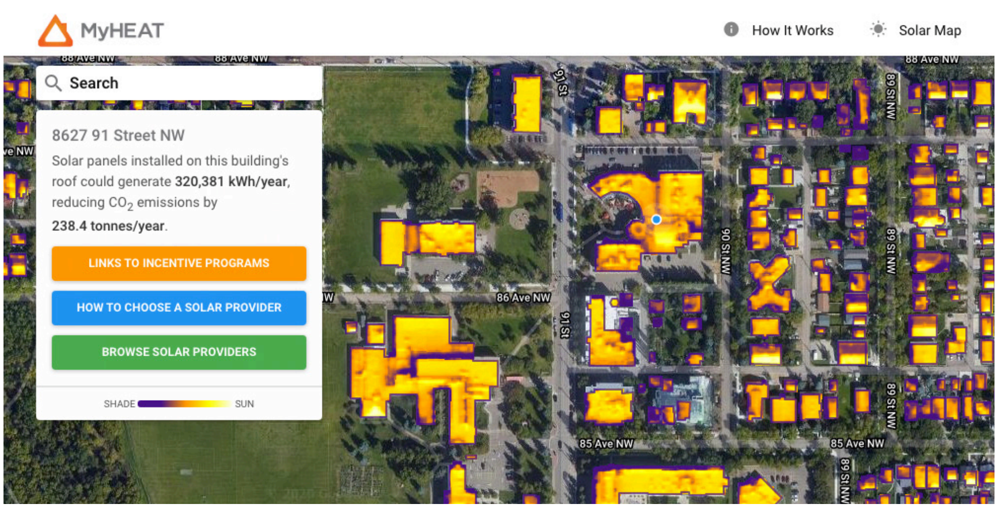
Solar Photovoltaics (PV)

Investigating solar power was part of the project application for the EcoCity Edmonton Infrastructure Acceleration Grant. Unfortunately, the building is not overly well-suited toward PV, as the roof was constructed in many pieces instead of as one continuous level.

From the electrical engineers' analysis, the building could generate up to 38,000 kWh of power on three different roof areas. In addition, there are a few other roof areas that could also generate power in smaller amounts — likely in the order of 43,000 kWh across the entire building, or less than 5% of the building's requirements.

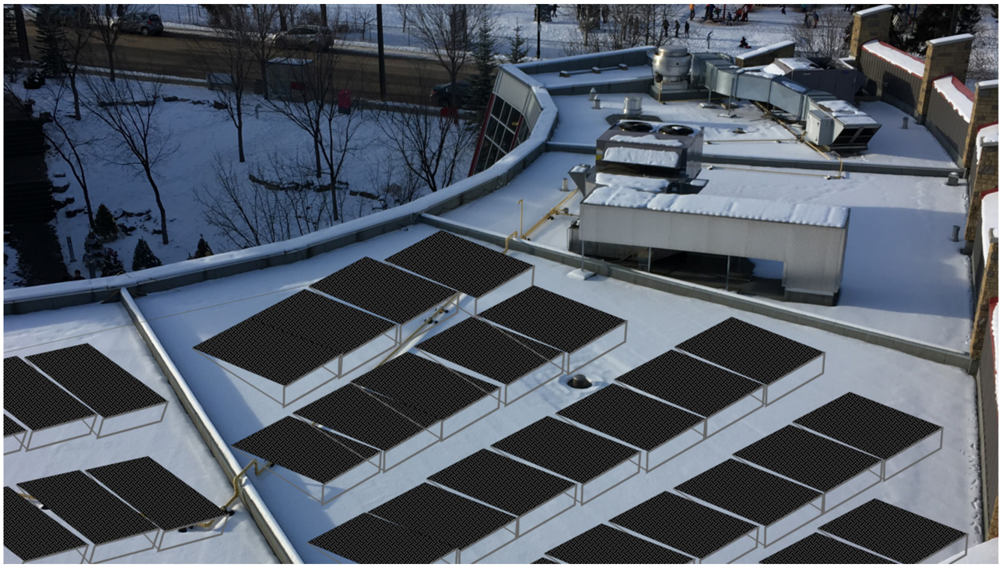
However, if all the power produced on the building could be used, La Cité could see a 10% return on investment.

When the glass needs to be replaced on the curved curtain wall, La Cité might consider building-integrated photovoltaics — windows that double as solar PV panels.



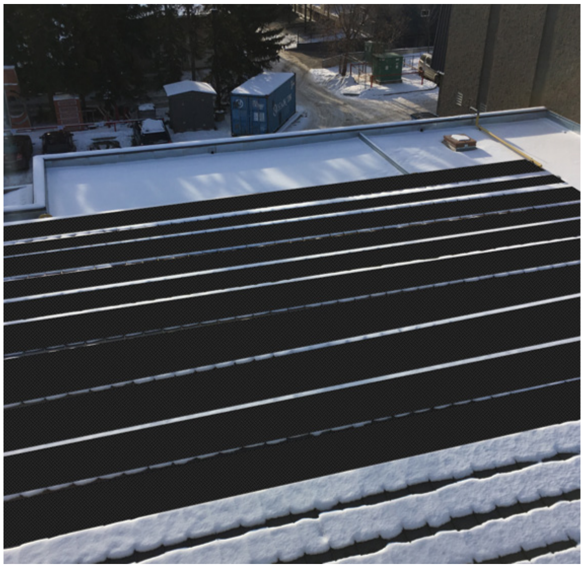
https://myheat.ca/map/solar-edmonton/

The above website provides information on the potential in Kilowatt hours that could be generated on a roof if there is no rooftop equipment or other items obstructing solar panels from being installed.



Phase 2 Curved Roof Potential for Photo Voltaics (PV) - Visualization

High South Roof Potential for Photo Voltaics (PV) - Visualization



Theatre Roof Potential for Photo Voltaics (PV) - Visualization

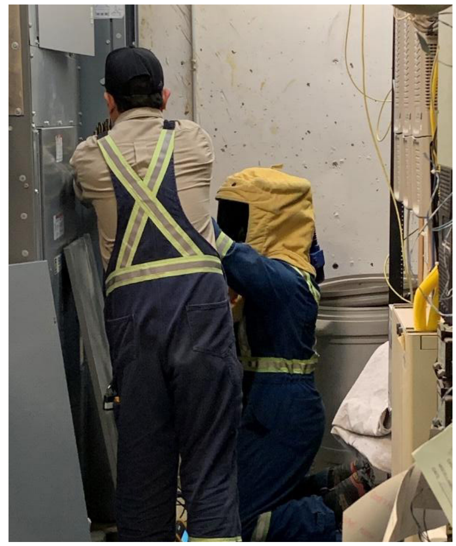
4.3.4 Overall Electrical Analysis

Main Power System

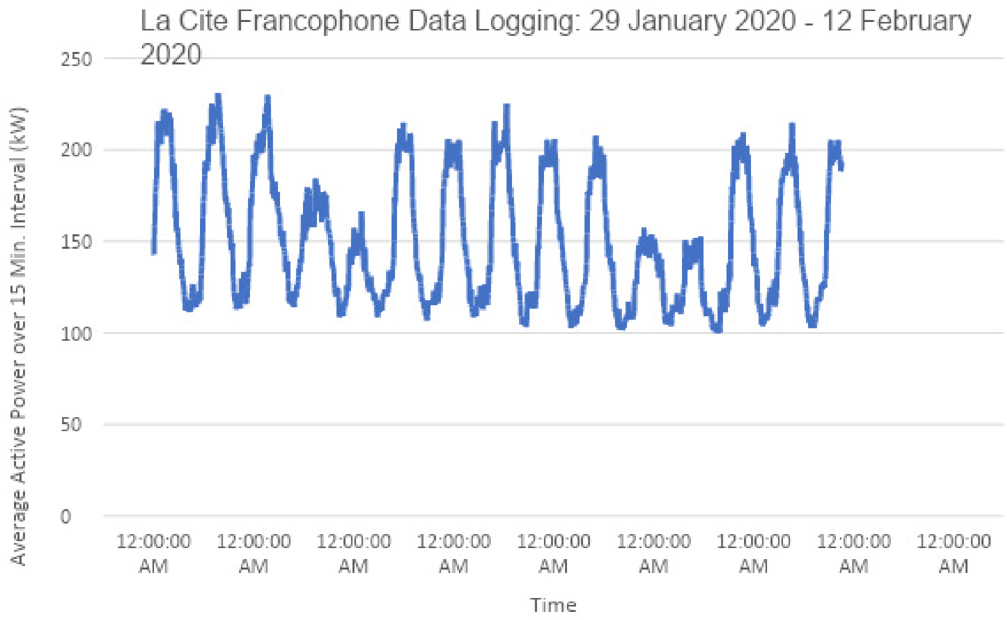
The 1200A main distribution system was monitored over a 2-week period, on 15 minute intervals, to determine a general use profile. We chose to cover the weekend of the Flying Canoe Festival, based on an understanding that this could be the peak winter usage. The meter was installed on 29 January 2020 and removed on 12 February 2020.

In reviewing the data, the following information is seen:

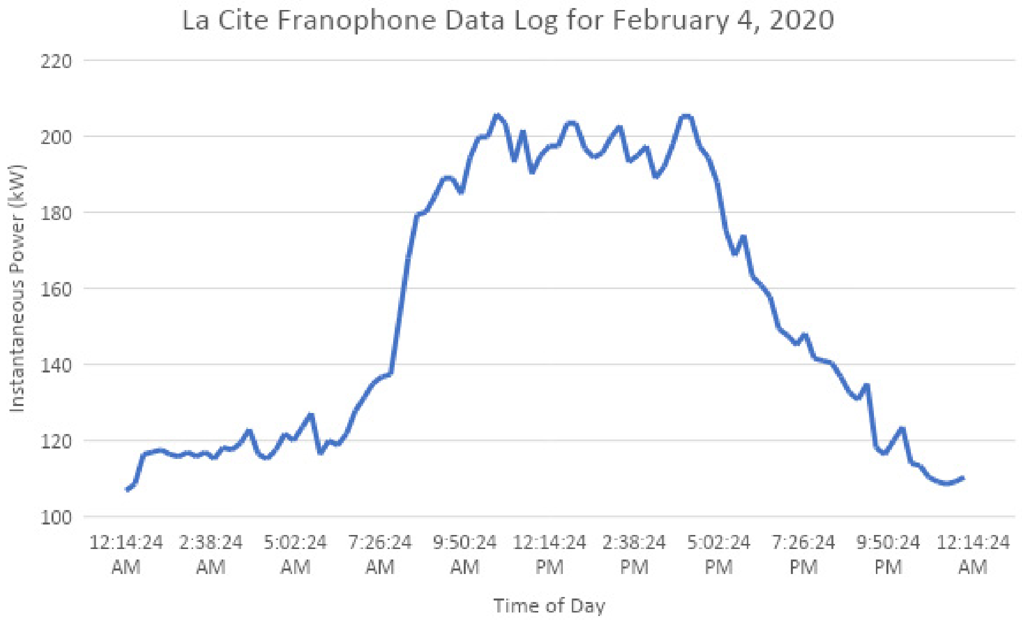
- The voltage within the facility is tapped slightly high, within standard utility tolerances of 5% – The lowest phase to phase voltage being 600.9V and a maximum of 621.6, for a total variation of 3.45%. Rated voltage is 600V.
- Power Factor varies through the day, with a low of 68% and a high of 98%. Depending upon the rate structures, utilities may penalize facilities with power factors under 90%. A low power factor is indicative of inductive (rotating) loads, such as motors, fans, etc., and can be corrected with capacitors.
- The base load (the power that is not turned off at night) is higher than anticipated from the mechanical loads, which implies that some lighting is left on 24 hours. Further, with the loads that come on during the day appear to be lighting, plug load and fan loads, but not all the electrical loads in the building are turned on at the same time, which is an expected situation.
- The weekend load drops, significantly, when compared to weekday loads, due to the offices and health clinic being closed. This means that their lights, computers and other plug loads are not operational during the weekend time-frames.
- A peak usage is noted during the Flying Canoe festival, near 5pm each day. Regular weekday peaks occur near noon or 2:30pm.
- Base load (which is load that is always operational) is 110 kW, while peaks tend to range around 225 kW, which means approximately half of the load runs continuously, while half is non-continuous.



Data Logger Installation - 29 January 2020



Data Logging, weeks of data



Data Logging, February 4, 2020 Data

Looking more closely at a single day, we've highlighted Tuesday, February 4th: The single day shows that most equipment is turned on between 7:45 and 8:30am, coinciding with the time most people arrive at work. At the end of the day, there is less of a distinct "off" time, which is indicative of most of the daytime load being lighting and computers, while most of the base load is mechanical systems. The radio station will also be a contributor to the base load.

Electrical Utility Bills (2017 – 2019)

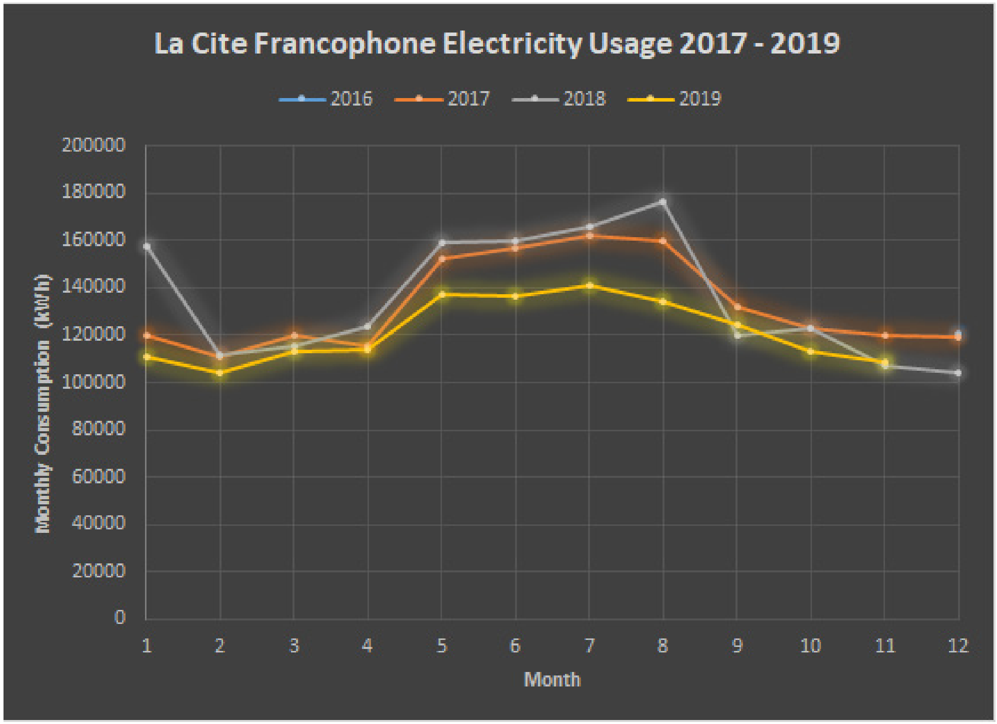
La Cité Francophone supplied the team with 3 years of electrical utility bills, encompassing consumption from December 2016 through to November 2019. The tabulation can be found in Appendix 1.

From the data, the following information is seen:

- La Cité Francophone has a peak electrical usage in the summer months, with no prominent winter peak.
- Electricity usage in 2017 and 2019 were relatively consistent, while 2018 was less consistent – it may be that the metering was less regular that year.
- The electricity consumption in 2019 was 10% less than the consumption in 2017, with a significant decrease in summer peak.

Looking closely at the rates noted within the individual electrical bills, there was a change in rate structure between 2017 and 2018. In 2018, a floating rate for electricity charges was added which increased the cost of electricity, overall. Distribution and transmission charges have remained relatively consistent throughout the time-frame. Total cost per kWh (including fixed, floating and distribution) ranged from $0.09 per kWh in 2017 to as high as $0.18 per kWh in February and May 2019.

For purposes of this energy audit, $0.15 per kWh is used as the current electricity rate, which is the average from 2019. From the data, the average rate increased 45% between 2017 and 2018, and an additional 10% from 2018 to 2019. In preparing return on investment and payback analysis we have predicted flat electrical prices from 2019 through 2020, and then 10% increase year over year.



Interior and Exterior Lighting

The quantity and general types of luminaires was counted from the drawings and verified through the walk-through audit, with the tabulation included in Appendix I. Hours of operation were estimated for each room and area.

82% of the lights in the facility are currently fluorescent based – with a mix of T12, T8, T5 and various compact fluorescent varieties. Fluorescent lighting was the most appropriate, cost effective energy efficient choice for general illumination until around 2014/2015 timeframe, at which point, LED became both cost effective and its white lighting became appropriate for general lighting.

The remaining interior lights are a mixture of Halogen, Incandescent and LED.

Exterior lighting was a mixture of Metal Halide and High-Pressure Sodium. These lamp styles were the industry standard until around 2010/2011 timeframe, at which point LED became the industry standard for exterior illumination, due to its improved optical control, on/off properties allowing occupancy sensors, and dimmability for curfew hours.


LANDFILL
LANDFILL
Basurero
SOILED PAPER / FOOD
COMPOST
Abono
RECYCLABLES
RECYCLE
Reciclaje

4.4 Energy & Resource Conservation Measures

A number of resource and energy conservation measures are applicable for La Cité based on the current age, condition and operational procedures of building systems reviewed. These include everything from simple modifications like changing the location or type of thermostats, to larger retrofits like replacing the gas-fired boilers. There are also many opportunities for utilities savings, given the high rates of electricity consumption during the summer months.

4.4.1 Architectural Opportunities

- Install a main door vestibule or revolving door
- Improve building envelope air tightness
- Replace glazing and window frames; add operable windows
- Consider window shades and exterior sun shades where possible
- Consider replanning/restacking office spaces
- Install an apiary on the roof or away from entrances
- Grow micro-greens that can be used by the café
- Consider permaculture for courtyard landscaping
- Install multi-bin receptacles for compost, recyclables and landfill materials
- Install a compost area on-site
- Consider transforming parking stalls on the upper level of parkade into raised garden beds
- Install living wall in hallway between café and atrium
- Provide bike- and car-share opportunities

4.4.2 Mechanical Opportunities

Many ECMs may be difficult to implement because the cost – such as the cost of replacing personal space heaters with more efficient units – would fall to La Cité's tenants. Furthermore, since the tenants' utilities are included in their rent, and do not fluctuate even when their energy use fluctuates, energy savings (and associated energy cost savings) from such ECMs would not be seen by the tenant, further reducing the incentive to implement ECMs. This problem could be mitigated if utility cost savings could be passed on to the tenants. Alternatively, La Cité could consider paying for such ECMs, knowing that there will be a reduction in energy costs.

ASHRAE Level 2 Audit Summary

The main purpose of an ASHRAE Level 2 energy audit is to provide the building manager/owner with practical measures to reduce the building's energy use to reduce the building's energy cost and environmental footprint. Information is collected for all major building elements (heating systems, cooling systems, building insulation levels, windows, lights, etc.) during a walk-through of the building. Once this information is collected, a building energy model is created to help understand the present state of the building's energy use; this will determine how much energy is used by heating, cooling, hot water, lights, etc. The building's natural gas and electricity bills are reviewed to determine how much energy is used by the building over the course of a year; this helps to calibrate the energy model. Finally, the energy auditor calculates how much energy can be saved by implementing various ECM's (energy conservation measures). The auditor focuses effort on ECM's from both an energy-saving perspective and cost perspective; ECM's with low implementation cost relative to energy savings are prioritized.

One important metric is to determine the greenhouse gas abatement rate for each ECM - what is the cost for each ECM to remove one tonne of CO2 from the atmosphere? This helps determine which ECM's are most worthwhile from an environmental cost perspective. Any ECM's with a GHG abatement rate of under $100-200/ton CO2 are worthwhile to investigate. ECMs with a GHG abatement rate of over $400/ton CO2 are less desirable.

Energy savings are also analyzed from a pure financial perspective: an ECM with a $2000 implementation cost which generates $400/year energy cost savings has a 5 year payback and would be prioritized above an ECM with a $4,000 cost and $200/year energy savings (20 year payback).

[The full ASHRAE Level 2 Audit document can be found in Appendix 5]

Energy Conservation Measures (ECMs)

Many ECMs may be difficult to implement because the cost of the ECM – such as replacing personal space heaters with more efficient units – would be paid for by the tenant, not the building's owner. Furthermore, since the tenant's utilities are included in their rent, and do not fluctuate even when their energy use fluctuates, energy savings (and associated energy cost savings) from such ECMs would not be seen by the tenant, further reducing the incentive to implement ECMs. This problem could be mitigated if utility cost savings could be passed on to the tenants. Alternatively, the building owner could consider paying for such ECMs, knowing that the owner will see a reduction in energy costs.

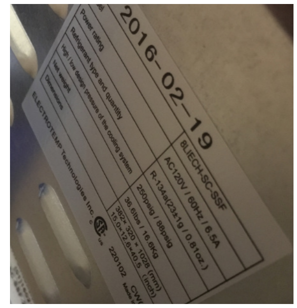
Low Cost ECMs (under $300)

- Install low-flow aerators on all faucets. Aerators cost approximately $7 each and require a simple screw-in installation. It is suggested to use 1.9 LPM aerators, which significantly reduce water use when compared to a typical 8.3 LPM aerator.
- Install a Building Management System.
- Install occupancy-sensing, "smart" thermostats. Although the existing thermostats do reduce the temperature to 16 °C during unoccupied hours, smart thermostats have occupancy sensors and will automatically reduce the thermostat setpoint (in winter) if a space is unoccupied for a pre-set length of time. As such, the setpoint will be reduced during the day (when otherwise it would be set to 22-23 °C) if no one is in the office – for example if a space is vacant mid-week, for holidays, etc.

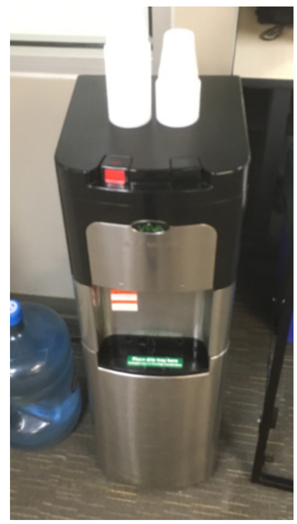
Typical Existing Thermostat

4.4.2 Mechanical Opportunities Cont'd

- Install "Vending Misers" for the two vending machines. These devices cut power to the vending machine periodically during periods of low occupancy or overnight, reducing electricity use. Since the building's two vending machines are refrigerated, and are quite old, significant energy savings could be seen.

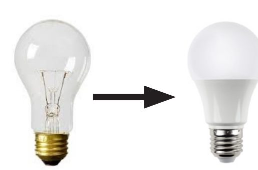


- Install plug-load times on hot/cold water dispensers. The are dozens of hot/ cold water dispensers located in various offices. Installing a $15 plug timer on each unit to automatically cut the power supply overnight will result in electricity savings.



- Replace convective space heaters with radiant-style space heaters. The building contains a high number of personal convective space heaters located typically under the desks of many workstations. Convective space heaters combine a fan and heating element to heat the air surrounding a person and typically use 1500 watts. Radiant space heaters are not designed to heat the air around a person. Instead, they heat a person directly via radiant heat which is much more efficient than heating the air around a person, resulting in approximately 90% less electricity use compared convective style heaters. It is suggested to therefore replace ~1500 watt convective space heaters with 150 watt radiant space heaters, which can be purchased for approximately $80.

- Install LED bulbs in place of incandescent or fluorescent bulbs with standard E26 bases. LED bulbs use roughly 75% less electricity than non-LED A19 bulbs. E26-base bulbs are those with standard dimensions as seen in the image below. A standard LED E26 bulb has a cost of $1.50 each.



Additional Mechanical Opportunities

- Change and Relocate Thermostats / Smart Thermostats
- Recommission Building Systems (check for settings on fresh air, ventilation, air conditioning and heating set points)
- Incorporate Energy Recovery Ventilation (ERVs)
- Replace Older Boilers to higher efficiency boilers
- Replace rooftop units with rooftop heat pumps
- Consider Rain Water Capture/Storage
- Make Up Air Heat Recovery in Cafe
- Air Filtration System (HEPA) for poor air quality days
- Energy Recovery
- Demand Control Ventilation
- Flat panel radiant personal space heaters
- Replace / Install Low flow aerators on taps
- Refrigerator upgrade
- District Energy feasibility study
- Geo-exchange
- Refrigerant additive to AC units to increase AC efficiency
- Air-side economizers on ventilation units

4.4.3 Electrical Opportunities

Photovoltaics

Each of the three roof areas has been measured, and the approximate number of PV panels able to be installed have been calculated, allowing for access between rows for maintenance purposes. Allowing for the intended angles of installation and the hours of available sunlight, an overall PV generation potential has been calculated.
The hours of available sunlight and the production per peak kilowatt of installed arrays are from Environment Canada, for the city of Edmonton, and are not site specific for this level of analysis.

La Cité Francophone – Possible PV System Characteristics

Nominal Power (Peak kilowatt: kWp) – Theatre	53 panels	17 kWp
Nominal Power (Peak kilowatt: kWp) – Phase 2	53 panels	17 kWp
Nominal Power (Peak kilowatt: kWp) - South	16 panels	5 kWp
Nominal Power (Peak kilowatt: kWp) - Glazing	N/A	20 kWp
Wattage per panel	> 320W	
Estimated annual production of energy	38,000 kWh plus Glazing of 25,000 kWh 63,000 kWh Total	
Producibility (kWh/kWp) for Edmonton	1250 (South, at 53 degrees)	
Voltage supply	120/208V 3 Phase	

Table 1 – PV System Potential

Main Power System

Though the existing main power distribution panels are in suitable condition for their age, we recommend the following maintenance and activities:

- Maintenance: a thermal scan to be done as part of general maintenance, to identify hot-spots within the distribution boards, which indicate potential problems with insulation break-down, and premature failures of the system.
- Code: there is a concern about clearance in front of the 1200A panel – to meet current electrical codes, it requires 1.2m clear – a data currently rack impedes upon this clearance. As the panel was installed under earlier codes, no work is required, however relocation of the data rack is recommended when data upgrades occur.
- Maintenance: given the size of the distribution system, and the transformer sizes, a full arc-flash study is recommended, to understand the risk of arc flash potential, and advise maintenance workers and electricians of the proper protective equipment required when working on the existing gear.

*As the above are all maintenance items, cost estimates have not been provided, at this time.

Power Distribution

Submetering is often recommended to understand the loads within the building and control the loads more effectively. The distribution within this building is not conducive to submetering, as the panels are not designed to serve particular loads or areas, but are distributed throughout the building, with various loads and nearby areas served by each panel. As such, we do not recommend submetering at this point in time.

Plug Loads

The building is occupied by a large variety of tenants, with different patterns and habits. Plug load, therefore, can be a difficult thing to control. In 2019, a program was developed to remind La Cité users and tenants about energy usage, and some of the reduction in power consumption in that year can be attributed to this program. Further programs should be developed to keep power usage "front-of-mind" for tenants.

More automated plug load control can be provided by incorporating occupancy sensor power bars into appropriate loads and working with IT to implement power-saver mode on computers, computer screens, and other electronics.The radio tower is currnetly a plug load that is creating a much higher than noraml base energy load. This should be investigated further to potentially reduce energy bills significantly.

Lighting

Because the existing lighting is a mixture of various sources, types and styles, we recommend redesigning the lighting to a consistent light type and style throughout the building, while moving to LED luminaires, throughout the building. In general, similar lighting types would replace similar lighting types.

Refer to Appendix 3 for lighting cut-sheets that are representative.

In addition to the lighting upgrade, we also recommend controls, including daylight sensors, vacancy sensors, timers and occupancy sensors to allow the lights to be used when needed, where needed.

For exit lighting, we recommend replacing all existing exit signs with the green pictogram egress signage. This will provide consistency throughout the facility, continue support the bi-lingual environment, along with providing energy savings.

Lighting Retrofit – Estimated Costs	$522,000
Electricity Savings (kWh per year)	246,000 kWh
Electricity Savings (2019 Rates)	$36,900
Maintenance Savings (materials, only; 2019 costs)	$10,800
Return on Investment (10% annual inflation on electricity, 2% on maintenance)	14%

Table 2 – Lighting Summary

Photovoltaic Potential

The intent of any PV installation will be to utilize the power produced by the PV system, first, offsetting the facility's electrical use, directly, with any excess PV generation sold back to the grid. The ultimate goal is to minimize the building carbon and energy footprint. The system will need to be installed with a protection relay and controller to throttle the energy output of the PV system, should this situation ever arise, in accordance with the Alberta Energy Utility Board requirements.

The system will need to allow for: electrical terminal and combiner boxes, quick-connect electrical connectors, DC wiring, DC disconnects, grid-connected inverters, AC disconnect, AC panelboard and interconnection to the main building distribution. The main distribution has sufficient capacity to allow the incorporation of solar into the distribution, in accordance with the Canadian Electrical Code.

The proposed system will be connected to the building's grounding system. Type 2 LV SPD surge protection will be used at the DC main distribution board. A bonding strategy will be included in the installation and all frameworks will have a common earth.

Maintenance Impact:

Operating and maintenance is made up of inspecting the following components:

- Monitoring, using controlling software and internet uplinks, the inverters, panels, DC and AC equipment
- Cleaning and visual inspections of panels semi-annually for horizontal, annually for vertical
- Additional maintenance and reviews with the annual power system inspections/maintenance
    - Electrical connections
    - Hot spots
    - DC combiner boxes
    - AC electrical panels
    - Inverters
    - Transformers
- Additional maintenance and reviews with the annual roofing inspections
    - Moisture penetration
    - Fixed structures

The expected lifespan of a solar installation is 25 years. Limiting components of the system are the inverters, which may need replacing every 10 – 15 years. The inverters can be purchased with an extended warranty to match the panels.

Inverters

With the opportunity on this site having multiple locations of solar panels, and the various orientations of the roofs, micro-inverters are recommended for this installation. Microinverters connect up to 4 solar panels, and then combine to provide input into the power distribution grid. As photovoltaic panel output is increasing, the micro-inverters are also increasing in their maximum output power. Micro-inverters are mounted directly behind the panels, within the racking system, to minimize additional space requirements within the existing building.

One possible microinverter is:

Mini Inverter Option

MPPT Voltage Range	22 - 45 V
Output Voltage	208V 3 Phase
Nominal MPPT Efficiency	99.5%
Operating temperature	-40°C to 65°C

Table 4: Inverter characteristics

Solar Panels:

The highest efficiency monocrystalline solar panels are recommended. The final specification of the panels will be delayed until closer to the installation date, to maximize the efficiencies, since the efficiencies are increasing, and costs are decreasing for solar panels on at least a semi-annual basis.

For the purposes of design, a 320W black monocrystalline panel by LG is proposed:

Dimensions	1686mm x 1016mm x 40 mm
Weight	20kg
Solar Cell types & dimensions	Monocrystalline 162mm x 162mm
Maximum allowed temperature	-40°C to +90°C
Rated maximum power	320 W

Table 3 - Panel characteristics

Solar PV Review for Opportunity at La Cité

During the 18 December 2019 walk-through, the roofs were reviewed for the potential of adding photovoltaic panels. The review was a visual review of the orientation and penetrations that would impact the solar access but did not assess the structural integrity of the roofs nor their ability to support the additional weight of PV panels. The structural analysis can be completed upon further direction to proceed to the next phase of design.

Glazing:

Incorporating PV within the glazing panels is a definite opportunity in the central "bowl". Such PV cell arrangement can reduce solar gain through the panels by providing shading, reducing the required cooling loads, while also generating power. This type of system has been used, successfully, in a long-term installation in Yellowknife, NWT, at the Greenstone Building (Government of Canada Building), and the Edmonton Convention Centre is currently undergoing this installation.

Replacing glazing is a long-term opportunity for La Cité . When it is time to do this work, the PV could be incorporated at relatively low incremental cost. If the PV is included to provide appropriate shading, it is likely that 50% of the glazing will have PV, with about 75% of that area covered with small panels.

Walls:

From a walk-around of the building, there are no immediate opportunities for wall-mounted PVs, as most of the walls have regular shade from the adjacent buildings and trees.

Theatre Roof

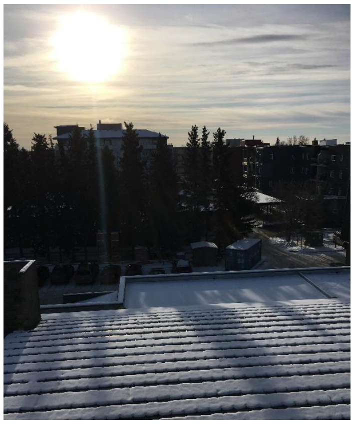
The theatre roof is a domed roof, with half of the dome facing south. The roof is solid (as opposed to glazed) and has a few shadows that pass across from adjacent trees. Placing the PV panels flat on the roof, on a ballasted rack, will have minimal impact to the visual aesthetic of this roof, while generating power.

Phase 2 roof

The sectioned roof of Phase 2 is impeded by a natural gas line serving the roof-top units. With a relocation of this gas line, there are three sections of roof that have potential to use for photovoltaic panels. In these roof sections, the opportunity would be to orient the panels at 15 degrees off of horizontal, to allow some natural shedding of snow, while maintaining a low profile to the roof, that maintains the general aesthetic from the ground. Ballasted support systems could be used to orient the panels.

High South roof

There is one roof on the south side of the building that shows potential to be used to mount PV panels. This location is more hidden from the ground and could have the panels oriented at an optimal angle of 50 – 55 degrees off vertical, utilizing a ballasted support system.


Theatre Roof


High South Roof


Curved Phase 2 Roof

Commercial, Ballasted Racking System:

Where located on the roof structure, walkway and circulation space will be required between the rows for the cleaning and servicing of the panels. The support structures should be designed utilizing lightweight in materials, utilizing commercially available racking systems (ballast secured) and as recommended by the structural engineers. The structural engineers will also incorporate any upgrades required to the roof structure to accommodate the additional weight of this system.

The rack for the roof mounted system will be a commercially available racking system, with ballasting at the base to maintain the location. One example of a roof mounted system is below.

Conclusion

In looking purely at the electrical system, the overall electrical energy use can be reduced by 20%-25% through a lighting retrofit and incorporation of PVs. Further electrical energy reductions can be had by optimizing the mechanical system and the building envelope, contributing to the longevity of La Cité Francophone. The overall return on investment is in the range of 13% for the electrical work, on its own.

APPENDIX 5

ASHRAE Level 2 Report

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T. 780.619.2270
revolveengineering.ca

ASHRAE Level II Energy Assessment

La Cité Francophone
8627 Rue Marie-Anne Gaboury, Edmonton, AB

Prepared For:
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Executive Summary

La Cité Francophone, located at 8627 Rue Marie-Anne Gaboury, Edmonton, AB, was visited by Revolve Engineering Inc. on December 18th, 2019 to gather information for an Ashrae Level II energy assessment. The purpose of the energy assessment is to identify practical measures which can be undertaken to reduce the building's energy use, energy cost and greenhouse gas footprint. Eleven energy conservation measures (ECMs) were assessed, resulting in a recommendation to proceed in the short term on the following five ECMs, ranked from lowest (best) GHG abatement rate to the highest:

ECM #	ECM Description	Estimated Capital Cost	Annual Natural Gas Savings (GJ)	Annual Electricity Savings (kWh)	Annual Energy Savings ($)	Annual GHG savings ($tCO2_e$)	Lifetime GHG savings ($tCO2_e$)	NPV	GHG Abatement Rate ($\$/tCO2_e$)
8	Low flow aerators	$150	11	0	$56	0.6	6	$528	$24
11	Water Cooler Plug Timers	$500	0	3,206	$340	1.9	15	$3,229	$33
6	Programmable Thermostats	$2,100	48	503	$300	2.8	42	$3,339	$50
10	Radiant Space Heaters	$6,400	0	12,960	$1,374	7.5	75	$15,500	$86
1	Demand Control Kitchen Ventilation	$20,000	177	2,314	$1,688	13	187	$9,337	$107

Implementing all five of the recommended ECMs would result in an estimated annual energy reduction of 237 GJ of natural gas, 18,982 kWh of electricity and 26 tonnes of $CO2_e$. The annual cost savings is estimated at $3,759 in the first year. The combined cost of all recommended ECMs is estimated at $29,150.

The remaining six ECMs detailed in this report – which are not presently recommended for implementation – may become viable based on changing energy prices, carbon taxes, changing building use, or financial incentives. Furthermore, although these six ECMs have poor financial incentives, they will reduce the building's environmental impact and as such could be considered for implementation. Two more ECMs are detailed in Section 10.0 for future investigation. In particular, BMS Optimization (Section 10.1) should be considered a high priority for investigation in more detail as soon as it is practical. This ECM is tied to Section 11.0 which discusses issues identified in the Building Management System (BMS).

It is also worth noting some of the ECMs with the highest GHG savings. The table below lists the top 6 ECMs in terms of lifetime GHG savings:

ECM #	ECM Description	Estimated Capital Cost	Annual Natural Gas Savings (GJ)	Annual Electricity Savings (kWh)	Annual Energy Savings ($)	Annual GHG savings ($tCO2_e$)	Lifetime GHG savings ($tCO2_e$)	NPV	GHG Abatement Rate ($/$tCO2_e$)
7	Lighting Upgrade	$426,200	-687	246,183	$22,580	108	857	-$4,455	$497
3	Window and Door Upgrade	$1,000,000	511	4,976	$3,142	29	844	-$873,135	$1,185
4	RTU ERV	$170,000	618	3,400	$3,524	34	525	-$105,333	$324
2	Boiler Upgrade	$50,000	347	0	$1,778	18	373	-$4,217	$134
9	Rooftop Solar PV	$87,500	0	38,032	$3,427	22	269	$34,819	$325
1	Demand Control Kitchen Ventilation	$20,000	177	7,385	$1,688	13	187	$9,337	$107

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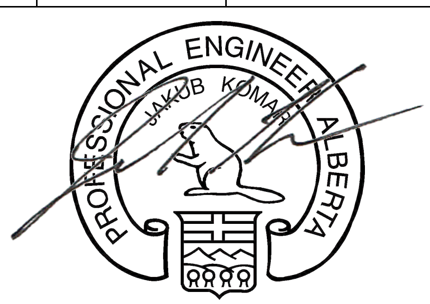
1.0 DISCLAIMER AND LIMITATIONS

This report represents information based on the experience, best judgement, and the quality of information gathered during the site visit, including information provided via discussions and email exchanges with the building's representative. Where complete building information was not available, the auditors estimated values using their best judgement. Energy savings calculated in this report depend on many variables that can change significantly; energy prices, costs to implement, future weather patterns and usage patterns can change widely and have a large impact on the financial viability of any ECMs listed in this report. Revolve Engineering does not guarantee energy savings, NPVs, simple paybacks, energy cost savings, GHG emission savings and capital costs listed in this report. All ECM costs should be verified by qualified contractors before a decision is made to implement.

2.0 REVISION RECORD

Rev	Date	Description	Prepared By	Reviewed By
0	April 27, 2020	Initial Release	Matthew Yarmon, P.Eng, EMIT Jacob Komar, P.Eng	Jacob Komar, P.Eng



2020-04-27

PERMIT TO PRACTICE
REVOLVE ENGINEERING INC.

RM SIGNATURE: ____

RM APEGA ID #: 70530

DATE: 2020-04-27

PERMIT NUMBER: P011229

The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

3.0 Report Overview

This report provides an analysis of La Cité Francophone's existing energy use patterns, including energy costs and greenhouse gas footprint and evaluates a number of energy conservations measures to aid in guiding the building's operator in ways to reduce energy use, energy cost and greenhouse gas footprint.

The building site visit occurred on December 18, 2019 by Matthew Yarmon and Jacob Komar.

4.0 Building Information

La Cité Francophone is a multi-purpose, three-storey facility located at 8627 Rue Marie-Anne Gaboury in Edmonton. The original building (phase one) was opened in 1997. A second phase was added, opening in 2010. In total, the facility has approximately 100,000 square feet of floor area. The facility consists mainly of office space but also contains a commercial kitchen and restaurant, theatre, radio station, dance studio, daycare, doctor's office, various other spaces, and an unheated open-air two-storey parkade.

4.1 Occupancy

The building's opening hours are 7 AM to 9 PM Monday-Friday, 8 AM to 9 PM Saturday and 9 AM to 5 PM Sunday. The building is currently at or near full capacity with few or no empty suites. Most building occupants are employees of the various businesses withing the building, working typically from 8 AM to 5 PM Monday-Friday. There are approximately 150 full time employees working in the building and another 100 part time employees. Additionally, one space is occupied by a 60-seat restaurant with opening hours of 8:30 AM to 9 PM Tuesday-Saturday and 8:30 AM to 5 PM Sunday.

4.2 Building Envelope

The building consists of a two-storey section in addition to two four-storey sections. The exterior finishes are brick and aluminum panels, as shown in Photo 1 below. The roof surface consists of a bituminous membrane. Insulation throughout the building's envelope consists primarily of 50mm rigid polystyrene.

The building's windows are aluminum-framed, dual-pane fixed (inoperable) units.

Photo 1: Building facade

Door seals and window seals were found to be in good condition, see Photo 2 and Photo 3 below.

Photo 2: Door seal detail

Photo 3: Window detail

One window was observed to have evidence of water penetration through the windows seal:

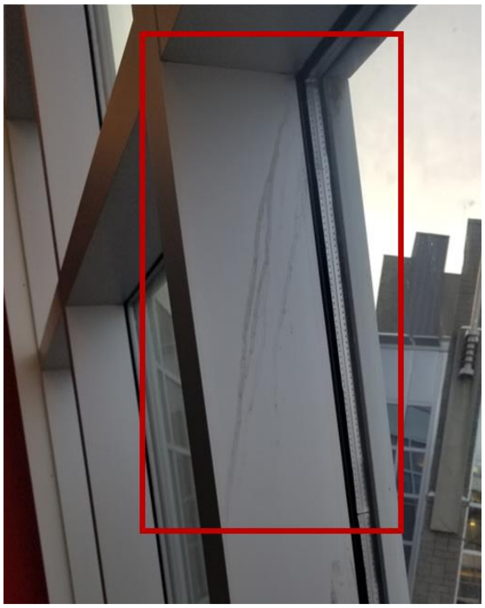


Photo 4: Possible window seal failure

4.3 MECHANICAL

4.3.1 FORCED AIR HEATING, COOLING AND VENTILATION

The facility contains 17 RTUs (packaged Roof Top Units) serving distributed VAV boxes. The RTUs provide ventilation, space heating and space cooling for all spaces within the building other than vestibules and some mechanical rooms and stairways. Five of the RTUs, located on the roof of Pavilion 1, and one RTU behind the theatre were replaced recently (RTU-1, 2, 6, 8, 9); these RTUs were manufactured in 2018 and have a nominal efficiency of 81%. RTUs 10 to 17 were manufactured in 2009 and were installed as part of the Phase 2 construction; these RTU's have a nominal efficiency of 80% with a present-day assumed degraded efficiency of 72%. The remaining four RTUs (RTU-3,4,5,7) were part of the original building construction and were installed in 1997; these have a nominal efficiency of 80% with an assumed degraded present-day efficiency of 64%. In addition, there is a Make Up Air (MUA) unit serving the kitchen, manufactured in 2010. MUA units are typically interlocked with range hood exhaust fans; the MUA is used to provide conditioned air to replace the exhaust air vented by the range hoods.

Photo 5: RTU-6, manufactured in 2018, located on Phase 1 roof

Photo 6: RTU-15 manufactured in 2009, located on Phase 2 roof

Photo 7: Kitchen MUA unit

Space cooling is provided by the packaged RTU's in addition to stand-alone central split air-conditioning units. Based on limited information available, Coefficients of Performance (COPs) for all air conditioning systems are assumed to be COP 3.0.

Photo 8: Air conditioning condenser

The building director noted that all RTUs other than the four RTUs manufactured in 2018 (RTU-1, 2, 6, 8, 9) are scheduled to be replaced within three to four years.

Each individual RTU provides fresh air (ventilation) to each individual zone. The outside air percentage in each unit varies between 15-20% of the total RTU's airflow. One MUA unit provides fresh air to the kitchen, in conjunction with a 5 hp (3.7 kW) exhaust fan. Additionally, there are approximately 20 smaller exhaust fans (ranging from 20 watts up to 250 watts) including bathroom exhaust fans throughout the building and on the roof.

4.3.2 HYDRONIC HEATING

Hydronic force-flow heaters are located in stairwells and vestibules, see Photo 9 and Photo 10 below. The forced-flow heaters are controlled by manual, non-programmable thermostats. Finned-type radiators are located along the perimeter of the building where glazing is present, see Photo 11 below.

Photo 9: Forced-flow hydronic heater in stairwell

Photo 10: Entryway hydronic radiant heater, with manual thermostat above

Photo 11: Perimeter radiant hydronic baseboard heater at base of windows (left), shown with cover removed (right)

Hot water for the hydronic radiant heaters is provided by the building's two boilers, shown in Photo 12 (a) and 12 (b) below . The Raytherm boiler in Phase 1 is approximately 24 years old with an input capacity of 1,100 MBH/h. Its efficiency when new is estimated to have been 80%; its efficiency today is estimated to be 63% due to normal degradation. The Raytherm boiler in Phase 2 was manufactured in 2017. Its nameplate efficiency is 85%; its efficiency today is estimated to be 84%.

Photo 12 (a) and (b): Phase 1 boiler (left), Phase 2 boiler (right)

4.4 DOMESTIC HOT WATER

The building's domestic hot water supply is provided by an 80% efficient 71-gallon natural-gas storage tank heater in Phase One and two 96% high-efficiency 100-gallon condensing natural-gas storage tank heaters in Phase Two. The restaurant also has a small electric boiler used for dishwashing purposes.

Photo 13: Phase 1 hot water tank (left), Phase 2 hot water tanks (centre, right)

4.5 ELECTRICAL SYSTEMS

4.5.1 LIGHTING

An inventory of the building's lights is shown in Table 1 below, including all interior, exterior and parkade lighting. Lights with the highest wattage are the theatre lights (750-1000 watts each), and the 450-watt metal-halide parkade lights. Occupancy sensors (Photo 14) are used in some washrooms to turn off the lights automatically when not needed.

Photo 14: La Cité Occupancy Sensor

Table 1: La Cité Lighting Inventory

Type	Qty	Watts Per Fixture	Total Watts
1'x4' Surface Wrap Around FL	75	76	5,700
1" x 4' Drywall FL, Dual T12	3	76	228
1200mm Dual T5 FL Strip	74	54	3,996
1200mm Dual T8 FL Strip	13	64	832
1200mm Dual T8 FL Strip w/ Wireguard	87	64	5,568
1200mm Dual T8 FL Wall Bracket	25	64	1,600
1'x4' Metalux Troffer, dual T12	325	76	24,700
2' & 4' Metalux FL Strip, dual T12	42	76	3,192
2' and 4' FL Strip T12	25	76	1,900
2X2 LED PANEL	1	30	30
2x4 dual t12	2	76	152
2x4 dual t5	2	56	112
300x1200mm FL Troffer, Dual T8	194	64	12,416
4' Metalux Wall Mount, dual T12	22	76	1,672
4' single T12 Valence Strip	15	76	1,140
6" Recessed FL Downlight	108	32	3,456
6" Recessed FL Shower Downlight	1	32	32
600mm Dual T8 FL Strip	8	64	512
750-1000w ea, 50% duty cycle, 280 SHOWS, 2 HRS EA	110	800	88,000
8" FL Downlight	84	28	2,352
A19	4	70	280
Area Light MH	7	102	714
Decorative A19 Sconce	28	90	2,520
DOUBLE BASKET T5 2X4	71	64	4,544
DOUBLE BASKET T8 2X4	229	64	14,656
EXIT Signage, variety	60	8	480
FL Wall Sconce	3	32	96
Halogen vanity	2	50	100
LED A19	32	11	352
LED POTS	17	11	187
LED Vanity A19	6	11	66
MH Floodlight	10	182	1,820
MH Surface Parkade	32	165	5,280
Outside MH Sconce	2	75	150
Outside Uplight MH	4	182	728
Par 36 Incandesent Downlight	8	90	720
Par 38 Incandesent Cylinder	14	90	1,260
Par 38 Incandesent Cylinder	2	90	180

Parking Lot MH	4	420	1,680
Recessed Downlight	8	28	224
Sensilite LCF124FL	10	13	130
SINGLE T5 1X4	157	28	4,396
SINGLE T8 1X4	6	32	192
Track Head	5	28	140
Wall Mount MH Downlight	6	75	450

4.5.2 Plug Loads

There are a variety of plug loads throughout the building. Most offices have a photocopier, coffee maker, fridge, microwave, water cooler, computers and several personal convective-style space heaters.

Photo 15: La Cité Typical Office Kitchen Plug Loads

4.5.3 Pumps

According to drawings reviewed by the energy auditors, there are 11 sump pumps (3 HP to 5 HP), two 5 HP heating pumps, and two snow melt pumps (size unknown).

Photo 16: Boiler water circulation pump

4.5.4 KITCHEN, RADIO STATION, ELEVATORS

Additional electricity end-use is allocated to the Cafe Bicyclette restaurant, radio station and two elevators. The radio station transmits its signal directly from the building.

5.0 UTILITY BILL SUMMARY

Three years of monthly natural gas and electricity bills were reviewed for La Cité, from 2017 to 2019, and are summarized below. Electricity for the building is provided by EPCOR. As of February 2019, natural gas has been provided by Campus Energy; prior to this date the provider was Alta Gas.

5.1 ELECTRICITY

Table 2 shows annual electrical consumption and cost. The cost shown include all items on the bill, including GST. Electricity consumption in 2019 was approximately 10% lower than the previous two years. A cost of 10.6 cents per kWh was used to calculate electricity savings associated with the various ECM's in Section 7.0, consisting of 6 cents per kWh of electrical energy and 4.6 cents/kWh of transmission and distribution charges (this blended rate is an estimate based on current bills that accounts for fixed charges not related to consumption). Electricity consumption for the parking stall plug-ins and the radio station equipment were not modeled which results in a smaller modeled electricity usage (1,350,511 kWh) compared to the building's actual electricity consumption (average 1,551,967 kWh).

Table 2: Annual Electricity Usage and Cost

Year	2017	2018	2019	Average	(Model)
Electricity Use (kWh)	1,590,873	1,623,541	1,441,488	1,551,967	1,350,511
Cost	$156,126	$230,479	$220,788	$202,464	n/a

Figure 1 shows electricity usage variation throughout the year. Peak electricity usage is seen in the summer months, likely as a result of higher air conditioning use. It can be seen that electricity use patterns are relatively consisted from one year to the next. The blue line indicates the computer energy model simulated electricity use.

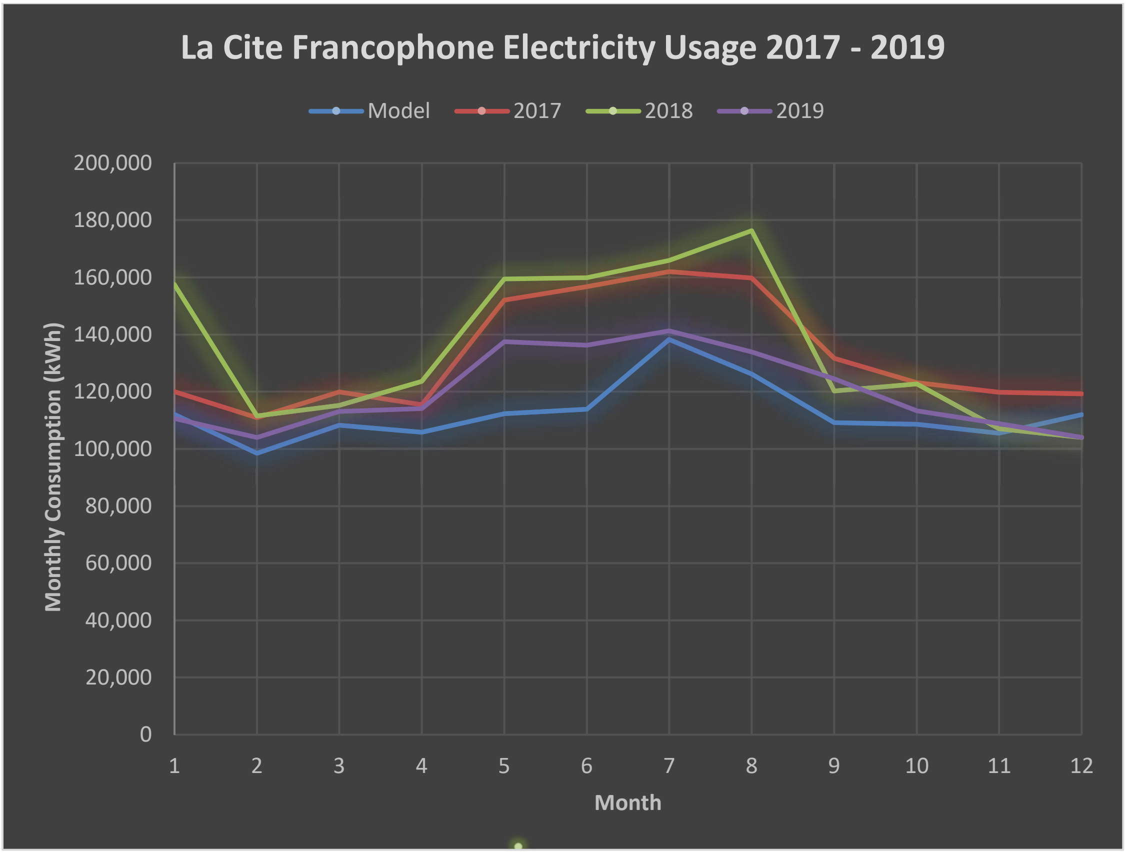


Figure 1: Monthly electricity consumption

5.2 NATURAL GAS

Table 3 shows annual natural gas consumption and cost. The cost shown includes all items on the bill, including GST. Annual natural gas use is trending up, increasing by 10.2% between 2017 and 2018 and another 4.3 % between 2018 and 2019. Modeled natural gas consumption is 9,815 GJ; this is lower than the "actual" average in part because the parkade parking ramp snow-melt system is not included in the model. A cost of $2.50/GJ was used to calculate natural gas savings associated with the various ECM's in Section 7.0.

Table 3: Annual natural gas use

Year	2017	2018	2019	Average	(Model)
Natural Gas Use (GJ)	10,365	11,419	11,915	11,233	9,815
Cost	$52,192	$57,205	$55,689	$55,029	n/a

Figure 2 shows natural gas usage variation throughout the year. As expected, consumption increases over the winter months and is lowest over the summer months. Usage shown over the summer months, approximately 300 GJ per month, is most likely entirely being used for domestic hot water heating. Consumption patterns are consistent from one year to the next. The blue line indicates the computer energy model simulated natural gas use.

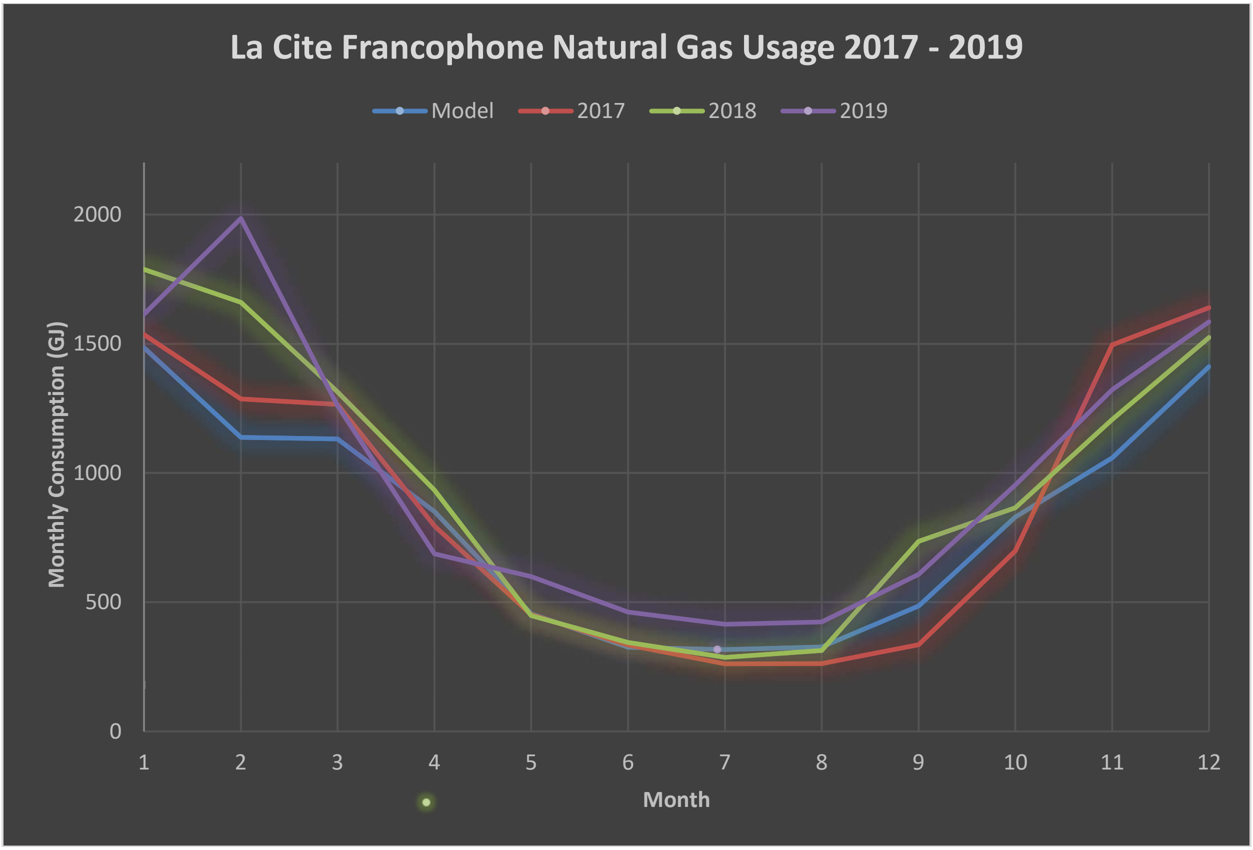
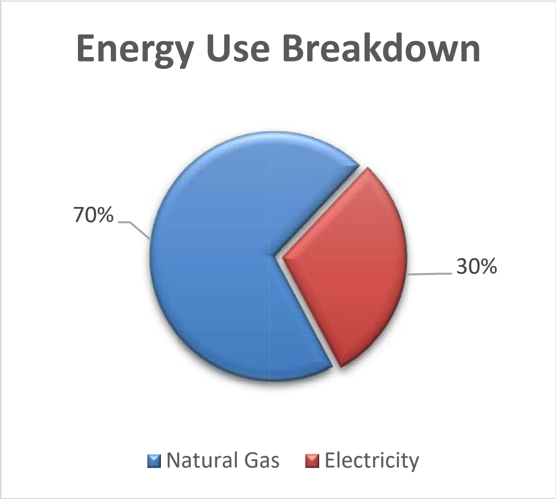


Figure 2: Monthly natural gas consumption

5.3 ENERGY BREAKDOWN

Figure 3 below show that 70% of energy use is from natural gas while the remaining 30% is from electricity. Even though natural gas use exceeds electricity use, since electrical energy is several times more expensive per GJ than natural gas, electricity costs far exceed natural gas costs, as shown in Figure 3. This suggests that there are likely more opportunities to save energy costs by electricity reduction than from natural gas reduction (based on today's energy prices).



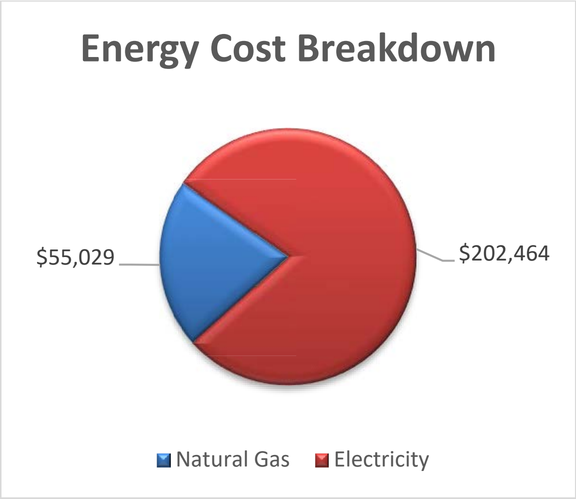


Figure 3: Building end use and energy cost breakdown

Although significantly less electrical energy is used by the building than natural gas, it can be seen that 64% of the building's GHG emissions are from electricity; this is because Alberta's electricity grid primarily relies upon fossil-fuel power plants as opposed to less carbon-intensive electricity sources such hydro-electric power plants (British Columbia). Electricity generated off-site needs to be transmitted over long distances, resulting in efficiency losses, further increasing the associated GHG emissions per unit of electricity. It can be inferred that there are likely more opportunities to reduce the building's associated GHG emissions via electricity reduction than from natural gas reduction. Please note our analysis does not take into account the increased GHG emissions associated with fugitive methane emissions associated with natural gas extraction, processing and delivery; neither for natural gas or on the grid. Furthermore, it should also be noted that as the grid intensity factor decreases over time, so will the associated emissions; the natural gas emissions are fixed.

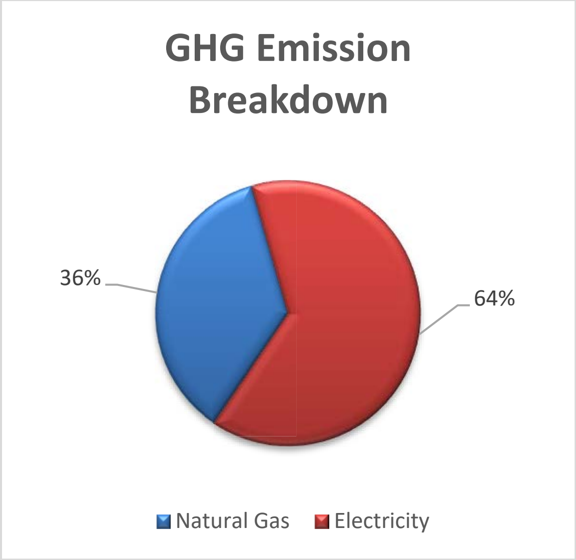


Figure 4: Building GHG emission breakdown

The building's modeled energy end-use breakdown is shown in Figure 5 below. Space heating is the largest component of energy use at 62%, followed by lights at 17% and fans at 7%.

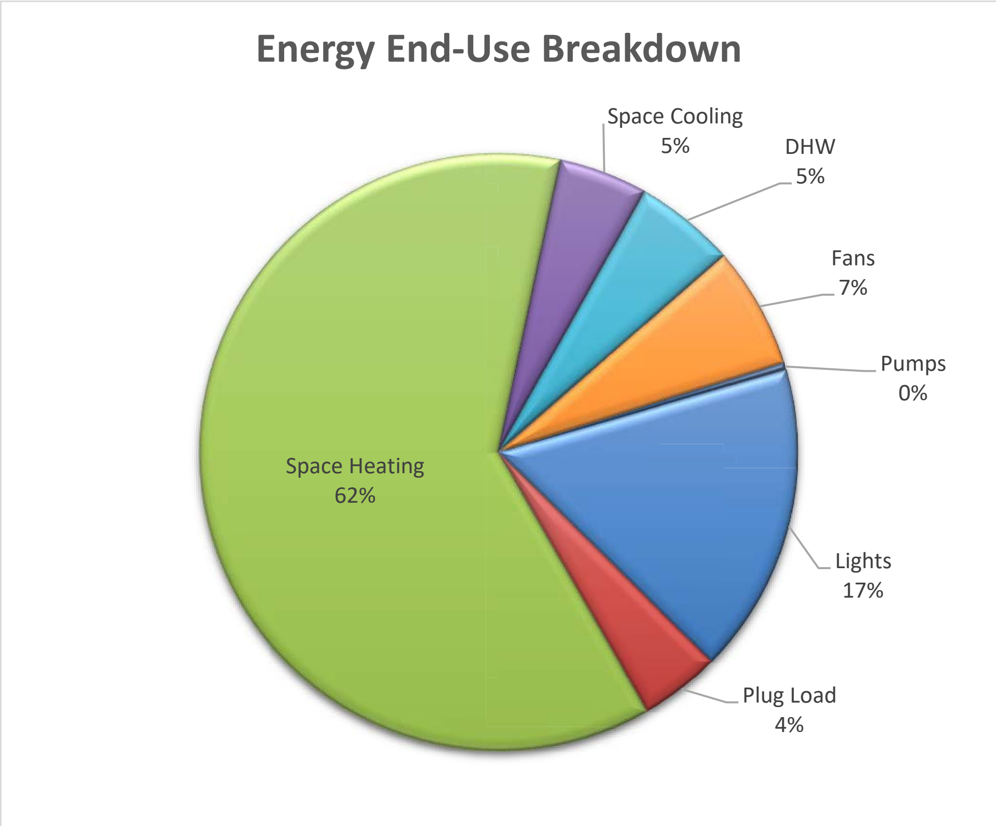


Figure 5: Modeled Energy End-Use Breakdown

6.0 ENERGY USE INTENSITY (EUI)

The building's energy use intensity, measured as total annual electricity and natural gas consumption (GJ) divided by floor area (m^2), was compared to similar buildings. Figure 6 below compares La Cité Francophone's energy intensity of 1.87 GJ/m^2 (519 kWh/m^2) with other benchmarks. Note that La Cité Francophone's EUI is likely inflated compared to the Offices benchmarks as most offices do not have a restaurant, radio station and snow-melt system. The most relevant comparison is the Edmonton – Offices[1] benchmark value of 1.62 GJ/m^2 and the report's 2000-2010 buildings value of 1.90 GJ/m^2. La Cité Francophone's EUI is within these two Edmonton benchmarks; it can be suggested that the building's energy use is typical for an office in Edmonton built circa 2000. The Canadian Energy Star[2] benchmark value for all office buildings in Canada has a much lower EUI of 1.00 GJ/m^2, however it is a less reliable benchmark than the others as it is Canada-wide; some regions of the country have smaller heating and cooling requirements.

1 https://www.edmonton.ca/programs_services/documents/PDF/BuildingEnergyBenchmarking-AnnualReport-Year2.pdf

2 https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/Canadian%20National%20Median%20Tables-EN-Aug2018-7.pdf

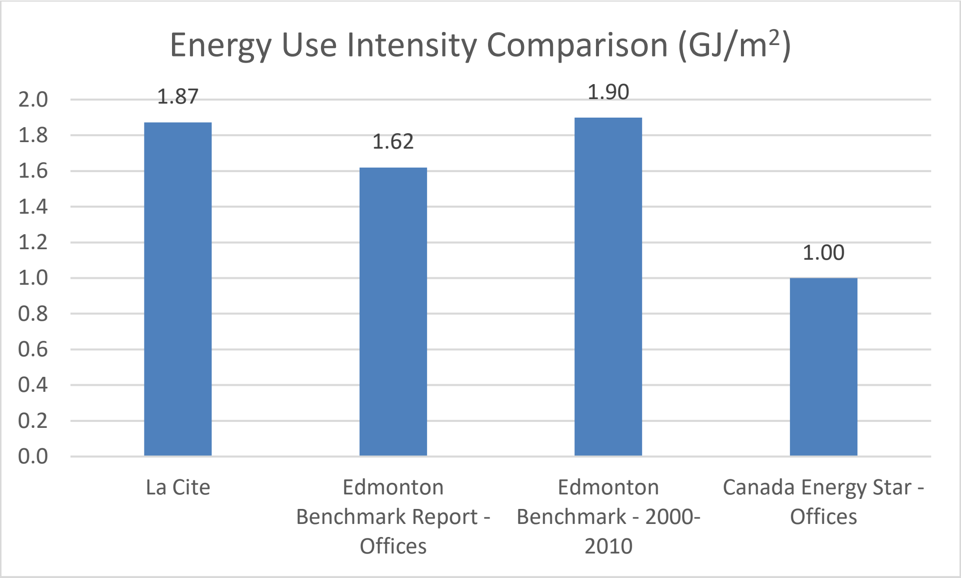


Figure 6: Energy Use Intensity Comparison

7.0 ENERGY CONSERVATION MEASURES

The Energy Conservation Measures (ECM's) assessed in this report have been analyzed based on the savings rates as listed in Table 4 below. The electricity GHG emission rate could be expected to drop in the coming years as Alberta's electricity grid continues to reduce use of fossil fuel based power generation (especially coal) and shifts towards renewable sources of electricity (this has been accounted for in the GHG savings calculation). The energy savings rates listed are based on the building's utility bills from January – December 2019.

Table 4: ECM GHG abatement and $ saving rates

GHG emission rates		
Natural Gas	0.05	t_{CO2e}/GJ
Electricity	0.00061	t_{CO2e}/kWh
Energy cost savings rates		
Natural Gas	$2.50	$/GJ
Electricity	$0.10	$/kWh

The Net Present Value (NPV) calculations are based on a discount rate of 3.05% (based on current mortgage cost) and assumed natural gas and electricity annual rate increases of 5.1% and 3.0% respectively. The financial viability of the ECMs analyzed are based in large part to these percentages. It should also be noted that design costs are *not* included in the ECM costs.

Table 5: NPV and Utility Cost Price Increases

Financial Metrics	
NPV Discount Rate	3.05%
Natural Gas Annual Price Increase	5.1%
Electricity Annual Price Increase	3.0%

The analysis also takes into account the escalating cost of the existing carbon tax, currently at $30/tonne and going up to $50/tonne by 2022 (as per federal mandate). The analysis starts with the 2022 rate ($2.62 per GJ) to account for the fact that most larger ECMs might not be completed until 2022. To account for changes in future climate policy, it is also assumed that the carbon tax will increase at a rate of 5.1% per year past 2022. While the increases might not be linear in reality, we believe this is a reasonable assumption.

Note regarding assumptions:

The above assumptions have been made based on historical energy costs, escalation rates, current climate policy etc… using credible sources whenever available. However, it should be noted that we are entering a time of very rapid transition in terms of climate policy, energy transition, energy systems and political landscape. Recent events surrounding COVID-19 have only exacerbated the uncertainty in forecasting the future energy landscape. The recommendations made in this report are based on the assumed starting energy costs, escalation rates, carbon taxes etc… but we will be the first to recognize that our assumptions may look silly even within a few years time depending on many factors beyond our control.

Currently, many ECMs don't look very attractive from a financial standpoint. This is mostly due to very low natural gas prices; making upgrades tough to justify financially. We would caution against the assumption that this will continue for too much longer. ECMs that looked very unattractive financially may become very attractive if energy prices or carbon taxes spike. This uncertainty should be kept in mind when reviewing the calculations for each ECM. Our general opinion is that using less energy will always be a good strategy going into the future.

7.1 ECM 1 – Demand Control Kitchen Ventilation (DCKV)

7.1.1 ECM Scope

This ECM will determine the feasibility of adding automatic controls to the Café Bicyclette restaurant kitchen ventilation system. Demand control kitchen ventilation works by means of sensors placed within the exhaust system; the sensors determine how many litres/second of fresh air and ventilation air are needed by measuring the amount of cooking activity. In this way, if there are relatively low levels of steam and smoke, the fans will operate at a lower speed thereby reducing both fan power and reducing the amount of natural gas required by the makeup-air unit to heat the fresh supply air. During periods of heavy cooking activity, the system will increase the volumes of supply and ventilation air accordingly.

7.1.2 EXISTING CONDITIONS AND ASSUMPTIONS

The kitchen ventilation system primarily consists of two Halton range hoods, understood to have been installed circa 2010. The range hoods are interlocked with a supply fan and Make Up Air (MUA) unit on the roof. The MUA unit has a 5 HP fan with a capacity of 2666 L/s and a maximum heating output of 683,650 btu/h. It is assumed that range hoods are used, on average, at maximum capacity for three hours per day throughout the year and that their maximum combined fan capacity and power is 2666 L/s and 5 HP respectively.

Photo 17: Large kitchen exhaust fan (left), MUA unit is seen on right in background

7.1.3 ECM DETAILS AND ASSUMPTIONS

It is assumed that the Demand Control Kitchen Ventilation system will reduce average exhaust and fresh air volumes by 40%, from 2666 L/s to 1600 L/s. Fan power will be reduced alongside reductions in air volumes. The operating hours per day are assumed to remain the same at three hours per day.

7.1.4 RESULTS AND RECOMMENDATION

Table 6: ECM 1 Summary

ECM Energy Details	**Natural Gas**	**Electricity**	**Total**
Units	**GJ**	**kWh**	**GJ**
Annual Energy Use - Baseline	9,815	1,350,511	14,673
Annual Energy Use - ECM	9,638	1,343,126	14,470
Annual Energy Savings	177	7,385	203
ECM GHG and Cost Savings	**Natural Gas**	**Electricity**	**Total**
First Year GHG reduction ($tCO2_e$)	9.0	4.3	13.3

First Year Cost Savings	$905	$783	$1,688
Financial Analysis			
Equipment Lifetime (years)	15		
Equipment Capital Cost	$20,000		
First Year Utility Cost Savings	$1,688		
NPV	$9,337		
Simple Payback (years)	11		
Lifetime Cost Savings	$29,337		
Lifetime GHG Savings ($tCO2_e$)	187		
GHG Abatement Rate ($/$tCO2_e$)	$107		

Based on the positive NPV and relatively low GHG abatement rate, it is recommended to proceed with this ECM, or at least move forward with getting a more detailed cost estimate.

7.2 ECM 2 – Boiler Upgrade

7.2.1 ECM Scope

This ECM will determine the feasibility of replacing the old Phase 1 boiler with a new, 88% near-condensing boiler.

7.2.2 Existing Conditions and Assumptions

The building has two boilers; a Raytherm unit manufactured in 1996 and a newer Dynaflame boiler manufactured in 2017. This ECM is only considering replacing the Raytherm boiler, which is used for perimeter, stairwell and entranceway radiant heaters in Phase 1 of the building.

The Raytherm boiler has a nameplate efficiency of 80% with an estimated present-day degraded efficiency of 63%.

7.2.3 ECM Details and Assumptions

It is assumed that the Raytherm boiler will be replaced with a near-condensing boiler with the same heating capacity and an efficiency of 88%. The new boiler will be connected to the same heating terminal units and will operate under the same space conditions (temperature setpoints, ventilation amounts, etc).

7.2.4 Results and Recommendation

Table 7: ECM 2 Summary

ECM Energy Details	Natural Gas	Electricity	Total
Units	**GJ**	**kWh**	**GJ**
Annual Energy Use - Baseline	9,815	1,350,511	14,673
Annual Energy Use - ECM	9,468	1,350,511	14,326
Annual Energy Savings	347	0	347

ECM GHG and Cost Savings	Natural Gas	Electricity	Total
First Year GHG reduction ($tCO2_e$)	17.7	0.0	17.7
First Year Cost Savings	$1,778	$0	$1,778
Financial Analysis			
Equipment Lifetime (years)	20		
Equipment Capital Cost	$50,000		
First Year Utility Cost Savings	$1,778		
NPV	-$4,217		
Simple Payback (years)	22		
Lifetime Cost Savings	$45,783		
Lifetime GHG Savings ($tCO2_e$)	373		
GHG Abatement Rate ($/$tCO2_e$)	$134		

This ECM has a negative NPV and a relatively long simple payback. It does have a relatively low GHG abatement rate of $134/$tCO2_e$ but considering the long payback and risk of fossil fuel assets becoming obsolete in the next 10 years, it is not recommended to proceed with this ECM.

7.3 ECM 3 – Window and Door Upgrade

7.3.1 ECM Scope

This ECM will determine the feasibility of replacing all external windows, including the glazed man-doors, with high performance windows; doing so will reduce heat loss in the winter, reduce heat gain in the summer and will also reduce air infiltration through the window itself.

7.3.2 Existing Conditions and Assumptions

The building has approximately 1,245 square meters of glazing (including all external windows and glazed doors). The glazing is dual-pane, aluminum-framed with air between panes, with a USI value of approximately 1.9 W/m^{2}K. It was noticed that some of windows had a compromised seal resulting in moisture ingress between the panes; this will of course also cause reduced window performance.

7.3.3 ECM Details and Assumptions

For the purposes of this ECM, it is assumed that windows with a USI value of 0.9 W/m^{2}K are installed. These windows are triple-pane, argon-filled and have frames manufactured from fiberglass. The fiberglass material helps to reduce thermal bridging through the window frame.

7.3.4 Results and Recommendation

Table 8: ECM 3 Summary

ECM Energy Details	Natural Gas	Electricity	Total
Units	**GJ**	**kWh**	**GJ**

Annual Energy Use - Baseline	9,815	1,350,511	14,673
Annual Energy Use - ECM	9,304	1,340,559	14,127
Annual Energy Savings	511	4,976	529
ECM GHG and Cost Savings	**Natural Gas**	**Electricity**	**Total**
First Year GHG reduction ($tCO2_e$)	26.1	2.9	29.0
First Year Cost Savings	$2,615	$527	$3,142
Financial Analysis			
Equipment Lifetime (years)	30		
Equipment Capital Cost	$1,000,000		
First Year Utility Cost Savings	$3,142		
NPV	-$873,135		
Simple Payback (years)	318		
Lifetime Cost Savings	$126,865		
Lifetime GHG Savings ($tCO2_e$)	844		
GHG Abatement Rate ($/$tCO2_e$)	$1,185		

Due to the very large negative NPV and high GHG abatement rate, this ECM is not recommended for implementation at this time. It may be considered once the existing windows have reached the end of their useful life, typically 30 years from when they were installed. The low cost of natural gas and very high capital costs results in a very poor NPV. Higher natural gas prices would improve the financial viability of this ECM.

7.4 ECM 4 – RTU ERV

7.4.1 ECM SCOPE

This ECM will determine the feasibility of installing bolt-on ERV's onto the building's 17 Roof Top Units (RTU's). In the heating season, ERV's function by transferring heat from already-conditioned exhaust air into incoming outdoor (supply) air. This reduces the amount of energy leaving the building when air is exhausted from the building.

Photo 18: Energy Recovery Ventilator

7.4.2 EXISTING CONDITIONS

The building has 17 Roof Top Units which are used for space heating, space cooling and to provide fresh air to the building. The RTUs range in age from 2 to 23 years old.

7.4.3 ECM DETAILS AND ASSUMPTIONS

It is assumed that there is enough physical space to install an ERV on each of the 17 RTU's; however, it may not be possible to install an ERV in some cases. The ERV's are assumed to operate at an efficiency of 72% sensible efficiency and 65% latent heat efficiency; each ERV is assumed to have a 0.1 kW power demand for running the wheel and accessories.

7.4.4 RESULTS AND RECOMMENDATION

Table 9: ECM 4 Summary

ECM Energy Details	Natural Gas	Electricity	Total
Units	GJ	kWh	GJ
Annual Energy Use - Baseline	9,815	1,350,511	14,673
Annual Energy Use - ECM	9,197	1,347,111	14,043
Annual Energy Savings	618	3,400	630
ECM GHG and Cost Savings	**Natural Gas**	**Electricity**	**Total**
First Year GHG reduction ($tCO2_e$)	31.6	2.0	33.6
First Year Cost Savings	$3,164	$360	$3,524
Financial Analysis			
Equipment Lifetime (years)	15		
Equipment Capital Cost Estimate	$170,000		

First Year Utility Cost Savings	$3,524
NPV	-$105,333
Simple Payback (years)	34
Lifetime Cost Savings	$64,667
Lifetime GHG Savings ($tCO2_e$)	525
GHG Abatement Rate ($/$tCO2_e$)	$324

Due to the large negative NPV and high GHG abatement rate, this ECM is not recommended. This ECM is often one of the most attractive upgrades to a building, however, for several reasons, it is not as attractive in this case. The reasons for this are, first, that the air distribution and ventilation is distributed around 17 separate RTUs, thus necessitating 17 separate upgrades, which is obviously more expensive than in a centralized option. The second reason is that the outdoor air ventilation percentage is relatively small in each unit (15-20%) and that the efficiency of these bolt-on units isn't as high as can be achieved with a centralized dual-core unit. The fact that the exhaust ductwork isn't exhausted to a central location is also a problem (necessitating the use of return air instead of exhaust air (for recovery) in many cases).

7.5 ECM 5 – Replacing Front Door with Revolving Door

7.5.1 ECM Scope

This ECM will determine the feasibility of replacing the west-facing main entrance door with a revolving door.

7.5.2 Existing Conditions and Assumptions

The main west entrance to the building consists of an aluminum-framed glazed door measuring 2.5 m wide x 2.5 m tall. Unlike the north-facing entrance on the first floor, there is no vestibule at the east-entrance. A vestibule acts as a barrier to prevent excessive outdoor air infiltration. Excess infiltration increases the building's heating demand in the winter and cooling demand in the summer. It is assumed that the lack of a vestibule at the east entrance results in 100 l/s of air infiltration that would otherwise not be present. Please note that estimating the actual infiltration is very difficult, this is simply an estimate based on modelling experience.

Photo 19: East-facing main entrance door

7.5.3 ECM DETAILS AND ASSUMPTIONS

It is proposed to replace the 2.5 m x 2.5 m standard door with a revolving door, as building a vestibule would be less practical. Reduction in air infiltration is assumed to be 100 l/s during the building's occupied hours.

7.5.4 Results and Recommendation

Table 10: ECM 5 Summary

ECM Energy Details	Natural Gas	Electricity	Total
Units	GJ	kWh	GJ
Annual Energy Use - Baseline	9,815	1,350,511	14,673
Annual Energy Use - ECM	9,793	1,350,511	14,651
Annual Energy Savings	22	0	22
ECM GHG and Cost Savings	**Natural Gas**	**Electricity**	**Total**
First Year GHG reduction ($tCO2_e$)	1.1	0.0	1.1
First Year Cost Savings	$114	$0	$114
Financial Analysis			
Equipment Lifetime (years)	25		
Equipment Capital Cost Estimate	$30,000		
First Year Utility Cost Savings	$114		
NPV	-$26,164		
Simple Payback (years)	263		
Lifetime Cost Savings	$3,836		
Lifetime GHG Savings ($tCO2_e$)	30		
GHG Abatement Rate ($/$tCO2_e$)	$1,013		

Due to the low energy savings relative to the cost to implement this ECM, and the high GHG abatement rate of $1,013/$tCO2_e$, it is not recommended to proceed with implementation of this ECM.

It should be noted that one relatively easy fix related to this ECM is the relocation of the thermostat that is near the door and on an exterior wall. Relocating this thermostat could significantly reduce the runtime of the associated RTU. It is recommended to relocate this thermostat immediately.

7.6 ECM 6 – Programmable Thermostats

7.6.1 ECM Scope

This ECM will determine the feasibility of replacing non-programmable thermostats with programmable thermostats.

7.6.2 Existing Conditions and Assumptions

Based on an interview of the building director, it is understood that all areas other than entryways have thermostats set to 22-23 °C during occupied hours and 16 °C overnight. The thermostats in most entryways are manual thermostats (see Photo 20 below) and have no overnight setback.

Photo 20: La Cité vestibule non-programmable thermostats

7.6.3 ECM Details and Assumptions

For the purposes of calculating energy savings, it is assumed that programmable thermostats will be installed in seven locations and that these thermostats will be programmed to 20°C during occupied hours and 16°C during unoccupied hours. Estimated cost, including installation is $300 per programmable thermostat.

7.6.4 Results and Recommendation

Table 11: ECM 6 Summary

ECM Energy Details	**Natural Gas**	**Electricity**	**Total**
Units	**GJ**	**kWh**	**GJ**
Annual Energy Use - Baseline	9,815	1,350,511	14,673
Annual Energy Use - ECM	9,767	1,350,007	14,623
Annual Energy Savings	48	503	50
ECM GHG and Cost Savings	**Natural Gas**	**Electricity**	**Total**
First Year GHG reduction ($tCO2_e$)	2.5	0.3	2.8
First Year Cost Savings	$246	$53	$300

Financial Analysis	
Equipment Lifetime (years)	15
Equipment Capital Cost Estimate	$2,100
First Year Utility Cost Savings	$300
NPV	$3,339
Simple Payback (years)	6
Lifetime Cost Savings	$5,439
Lifetime GHG Savings ($tCO2_e$)	42
GHG Abatement Rate ($/$tCO2_e$)	$50

Based on the low capital cost, positive NPV, short payback, and low GHG abatement rate, it is recommended to proceed with this ECM.

7.7 ECM 7 – LIGHTING UPGRADE

7.7.1 ECM SCOPE

This ECM will determine the feasibility of replacing interior and exterior lights and fixtures with low-power LED bulbs and fixtures.

7.7.2 EXISTING CONDITIONS AND ASSUMPTIONS

The building has a wide variety of roughly 2000 lights with a total wattage of 200,000 watts. Most of the lights are fluorescent tube style T12's (76 watt) and T8's (64 watts) and 8" downlights (28 watt). It is assumed that the lights in the office spaces are turned on only during building office occupied hours (8am-5pm, Monday-Friday). Lights in common areas (hallways, entranceways, etc.) are assumed to be on seven days a week: 7 AM to 9 PM Monday - Friday, 8 AM to 9 PM Saturday and 9 AM to 5 PM Sunday.

7.7.3 ECM DETAILS AND ASSUMPTIONS

Error! Reference source not found. below summarizes the light fixture wattages before and after ECM implementation. The total reduction in lighting wattage is 62.5%, from 199 kW to 131 kW. Please see Appendix A for a detailed table showing lighting reductions per fixture.

7.7.4 RESULTS AND RECOMMENDATION

Table 12: ECM 7 Summary

ECM Energy Details	**Natural Gas**	**Electricity**	**Total**
Units	**GJ**	**kWh**	**GJ**
Annual Energy Use - Baseline	9,815	1,350,511	14,673
Annual Energy Use - ECM	10,502	1,104,328	14,474
Annual Energy Savings	-687	246,183	199
ECM GHG and Cost Savings	**Natural Gas**	**Electricity**	**Total**
First Year GHG reduction ($tCO2_e$)	-35.1	142.8	107.7
First Year Cost Savings	-$3,515	$26,095	$22,580
Financial Analysis			
Equipment Lifetime (years)	15		
Equipment Capital Cost Estimate	$426,200		
First Maintenance Cost Savings	$4,800		
First Year Utility and Maint. Cost Savings	$22,580		
NPV	-$4,455		
Simple Payback (years)	16		

Lifetime Cost Savings	$421,745
Lifetime GHG Savings ($tCO2_e$)	857
GHG Abatement Rate ($/$tCO2_e$)	$497

Although the annual electricity cost savings and GHG savings are significant, the large $426,200 capital cost for this ECM results in a negative NPV and a high GHG abatement rate. It is therefore recommended to consider replacing non-LED lights upon failure (in a phased approach that accounts for technical and practical constraints). Replacing lights when they fail will increase the financial attractiveness of this ECM significantly. This is also an ECM that should be monitored for future consideration should installation costs come down, or electricity prices go up.

7.8 ECM 8 – LOW FLOW AERATORS

7.8.1 ECM SCOPE

This ECM will determine the feasibility of replacing aerators for faucets withing the building that either do not have low-flow aerators installed, or do not have an aerator installed at all.

7.8.2 EXISTING CONDITIONS AND ASSUMPTIONS

In addition to faucets in the restaurant and public bathrooms located within the building, each separate office has a small kitchen and small bathroom. During the walk-through of the building, it was noted that most of the faucets had a low-flow aerator already installed (1.9 L/min) however approximately 15 faucets either had no aerator installed or have a high-flow aerator (8.3 L/min).

Photo 21: La Cité high-flow aerator (left), low-flow aerator (right)

Photo 22: La Cité faucet with no aerator installed

7.8.3 ECM Details and Assumptions

It is assumed that the fifteen (15) 8.3 L/min faucet aerators are replaced with 1.9 L/min aerators, resulting in a 77% reduction in domestic hot water consumption for these 15 faucets. To be conservative, the faucets with no aerators were assumed to have an 8.3 L/min aerator installed. An installed cost of $10 per aerator is assumed.

7.8.4 Results and Recommendation

Table 13: ECM 8 Summary

ECM Energy Details	Natural Gas	Electricity	Total
Units	**GJ**	**kWh**	**GJ**
Annual Energy Use - Baseline	9,815	1,350,511	14,673
Annual Energy Use - ECM	9,804	1,350,511	14,662
Annual Energy Savings	11	0	11
ECM GHG and Cost Savings	**Natural Gas**	**Electricity**	**Total**
First Year GHG reduction ($tCO2_e$)	0.6	0.0	0.6
First Year Cost Savings	$56	$0	$56
Financial Analysis			
Equipment Lifetime (years)	10		
Equipment Capital Cost Estimate	$150		
First Year Utility Cost Savings	$56		
NPV	$528		
Simple Payback (years)	2		
Lifetime Cost Savings	$678		
Lifetime GHG Savings ($tCO2_e$)	6		
GHG Abatement Rate ($/$tCO2_e$)	$24		

Based on the low capital cost, positive NPV and low GHG abatement rate, it is recommended to proceed with this ECM.

7.9 ECM 9 – Rooftop Solar PV

7.9.1 ECM Scope

This ECM will determine the financial and environmental costs and benefits of installing a solar photovoltaic array on the roof of La Cité.

7.9.2 Existing Conditions

The roof of La Cité has areas in which solar PV modules could be installed. There are many obstructions on the roof (17 RTU's, exhaust fans, etc.) and some areas which are heavily shaded; this reduces the available area for solar modules to be installed.

7.9.3 ECM Details and Assumptions

The following assumptions have been made:

- It is assumed that the roof is structurally able to handle the added weight of the solar modules and mounting hardware; a structural engineer would need to verify if the added weight is acceptable.

- An installed cost of $2.25 per watt is assumed based on information from local solar PV contractors.

- The amount of energy cost savings is based on $0.10/kWh.

- As the PV system provides a small percentage of the building's overall electricity use, it is assumed that 100% of produced electricity is used by the building itself and none is exported. (Electricity exported to the grid yields a lower electricity cost savings than electricity used by the building.)

Table 14: Solar Array Details

Section	Available surface area (m²)	Available surface area for PV (m²)	Approximate number of Modules	Calculated Wattage (kWp)	Estimated Annual Production (kWh)
Phase 2 Roof	210	105	53	17	15,750
Theatre Roof	140	105	53	17	15,750
High Roof	66	33	16	5	6,532
Total	416	243	121	39	38,032

7.9.4 RESULTS AND RECOMMENDATION

Table 15: ECM 9 Summary

ECM Energy Details	Natural Gas	Electricity	Total
Units	GJ	kWh	GJ
Annual Energy Use - Baseline	9,815	1,350,511	14,673
Annual Energy Use - ECM	9,815	1,312,479	14,536
Annual Energy Savings	0	38,032	137
ECM GHG and Cost Savings	**Natural Gas**	**Electricity**	**Total**
First Year GHG reduction ($tCO2_e$)	0.0	22.1	22.1
First Year Cost Savings	$0	$3,427	$3,427
Financial Analysis			
Equipment Lifetime (years)	35		
Equipment Capital Cost Estimate	$87,500		
First Year Utility Cost Savings	$3,427		
NPV	$34,819		
Simple Payback (years)	25		
Lifetime Cost Savings	$122,319		
Lifetime GHG Savings ($tCO2_e$)	269		
GHG Abatement Rate ($/$tCO2_e$)	$325		

This ECM has a positive NPV (the highest of all ECMs) but has a long payback (based on today's energy prices) and relatively high GHG abatement rate. The GHG savings are significant but not as high as other ECMs, partly because future emissions reductions are offset by a greening grid. From a financial perspective it is recommended to wait with this ECM for a time when the installation cost might decrease, and/or the energy costs increase. However, there are other considerations that make this ECM attractive, including significant short term GHG reductions, and possible grants or incentives that would reduce the first cost.

7.10 ECM 10 – Space Heaters

7.10.1 ECM Scope

This ECM will determine the feasibility of replacing convective space heaters located throughout the building with radiant-style space heaters. Radiant space heaters work by directly heating a person and do not rely on a fan to blow air from the heater to the person. Unlike convective space heaters, radiant heaters do not lose heat as the infrared energy passes through the air. Typically, a 1,500 watt convective space heater can be replaced with a 150 watt radiant space heater, reducing energy use by 90%.

7.10.2 Existing Conditions and Assumptions

During the walkthrough of the building, it was noted that most individual workspaces have convective personal space heaters under or on top of a worker's desk. Convective space heaters combine a fan and heating element to heat the air surrounding a person and typically use 1,500 watts. An exact number of space heaters is not known but for the purposes of this ECM it is assumed that 80 are in operation for 1.5 hours per day, Monday-Friday, from mid-November to mid-March; this equates to 120 hours per heater per year. At 1.5 kw per heater, each heater consumes 180 kwh per year and in total all 80 heaters consumer 14,400 kwh/year of electricity.

Photo 23: La Cité convective space heaters

7.10.3 ECM Details and Assumptions

Convective space heaters combine a fan and heating element to heat the air surrounding a person and typically use 1,500 watts; radiant space heaters are not designed to heat the air around a person. Instead, they heat a person directly via radiant heat which is much more efficient than heating the air around a person, resulting in approximately 90% less electricity use compared convective style heaters. It is suggested to therefore replace 1,500 watt convective space heaters with 150 watt radiant space heaters, which can be purchased for approximately $80.

Demand on the RTU's and boilers is assumed to remain the same once the space heaters are replaced.

Photo 24: Radiant style space heater

7.10.4 RESULTS AND RECOMMENDATION

Table 16: ECM 10 Summary

ECM Energy Details	Natural Gas	Electricity	Total
Units	**GJ**	**kWh**	**GJ**
Annual Energy Use - Baseline	9,815	1,350,511	14,673
Annual Energy Use - ECM	9,815	1,337,551	14,627
Annual Energy Savings	0	12,960	47
ECM GHG and Cost Savings	**Natural Gas**	**Electricity**	**Total**
First Year GHG reduction ($tCO2_e$)	0.0	7.5	7.5
First Year Cost Savings	$0	$1,374	$1,374
Financial Analysis			
Equipment Lifetime (years)	15		
Equipment Capital Cost Estimate	$6,400		
First Year Utility Cost Savings	$1,374		
NPV	$15,500		
Simple Payback (years)	4.7		
Lifetime Cost Savings	$21,900		
Lifetime GHG Savings ($tCO2_e$)	75		
GHG Abatement Rate ($/$tCO2_e$)	$85.70		

Replacing the convective style space heaters with radiant style space heaters results in a relatively short simple payback period of 4.7 years and a positive NPV of $15,500. This ECM is recommended for implementation before the next heating season.

7.11 ECM 11 – WATER COOLER TIMERS

7.11.1 ECM SCOPE

This ECM will determine the feasibility of installing electronic, programmable timers on to the building's water drinking water coolers.

7.11.2 EXISTING CONDITIONS AND ASSUMPTIONS

During the walk through of the building, it was noticed that most offices have a water cooler, a photo of one of the water coolers is shown in below.

7.11.3 ECM DETAILS AND ASSUMPTIONS

- The building has 20 water coolers in operation regularly which are left plugged in year-round, with an average electricity consumption during unoccupied hours of 20 watt-hours.
- It is assumed that an electronic timer will reduce unoccupied operation of the water coolers from 5pm-8am, 365 days a year and from 8am-5pm on all Saturdays and Sundays, totaling 6,411 hours per year. This totals 128 kwh per water cooler and 2,564 kwh for all 20 water coolers.
- It is assumed that a programmable digital timer can be purchased, programmed and installed for $25 per timer.

Photo 26: Digital programmable plug timer

Photo 25: La Cité water cooler

7.11.4 Results and Recommendation

Table 17: ECM 11 Summary

ECM Energy Details	Natural Gas	Electricity	Total
Units	**GJ**	**kWh**	**GJ**
Annual Energy Use - Baseline	9,815	1,350,511	14,673
Annual Energy Use - ECM	9,815	1,347,305	14,662
Annual Energy Savings	0	3,206	12
ECM GHG and Cost Savings	**Natural Gas**	**Electricity**	**Total**
First Year GHG reduction ($tCO2_e$)	0.0	1.9	1.9
First Year Cost Savings	$0	$340	$340
Financial Analysis			
Equipment Lifetime (years)	10		
Equipment Capital Cost Estimate	$500		
First Year Utility Cost Savings	$340		
NPV	$3,229		
Simple Payback (years)	1.5		
Lifetime Cost Savings	$3,729		
Lifetime GHG Savings ($tCO2_e$)	15		
GHG Abatement Rate ($/$tCO2_e$)	$33		

Based on a low cost to implement, positive NPV and low GHG abatement rate, this ECM is recommended.

8.0 ECM SUMMARY

Table 18 summarizes all ECMs, ranked from the lowest (best) GHG abatement rate to the highest.

Table 18: ECMs summary table

ECM #	ECM Description	Estimated Capital Cost	Annual Natural Gas Savings (GJ)	Annual Electricity Savings (kWh)	Annual Energy Savings ($)	Annual GHG savings ($tCO2_e$)	Lifetime GHG savings ($tCO2_e$)	NPV	GHG Abatement Rate ($/$tCO2_e$)	Recomm-ended?
10	Radiant Space Heaters	$6,400	0	12,960	$1,374	7.5	75	$15,500	$86	Y
11	Water Cooler Plug Timers	$500	0	3,206	$340	1.9	15	$3,229	$33	Y
8	Low flow aerators	$150	11	0	$56	0.6	6	$528	$24	Y
6	Programmable Thermostats	$2,100	48	503	$300	2.8	42	$3,339	$50	Y
1	Demand Control Kitchen Ventilation	$20,000	177	7,385	$1,688	13	187	$9,337	$107	Y
2	Boiler Upgrade	$50,000	347	0	$1,778	18	373	-$4,217	$134	N
9	Rooftop Solar PV	$87,500	0	38,032	$3,427	22	269	$34,819	$325	N
4	RTU ERV	$170,000	618	3,400	$3,524	34	525	-$105,333	$324	N
7	Lighting Upgrade	$426,200	-687	246,183	$22,580	108	857	-$4,455	$497	N
5	Replacing front door with revolving door	$30,000	22	0	$114	1.1	30	-$26,164	$1,013	N
3	Window and Door Upgrade	$1,000,000	511	4,976	$3,142	29	844	-$873,135	$1,185	N

Determining which ECMs to prioritize is normally based on capital cost, NPV, and GHG abatement rate. However lifetime GHG savings is also important. ECMs 8 (low flow aerators) and ECM 11 (water cooler plug timers) have low upfront costs, positive NPVs and very low GHG abatement rate and are recommended for immediate implementation. ECM 10 (radiant space heaters) has a modest upfront cost, a positive NPV and low GHG abatement rate; it should be considered for implementation before next winter. ECM 6 (programmable thermostats for vestibules/entryways) has a small positive NPV, modest cost and low GHG abatement rate and should be considered for implementation next. ECM 1 (demand control kitchen ventilation) is also recommended for further investigation as it has a low GHG abatement rate, positive NPV and relatively large annual GHG emission reduction. ECM 9 (Rooftop Solar PV) has a large positive NPV and GHG savings, but a long payback period and high GHG abatement rate, making a recommendation to proceed difficult. Financial incentives would make this ECM more attractive.

ECM 7 (lighting upgrade) has a high upfront cost and large negative NPV; it is suggested to phase in the replacement on non-LEDs as needed, or when the existing fixtures reach end of life. ECM 2 (boiler upgrade), ECM 3 (window and door upgrade), ECM 4 (RTU ERV) and 5 (replacing front door with revolving door) are not recommended due to poor NPVs and large upfront costs.

The low cost of natural gas, \$2.50/GJ (or \$3.55/GJ with today's carbon tax), results in poor financial incentives for many ECMs which reduce natural gas use. Natural gas prices have been at historical lows for the better part of the last decade but this is not expected to continue into the next decade. Furthermore, increasing carbon taxes will continue to put pressure on natural gas prices. For this reason it is suggested to reassess the viability of the ECMs if natural gas prices increase, and to stay up to date with developments in natural gas markets.

Implementing all five of the recommended ECMs result in annual reductions of 237 GJ natural gas, 18,982 kWh of electricity and 26 tonnes of $CO2_e$. The combined cost of all recommended ECMs is estimated at \$29,150.

Table 19: All recommended ECMs

Addition of all recommended ECMs				
Estimated Cost	**Annual Natural Gas Savings (GJ)**	**Annual Electricity Savings (kWh)**	**Annual Energy Savings (\$)**	**Annual GHG savings ($tCO2_e$)**
\$29,150	237	18,982	\$3,758	26

9.0 ECMs Deemed Impractical

Several ECMs were reviewed however due to negligible calculated energy savings, were not included in Section 7.0. These ECMs are as follows:

1. Window film to reduce glazing SHGC and associated air conditioning electricity consumption
2. Glycol Runaround heat recovery to recover heat from kitchen exhaust fans

10.0 ECMs For Future Consideration

A lack of information prevented full analysis of the following ECMs, however these should be considered once information is available:

10.1 BMS optimization.

As described in Section 11.0, several potential issues were discovered in the current operation of RTU-1 and RTU-2. These issues likely extend to the rest of the building. Resolving these issues should help greatly to reduce the building's energy use, this could be the cheapest and most effective ECM in this report. More information and analysis of all RTU control systems is required to complete this ECM (only 2 RTUs are on the BMS).

10.2 Occupancy sensors for the vending machines.

There are two vending machines in the building, which use energy overnight when the building is unoccupied. A specialized occupancy sensor, specifically designed for vending machines, can be connected to the vending machines to reduce their electricity use overnight. In order to calculate energy savings, it is recommended to first log the electricity use of the vending machines to determine if it is viable to proceed with this ECM.

11.0 Building Management System (BMS) Observations

A building management system (BMS) is a computer-based control system that monitors and controls building equipment such ventilation units, lighting, security, heating, etc. A BMS system is a very valuable tool to not only help centrally and remotely control all aspects of the building operations but can help diagnose problems very easily.

A properly programmed BMS results in lower energy use and improved occupant comfort. A poorly programmed BMS can result in the opposite: wasted energy and occupant discomfort. For example, a BMS system should be programmed to reduce space temperatures overnight (except in summer), and to reduce the volume of fresh air entering the building overnight; if not set up as such, the building's heating systems will be operating unnecessarily, wasting energy and increasing the building's GHG footprint.

The BMS system can be used to program temperature setpoints throughout the building from a computer interface online. It is understood based on discussions with the building director that the BMS system is currently set to control temperatures to between 21-24 °C during building occupied hours (7 AM to 9 PM Monday - Friday, 8 AM to 9 PM Saturday and 9 AM to 5 PM Sunday), and 16 °C during unoccupied hours. Occupants are only able to control the temperatures within the 21-24 °C range – although setting to 20 °C may be possible. However, based on our investigations, this may not be the case. This will be discussed below.

In our investigations, it was found that La Cité does *not* have a central BMS system to control *all* HVAC, lighting and other systems. However, a BMS system is in place to control RTU-1 and 2, as well as Boiler 1. The rest of the rooftop units are controlled with other means, mostly built-in control systems. These built-in control systems will have to be checked individually to see if they have the same issues as the ones identified below.

The following are potential issues identified during our investigation of the limited data available through the BMS:

11.1 2ND AND 3RD FLOOR SETPOINTS NOT CHANGING DURING UNOCCUPIED HOURS

Figure 7 (a) and (b) below show a snapshot of the 2nd and 3rd floor setpoints and temperatures on Saturday afternoon (when the building is unoccupied). As seen below, the temperature setpoints are very high and are not set back to a lower (or higher in cooling) setpoint.

Figure 7 (a) and (b)

11.2 OVERHEATING IN SEVERAL ZONES

As can be seen in Figure 7 above, Zone 212 and 210 are both significantly above their setpoint temperatures. Figure 8 below shows Zone 212 on April 3, 2020 at approximately 4:30pm. The zone setpoint is 22.5C, the room temperature is 27.3C and yet the radiator valve is on. This indicates either a control problem or an issue with the radiator valve. At least one other room (Zone 210) has this same problem.

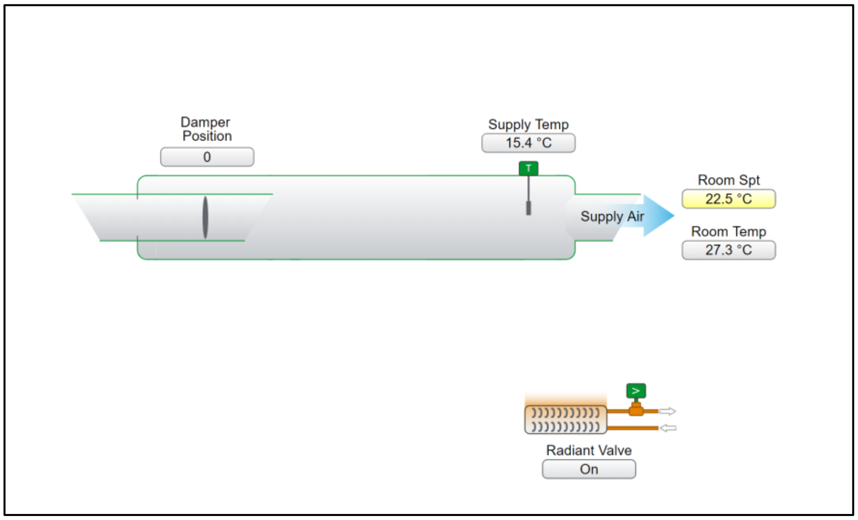


Figure 8

11.3 ZONE 301 EXAMPLE – NO SETBACK, OA AT NIGHT, AND SIMULTANEOUS HEATING AND COOLING

Figure 9 below shows Zone 301 on April 9th (Thursday) at 10:36pm. The system room temperature setpoint should be set back to 16-18 °C, but the room setpoint is still 24 °C. Notice that the damper position is open at 10%, feeding 15.2 °C air into the space, cooling it down (room temperature was at 22.5°C (below setpoint) so room should not need to be cooled). It should also be noted that the room radiator is also on. This shows one of many cases of simultaneous heating and cooling. Outside air should not be required in the evening, so the damper position should be at 0%.

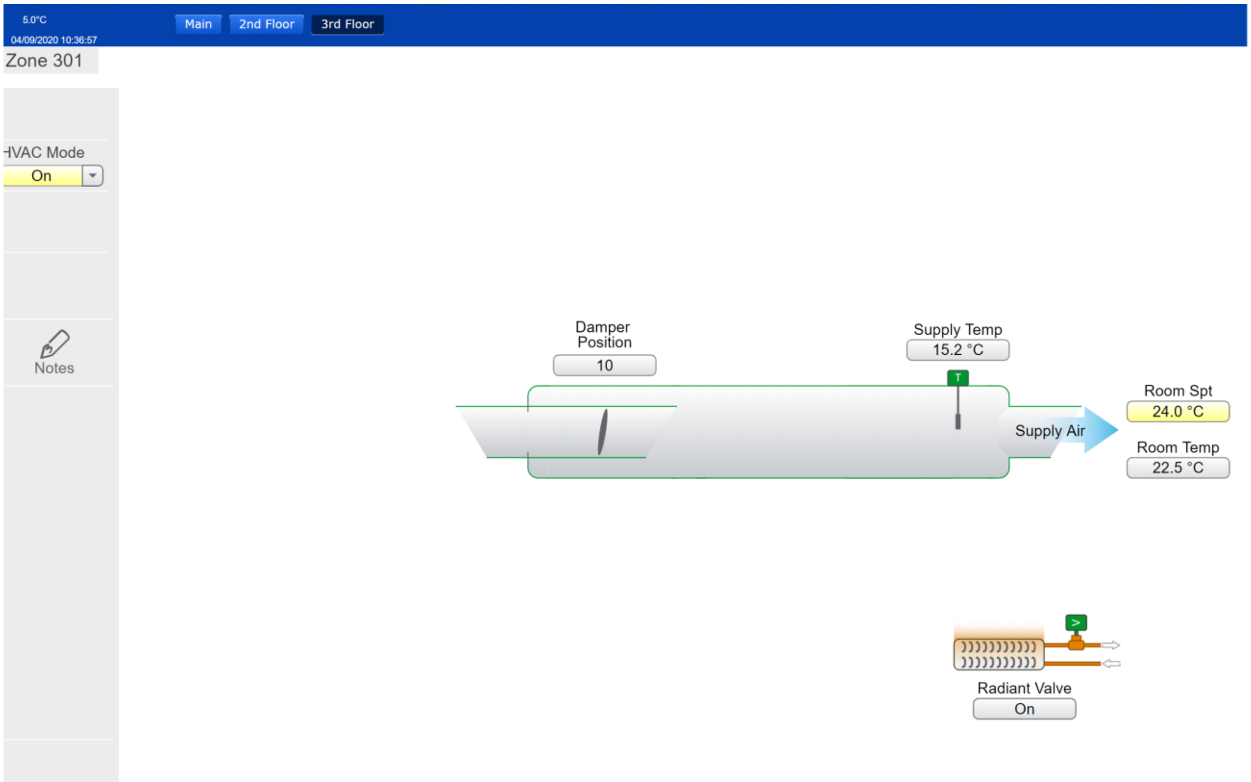


Figure 9

11.4 RTUS ARE OPERATING CONTINUOUSLY AND BRINGING IN OUTSIDE AIR (OA) EVEN DURING UNOCCUPIED PERIODS

As seen in Figure 10 and Figure 11 below, and based on BMS observations, it seems that RTU-1 and RTU-2 operate continuously and never shut off. Furthermore, you can see that the Outdoor Air (OA) damper is open even at 10:30pm at night. The same behaviour was observed on the weekend. With the perimeter radiation system in the building, all of the rooftop units should be turned off during unoccupied periods. This after hours operation is likely causing a significant amount of energy use both for heating and cooling, as well as fan power.

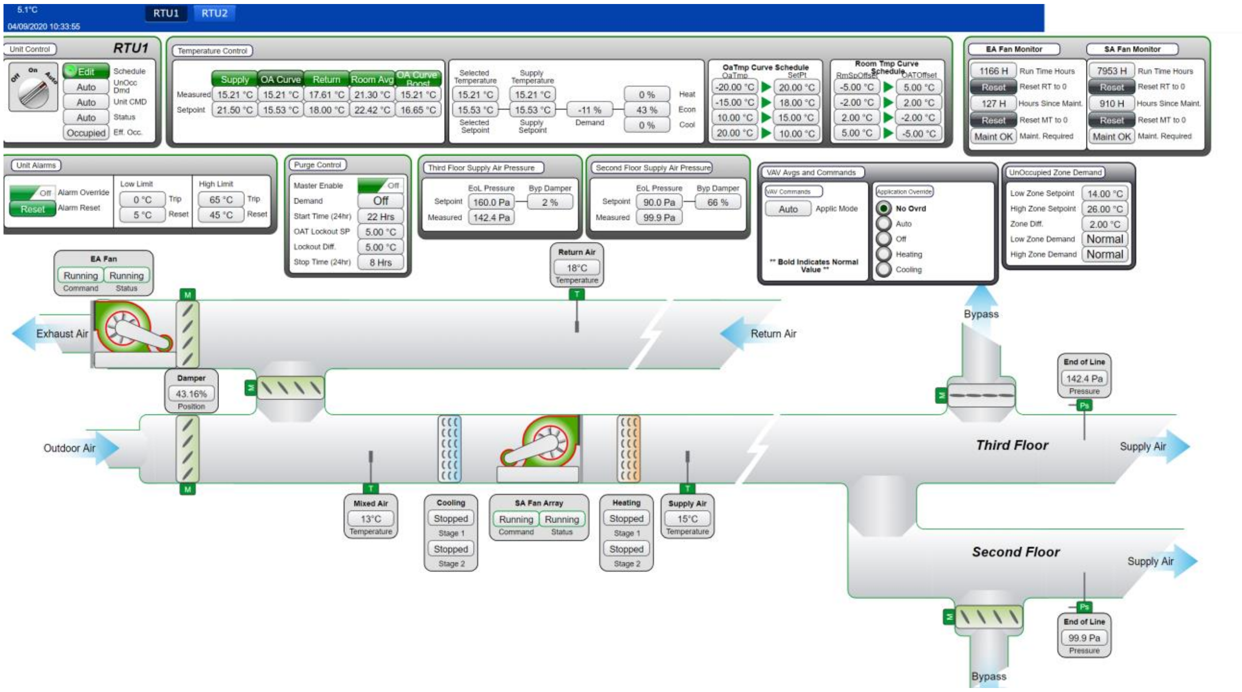


Figure 10

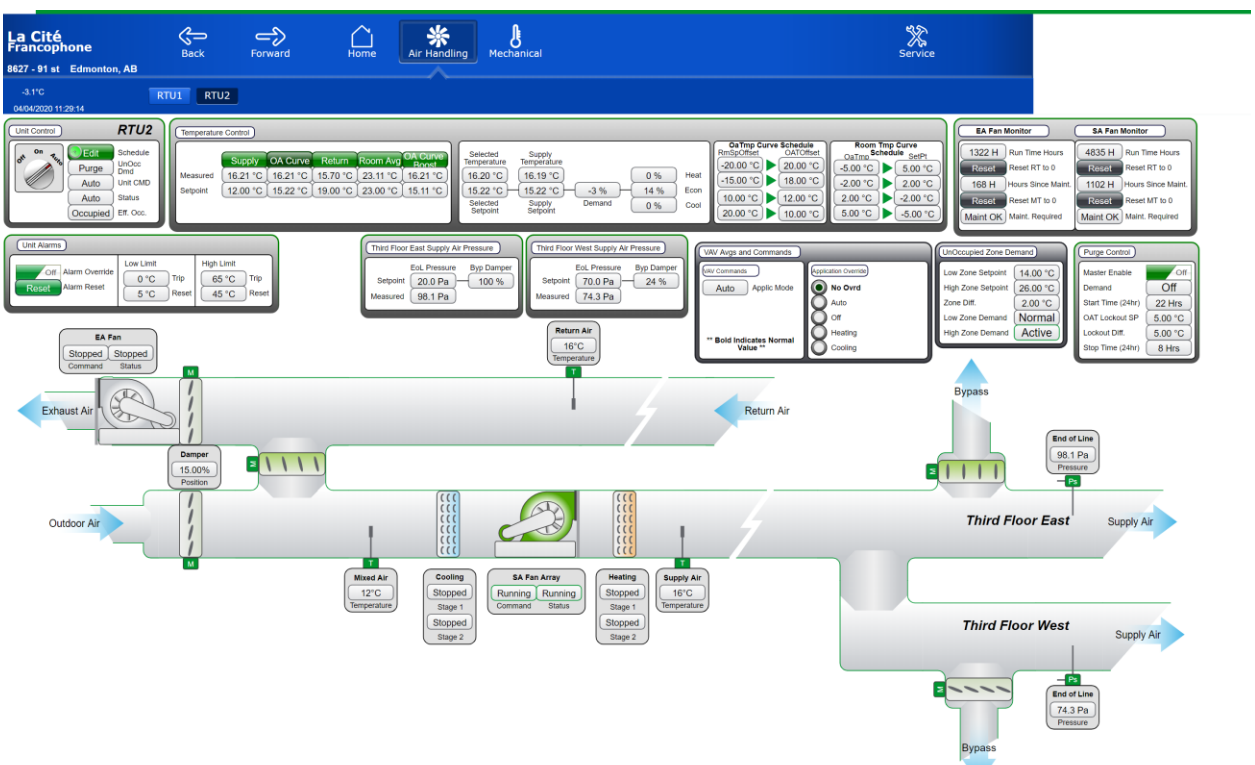


Figure 11

11.4.1 Peculiar Boiler Return Temperature

As seen in Figure 12 below, the return temperature to Boiler 1 is higher than the supply temperature. This is peculiar and should be investigated.

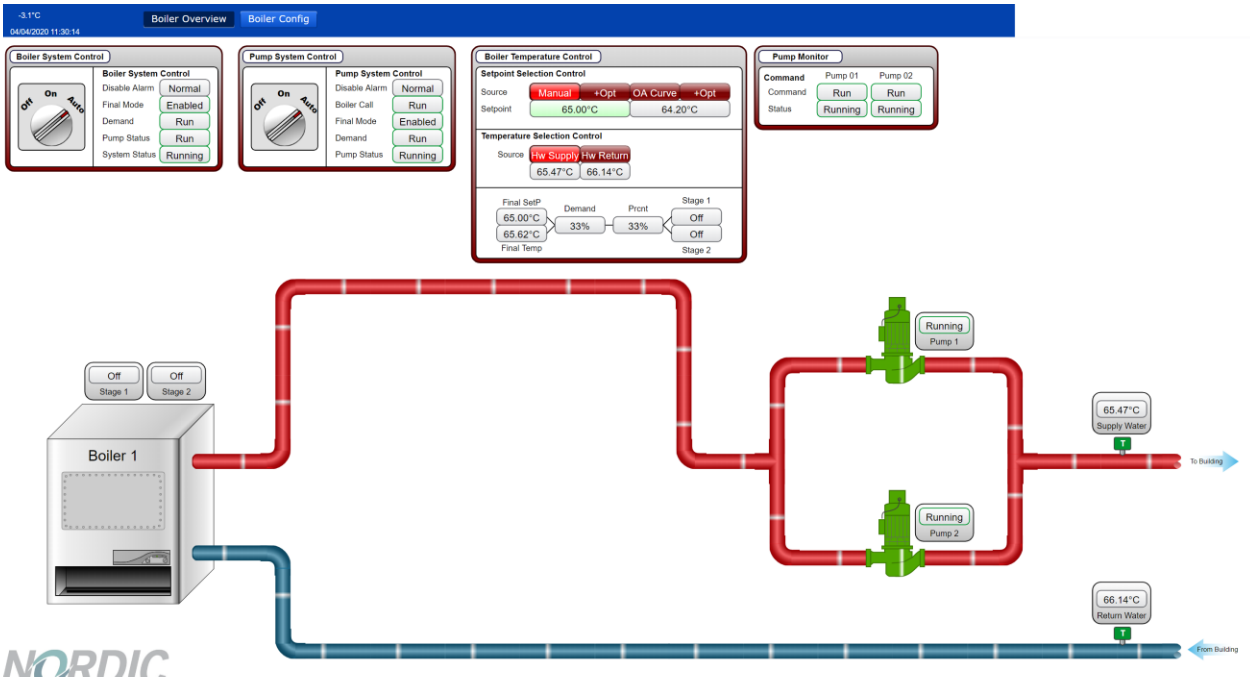


Figure 12