



City of Ottawa's Energy Evolution Catalyst Project Program Summary Report (June 2018)

1. Background

City Council approved a one-time funding of \$300,000 for the Energy Evolution Catalyst Project Program to pilot catalyst projects in 2017 that support the vision and goal of Energy Evolution: Ottawa's Community Energy Transition Strategy. Catalyst projects are initiatives led by Ottawa-based organizations that either serve as demonstration projects or lays the foundation for demonstration projects to be scaled up in the future. Collectively, these projects were used to increase energy literacy, pilot emerging technologies, and/or enable innovative approaches.

A total of eight projects were successful in receiving funding. They were:

- Canada Green Building Council, Ottawa Renewable Energy Co-operative, and EnviroCentre *ClimateWise Retrofit Project*
- City of Ottawa *Low Temperature Ice Flooding*
- EnviroCentre *Ottawa Business Energy and Emissions Profile (BEEP)*
- EnviroCentre *Ottawa EV Days*
- Hydro Ottawa *Supplemental Use of Electric Water Heating for Environmental and Cost Reduction*
- JAZZ Solar Solutions *PV Hot Water at City of Ottawa Facility*
- Ottawa Community Housing *OCH Tenant Energy Engagement Pilot*
- prototypeD TEAM Inc. *Urban Innovation Pods*

Following the funding announcement, it was determined that one of the projects, the City of Ottawa's Low Temperature Ice Flooding project, would not be pursued as the technology did not prove to be viable. The project's funding was reallocated to JAZZ Solar Solutions' project as the latter maintained the original intent of the former to make City facilities more energy efficient. The program came to an end December 31, 2017 and each funding recipient was required to complete a project evaluation report that outlined the project's achievements and benefits, how the project could lend itself to being scaled up in the future, and lessons learned.

2. Project Summaries

a. Canada Green Building Council, Ottawa Renewable Energy Co-operative and EnviroCentre's ClimateWise Retrofit Project

Total Funding Allocation: \$53,000

Project Locations: Ward 12, Ward 13, Ward 15



Project Description

This collaborative project between the Canada Green Building Council, the Ottawa Renewable Energy Co-Op, and EnviroCentre identified five high-rise, residential, nonprofit buildings to be part of a pilot to help building owners understand the financial viability of retrofits, identify ways to improve the occupant experience and support property managers in overcoming identified obstacles to the implementation of deep energy retrofits. The high-rise, residential, nonprofit buildings included:

- Coop Voisins
- Coopérative D'habitation Desloges
- Communityworks' Cliff House
- Unity Non-Profit Housing
- 151 Parkdale

Through this process, five Level I ASHRAE audits were conducted and presented to each participating building owner and property management team. Owners were provided with access to free training on energy benchmarking, energy savings, and the rationale for green buildings. They were also given the opportunity to participate in a design charrette (brainstorming workshop) with 12 local green building professionals, utility representatives, and other facility managers. Through the workshop, they had a chance work with industry experts to identify potential risks, opportunities, and best practices. They were also presented with the opportunity to discuss in detail a key issue specific to their building that was identified in the audit report.



Results

Some of the key achievements include:

- Four of the five buildings will be moving forward with some form of energy retrofit within the next year;
- New insights and sharing of best practices in tenant engagement;
- Testing the viability for a new business model that would allow for community financing of energy efficiency retrofits in MURBs;
- Better appreciation and understanding of the unique challenges of deep energy retrofits for MURBs and social housing in particular; and

- Ongoing support over the next two years for all participating buildings in measuring and monitoring their carbon footprint and tenant engagement.

Scalability

Through this project, a new business model was tested that addresses an underserved segment of the market (in particular, non-profit residential buildings over 25,000 ft) with the potential to achieve significant emissions reductions. This new business model will support deep energy retrofits through community financing, a model that hasn't existed in Canada before, and has the potential to help thousands of local residents reduce their GHG footprint.



New relationships and connections were made that will help to facilitate future collaborations and will support these and future buildings with retrofit projects. Industry experts and utility incentive program managers were connected directly with non-profit building owners through the workshop. Key stakeholders increased their energy literacy through the information and tools provided to better

understand the benefit of deep energy retrofits. Additionally, an emerging green professional was recruited, trained, and mentored to deliver and execute all five energy audits, thus supporting the next generation of green building experts and increasing the local capacity.

b. EnviroCentre's Ottawa Business Energy and Efficiency Profile (BEEP)

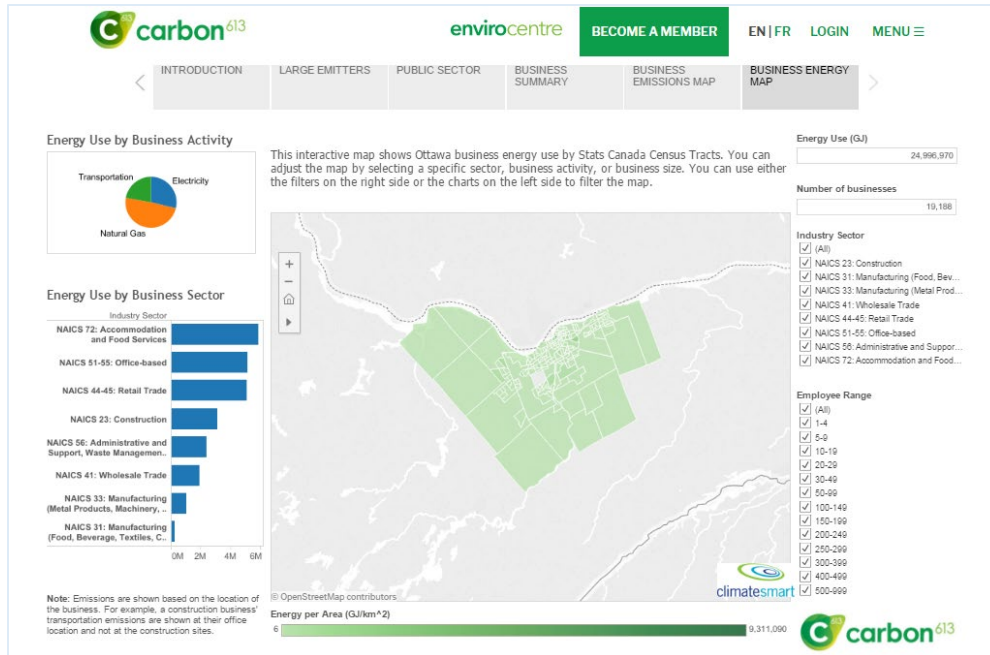
Total Funding Allocation: \$17,500

Project Location: City-wide

envirocentre

Project Description

EnviroCentre created and launched the Ottawa Business Energy and Emissions Profile (BEEP) dashboard as part of EnviroCentre's Carbon 613 program. The BEEP dashboard provides an overview of Ottawa's business community's GHG emissions by sector across the city and identifies the areas with the greatest potential for achieving reductions in the areas of waste, electricity, natural gas, and transportation. It is a powerful data visualization tool that is comprised of a written report and interactive digital dashboard. The interactive BEEP dashboard can be found on the Carbon 613 program's website at <https://carbon613.ca/beep-report/>.



Results

The draft dashboard was made available at the Carbon 613 annual evening of recognition held on June 6, 2017 that had over 125 attendees. The public launch was made on September 12, 2017 via the Carbon 613 newsletter, which was circulated to over 650 newsletter recipients. The following is a breakdown of the metrics from the launch day of the BEEP.

a. September 2017 Newsletter

- Released Tuesday, Sep 12, 2017 at 10:00 am
- Open Rate - 24.6% (Industry average (Non-Profit) 22.0%)
- Click rate – 6.4% (industry average (Non-Profit) 2.6%)
 - 50% of total clicks were to BEEP report

b. Web traffic

- Tuesday, September 12, 2017: 42 page views

c) Social media – Twitter

- Released announcement tweet on Tuesday, September 12, 2017
- 1,345 impressions
- 19 total engagements

Scalability

There is longevity in the applicability of the results of this project as it sits within the Carbon 613 program. The hosting of the interactive visual dashboard will be maintained by EnviroCentre on a go-forward basis and will be used in various promotional channels, whether through Carbon 613 or EnviroCentre more broadly (e.g. e-newsletter and social

media channels), to ensure that the dashboard continues to be promoted in the community. The intention is that this report and dashboard would be updated using Carbon 613 actual business data and Carbon 613 will continue to strive to be the brand under which GHG data is collected and tracked for the local business community. It also provides insights into opportunities to target specific business sectors to further reduce GHG emissions.

c. EnviroCentre's Ottawa EV Days

Total Funding Allocation: \$15,000

Project Locations: Ward 1, Ward 4, Ward 9



Project Description

Ottawa Electric Vehicle (EV) Days was a three-day event held in October 2017 in three different areas of the city: Barrhaven, Kanata, and Orléans. The main goal of Ottawa EV Days was to raise awareness amongst residents about the benefits of switching to EVs. According to the 2011 NCR Origin-Destination Survey, 84% of households in Ottawa have one or more vehicle. EVs are a sustainable choice for those that need a car and the information learned at the event will contribute to an increase in the number of EVs purchased and used in Ottawa. The events focused on:



- Awareness of how EVs reduce GHGs associated with transportation;
- Awareness of the variety of EVs available
- Overcoming range anxiety by sharing information about vehicle types from pure electric to range extended vehicles; and
- Personal financial savings from reduced fuel and maintenance costs.

These objectives were met by providing:

- Access to knowledgeable and local EV owners from the Electric Vehicle Council of Ottawa
- A showcase of 10-15 privately owned EVs at each event
- Test drives arranged through Plug 'N Drive, a non-profit organization dedicated to sharing information to encourage EV ownership
- Distribution of over 300 booklets that provide information regarding provincial rebates, energy needs and models available in Canada.

Results

Over the course of three days, EV Days had:

- Approximately 675 attendees
- Over 250 test drives of electric vehicles coordinated/managed by Plug 'N Drive

- Media attention from CTV News and Radio Canada
- Attendance by Mayor Jim Watson, five City Councillors and 2 MPPs.

Enviro Centre surveyed participants to see if the EV Days event would change or impact their behaviour. Eighty participants in total were surveyed and of those surveyed:

- 95% of attendees had a traditional gas car.
- 89% of attendees reported learning new information about EVs
- 76% learned something that would inspire them to purchase/lease an EV within two years.

Scalability



Ottawa EV Days began as a one-day event in downtown Ottawa that evolved into a three-day event in three different areas. Hosting EV Days in a new location each year would help broaden the impact of knowledge sharing throughout Ottawa. Additionally, the Electric Vehicle Council of Ottawa and Plug 'n Drive brought not only knowledge about EVs, they were able to provide information about how many test drives to expect, best layouts for showcasing cars, and what

common questions people may have about EVs. It is recommended that these organizations continue to be included in the early stages of planning future EV Days.

d. JAZZ Solar's PV Hot Water at City of Ottawa Facility

Total Funding Allocation: \$92,500

Project Location: Ward 14



Project Description

JAZZ Solar introduced solar Photovoltaic (PV) pre-heating of domestic hot water (DHW) at the City of Ottawa's Plant Recreation Centre to offset conventional energy with renewable energy. 15.4 kW of PV modules were installed on the south-west roof surface of the original building portion of the facility, and preheats water in conventional electric tanks to supply the existing water heating systems. Solar energy is stored thermally and the system is not electrically connected to the grid. Given large daytime demand for DHW at Plant Recreation Centre, it is estimated that most of the energy collected by the PV modules (accounting for component efficiencies and tank standby loss) will be utilized. The estimate for the energy contribution this system will make is approximately 18,000 kWh per year.



Results

The project provides a real operational example of PV DHW and will provide data to evaluate the benefit of future similar projects being considered. Kilowatt hour (kWh) loggers were installed to monitor the amount of energy delivered to the hot water tanks. The loggers will be checked periodically, and monthly/seasonal/annual energy collection will be compared to predicted load. Due to the late 2017 installation, insufficient data has been collected to make conclusions other than to confirm the system is working and producing hot water. Further analysis will be deferred until at least mid-2018 when 6 months of data across a variety of weather and municipal supply water temperatures can be included.

Scalability

The solar contribution to water heating at Plant Recreation Centre will be ongoing and sustained for the life of the equipment. Scaling the system up would be relatively simple given the modular architecture of the design (eight PV modules energize one DHW tank). If data analysis of system performance in combination with Plant Recreation Centre billing analysis shows that there is sufficient DHW load for additional PV contribution, system expansion could be considered.

This site will generate valuable energy production data that could be applied to other potential sites. Identifying a site with a large daytime DHW load and a base case DHW system that is electric, propane or oil, rather than natural gas would result in better return on investment. Assuming that other potential sites have sufficient DHW load, production data would be valid with appropriate adjustments for array size, orientation, and shading losses. Financial analysis would differ due to displacement of the more expensive base case energy source. Additionally, the cost of PV systems continues to fall. The specific inverter technology used for this architecture has the potential for significant price reductions because it is presently produced in low volume with little competition. As PV DHW becomes more widely deployed pricing should fall and the financial case for these kinds of projects should improve.



e. Hydro Ottawa's Supplemental Use of Electric Water Heating for Environmental Cost and Reduction

Total Funding Allocation: \$30,000

Project Location: Ward 14



Project Description

Hydro Ottawa and its partnering developer, Thorium Technologies, undertook a project to prove the environmental and cost benefits of supplementing natural gas heating with electric heating. The primary deliverables under this project were:

- To design, develop, test and verify a software solution (the Optimization Program) that will cue the Building Automation System (BAS) at Ottawa City Hall as to when optimally to use the thermal electric heating to supplement heating by natural gas.
- To quantify the savings potential for the selected site using straight resistive heating, or an air-source heat pump.



Ottawa City Hall's BAS will be the key element in controlling use of "surplus" electricity demand capacity for thermal energy purpose in a facility (i.e. control set-up and modelling). The Optimization Program will do the following:

- Import the Ontario Hourly Electricity Price (HOEP) in real time and determine the effective real-time marginal cost of electricity and compare this to the gas price (which will be inputted periodically).
- Determine if electricity would be cheaper than gas for either i) operation of heat pump technology (adjusted for outdoor air temperature), and / or ii) determine if there is an opportunity for electric resistance heating.
- Import facility demand profile data and set limits for how much additional demand may be used during different periods so that using electricity for thermal energy does not set the monthly account demand peak.
- Visually show, and provide in a report, the modulated outputs for both air to water heat pumps or resistance heating.
- Set up historical tracking to record and report the input and output data to validate the savings using the hypothetical versus traditional way for heating.
- Provide, as a mock-up without an actual electric boiler installed, for BAS acknowledgement of request to engage electric heating and confirmation of how much electric heating was dispatched, and for how long.
- Provide a report that quantifies the potential seasonal dollar and greenhouse gas savings.

To accomplish this, an optimization algorithm was developed to queue the boiler control system when to consider electric supplement heating. The algorithm relies on the following inputs to function accurately:

- Natural gas price
- Electricity price
- Regulatory and debt retirement charges
- Current building electricity consumption
- Current month peak consumption
- Current month peak consumption for the year prior
- Outdoor ambient dry-bulb temperature

Once all the above data points are known, the software can execute the decision algorithm for queueing the BAS when it is best to use the electric boiler supplement heating.

Results

The simulation result showed overall energy cost saving potential of at least \$22,000 and 150 tCO₂e. The greenhouse gas reduction is equivalent to planting approximately 3,940 urban trees or removing 29 average cars from the roads, annually using straight resistance heating. These savings were based on extrapolating data from the 10-day trial during the heating season at Ottawa City Hall. The actual trial results confirmed the expected \$15,000 savings, and exceeded the 70 tCO₂e reduction obtained from the pre-trial simulation results simply based on the Ottawa City Hall historical 2016-2017 heating season and 2017 cost parameters.

Scalability

The City of Ottawa has an executable version of The Optimization Program for use in assessing various scenarios for City Hall. Opportunity exists to:

- Continue work on installing electric heating at a City facility,
- Host the Optimization Program in the cloud,
- Assess other City sites,
- Assess if and when it is advantageous to exceed the monthly building electrical peak, and
- Enhance the Optimization Program based on new learnings and needs, especially reporting plus alerting and alarming.

f. Ottawa Community Housing's OCH Tenant Energy Engagement Pilot (TEEP)

Total Funding Allocation: \$70,000

Project Locations: Ward 4, Ward 12, Ward 13, Ward 16



Project Description

Tenants in bulk metered buildings, who never see a utility bill, tend to consume more per capita than those who are responsible for their utilities and they have no feedback to inform their consumption behaviour. Providing bulk metered tenants feedback and measurements of their consumption is the first step in informing and modifying their consumption behaviour. When this information is combined with a tool, like a programmable thermostat or LED lights, the tenant now has the resources to positively impact their consumption. Finally, education on how to best use those tools and on-going support to maintain conservation as a priority can ensure that the initial savings are sustained over a long period of time.



Since March 2017, Ottawa Community Housing has been preparing its Tenant Energy Engagement Pilot (TEEP) in the following four buildings: 231 Penfield, 280 Montfort, 1180 Shillington, and 725 Bernard. The TEEP has three components which are designed to initiate, support and sustain behavior change toward sustainability: active engagement, passive engagement, and conservation tools. Since Sept 2017, different aspects of the pilot have been deployed and in January 2018, the pilot was fully operating.

Results

It is still too early to fully report on the extent of the savings and payback periods, but the initial results at two of the buildings, 231 Penfield and 280 Montfort, already suggest a 5% reduction in energy consumption throughout the building. It is hoped that similar results will be encountered through out the other buildings.

Direct tenant engagement is difficult to quantify. The main benefit of TEEP is an increased energy literacy amongst tenants. Since utilities are included as part of their rent, utility consumption is completely foreign to these tenants. At minimum, Ottawa Community Housing is aiming to educate and create an awareness about utility consumption and conservation, which will lead directly to energy conservation and savings.



Scalability

In order to ensure the longevity of the savings, Ottawa Community House has targeted components which are inherently timeless. Once installed, the lobby displays and the thermostats will continue to operate and produce savings in perpetuity with minimal upkeep. Direct tenant engagement can be maintained through quarterly presentation and reports at tenant association meetings. With a small amount of upkeep, it is believed that the components of the TEEP will continue to yield savings for many years to come.

Implementing the tools and the tenant engagement does require funds and it is believed that the costs of the program can be recovered and even exceeded within five years of implementation. The benefits of utility savings is a reduced cost to Ottawa Community Housing, that can then re-invest the savings into their communities.

g. prototype D TEAM Inc's Urban Innovation Pods

Total Funding Allocation: \$22,000

Project Locations: City-wide

Project Description

prototypeD designed and constructed two innovation Pods which are completely solar powered, off grid buildings used for delivering innovation products and services. The pods are full season units. These Pods benefit from being entirely prefabricated, custom designed, locally built (within the Ottawa valley) and bring together clean technology connectivity. They can be placed throughout the urban centres of Ottawa to create an innovative hub of off-grid buildings and establish a network of high-tech and sustainable stations.



There are three solar panels per pod that result in an instantaneous generating capacity of 765 W. That power is delivered into four storage batteries resulting in a storage capacity of 5.6 kWh. The Pods are heated by a 8000 btu propane furnace with direct venting and no electrical power requirements. There is no water supply as on-board water and wastewater systems would increase the weight of these small trailers to the point where they would require extra axles, wheels, brakes and would a larger towing vehicle. The energy systems within the Pods do not currently track power generation and consumption.

Results

Two social enterprises have made use of the pods to date. Growcer, a company focused on food security for northern communities has just finished a research and development (R&D) project. This R&D will be implemented into Growcer's larger hydroponic shipping container system to increase food growing yields. This will increase access to fresh food, and profit in remote communities. Robot Missions, an organization that uses open source, 3D printed beach cleaning robots has made the final arrangements with the city to deploy a pod on Westboro beach for the summer. Robot Missions will use the pod to engage with community members and get children interested in Robotics.

More tentative agreements with several social enterprises have been made throughout Ottawa. These groups will bring the mobile Pods and green energy services to their members to offer new services. The length of time each pod will remain in each location will change depending on the partner. Due to the increased capacity with the addition of two new pods, prototypeD will be able to offer them for longer intervals.

Scalability



prototypeB will link with the Bayview Yards Innovation Centre, local BIAs, and local social enterprises to demonstrate the potential of clean, renewable and sustainable infill buildings.

Pods will be deployed in the urban and suburban core and will highlight potential use as greenhouses, home offices, educational centres, and workshops. As the public begins interacting with organizations within the Pods, new design changes may be discovered that could improve future designs, just as the first two Pods influenced design decisions with the latest Pods.