



To: General Purposes Committee **Date:** May 6, 2024
From: Peter Russell **File:** 10-6000-01/2024-Vol
 Director, Sustainability and District Energy 01
Re: **Municipal Top-Ups for Heat Pump Retrofits in Existing Ground-Oriented Residential Homes**

Staff Recommendations

1. That the report titled “Municipal Top-Ups for Heat Pump Retrofits in Existing Ground-Oriented Residential Homes” from the Director, Sustainability and District Energy, dated May 6, 2024, be endorsed;
2. That the City enter into a Municipal Contribution Agreement with the Province of BC and BC Hydro to offer top-up incentives for heat pump and electrical service upgrades for ground-oriented residential homes in Richmond, and the General Manager, Engineering and Public Works/Deputy Chief Administrative Officer or Chief Administrative Officer be authorized to execute the agreement; and
3. That the Consolidated 5 Year Financial Plan (2024-2028) be amended accordingly.

Peter Russell
 Director, Sustainability and District Energy
 (604-276-4130)

Att. 3

REPORT CONCURRENCE		
ROUTED TO:	CONCURRENCE	CONCURRENCE OF GENERAL MANAGER
Communications	<input checked="" type="checkbox"/>	
Finance Department	<input checked="" type="checkbox"/>	
Building Approvals	<input checked="" type="checkbox"/>	
SENIOR STAFF REPORT REVIEW	INITIALS: 	APPROVED BY CAO

Staff Report

Origin

This report seeks Council approval to begin offering top-up rebates on current CleanBC incentives for installation of electric heat pumps in existing single-detached and attached homes in Richmond. The proposed municipal top-up incentive is seeking to raise local interest and understanding of the advantages of electric heat pumps for both space heating and cooling, as well as domestic hot water, to accelerate local adoption of near-zero emission mechanical systems for ground-oriented existing residential buildings in Richmond.

This report supports Council's Strategic Plan 2022-2026 Focus Area #4 Responsible Financial Management and Governance:

4.4 Work with all levels of governments for grant and funding opportunities.

This report supports Council's Strategic Plan 2022-2026 Focus Area #5 A Leader in Environmental Sustainability:

5.1 Continue to demonstrate leadership in proactive climate action and environmental sustainability.

This report supports the implementation of Richmond's Community Energy and Emissions Plan 2050, and OCP emission reduction policies through:

Strategic Direction 1: Retrofit Existing Buildings

Action Categories: Create incentives and remove barriers to low carbon energy retrofits

Analysis

Policy Framework for Decarbonization Building Heating and Cooling Systems

The Community Energy and Emissions Plan 2050 (CEEP) identifies transitioning from fossil fuel-based heating to energy-efficient electric heat pump systems in existing homes as a key strategy in reducing citywide greenhouse gas (GHG) emissions, and calls for the development of comprehensive programs to incentivize and accelerate energy-related retrofits. During community engagement processes, staff conducted two surveys of residents that indicated incentives were a preferred means of implementing CEEP actions for existing buildings (see Attachment 1). The CEEP also identifies the need to broaden awareness of the benefits of decarbonizing mechanical systems in existing buildings, and support the transition to heat pumps with ongoing engagement and capacity building with stakeholders.

The Role of Electric Heat Pumps in Decarbonization

Ground-oriented residential homes are the most common building type by number in Richmond, comprising 59% of all structures within the City building stock.¹ These building types account for 38% of the total GHG emissions from all existing buildings, with approximately 28% coming from single detached homes and 10% from attached homes.²

¹ There are 28,000 ground-oriented residential buildings in Richmond, representing 43,000 dwelling units.

² Attached homes include duplex and multi-plex homes, as well as townhouses.

Space heating and domestic hot water systems account for approximately 90% of annual greenhouse gas (GHG) emissions from existing ground-oriented residential buildings in Richmond, or an estimated 148,000 tonnes CO₂e annually. Attachment 2 includes a detailed breakdown of energy use and carbon emissions in ground-oriented detached and attached residential buildings in Richmond, categorized by age cohort.

Electric heat pumps are typically three times more efficient than the best-performing natural gas furnaces and boilers. GHG emissions from the electricity grid is only 6% of the equivalent amount of natural gas energy. As such, staff estimate that retrofitting gas-fired furnaces and domestic water heaters with electric heat pumps, in an average Richmond house built between 1946 and 1990, could result in a reduction equivalent to 3.48 tonnes of CO₂ per year³, with an additional 1 tonne achieved through replacement of the existing gas-based domestic hot water system with an electric heat pump. Together, these reductions would result in a reduction of 85-90% of annual GHG emissions in a typical home.

CleanBC Incentive Program

Until recently, there was relatively little uptake of heat pumps in BC. Heat pumps have both higher purchase and installation costs, and had higher operational costs in comparison to natural gas mechanical systems. This incremental cost barrier was compounded by a lack of public awareness regarding the efficiency, health, and thermal comfort benefits of installing heat pumps, apart from lack of industry capacity to properly design and install heat pumps in existing homes. In recent years, however, the operating temperature range and efficiency of heat pumps available to consumers has been continually improving, and the cost of heating with heat pumps is now less than that with natural gas⁴.

Since 2018, the Province has offered and continues to offer rebates for the replacement of gas-fired systems with space heating and domestic hot water electric heat pumps in ground-oriented homes through the Better Homes program. In 2021, the Province substantially increased its incentives through the CleanBC initiative, offering rebates of up to \$6,000 for space heating electric heat pumps and up to \$1,000 for heat pump water heater retrofits.⁵ Together with federal rebates, these incentives have lowered the incremental cost of heat pumps, making these systems a far more cost-competitive option.

Municipal Top-up Incentives

The CleanBC program has enabled municipalities to provide an optional top-up incentive for residents undertaking heat pump retrofits within a participating jurisdiction. Municipalities also have the option of providing top-ups to offset costs related to electrical service upgrades, which may be necessary for some homes with limited electric panel capacity.

For administrative simplicity, the Province has set the allowable municipal top-up incentive amount for heat pumps to either \$350 or \$2,000 per home. These tiers are equivalent to 6% and 33% respectively of the maximum CleanBC rebate amount. Staff are proposing the lower top-up

³ Includes the very small incremental GHG emissions from addition of cooling by installing an electric heat pump.

⁴ When carbon tax is factored in. Currently: \$80/ton of CO₂e.

⁵ Clean BC also has an income-qualified program for which low-income households may be eligible. Rebates up to \$9,500 for space heating, and up to \$3,500 for heat pump water heating are available.

incentive level for the time being, based upon research into the effectiveness of municipal top-up incentives by other municipalities, which is covered in the next section.

Assessing the Market Effectiveness of Municipal Top-up Incentives

Staff conducted a research comparing the number of electric heat pumps retrofits in Richmond with other municipalities across the Lower Mainland and Vancouver Island that have been offering top-up incentives.⁶ Attachment 3 provides the percentage of homes retrofitted with heat pumps in the last three years, normalized by the number of eligible homes in each municipality.

In this research, municipalities were categorized into three groups:

1. **Control Group:** Municipalities that do not offer heat pump top-ups.
2. **Top-ups Group:** Municipalities that offer top-ups but no other significant support.
3. **Enhanced Group:** Municipalities that offer top-ups along with other major incentive support (e.g. retrofit concierge service and/or retrofit financing program).

The analysis reveals that municipalities offering top-up incentives only (Top-ups Group) double the uptake (0.85% of the community's eligible housing stock over last 3 years) over the control group (0.42%). Furthermore, municipalities that provided both top-ups and additional enhanced support showed further increases in percentage of homes upgrading their space heating and/or domestic hot water systems, reaching an average of 1.95% of their eligible housing stock. Of the 20 BC municipalities that offer top-up incentives, six are now fully subscribed, and ten are nearing full subscription, showing the substantial uptake of municipal top-ups, even though they are relatively modest compared with the larger CleanBC incentive amount.

Since 2020, an average of 57 space heating heat pump retrofits per year have been observed in ground-oriented homes in Richmond. Based upon the top-up participation rates observed through this research, staff forecast that by implementing even the modest \$350 top-up incentive, the number of households pursuing electric heat pump retrofits in Richmond could potentially double to 115 projects per year.

Assessing the Economic Effectiveness of Municipal Top-up Incentives

Staff also compared the cost-effectiveness of a municipal top-up incentive by examining the relationship between dollars spent and GHG emissions reduced, based upon a forecast of heat pump retrofits in Richmond. Currently, CleanBC Better Homes incentive program has a ratio of \$114 per tonne of CO₂ equivalent (tCO_{2e}) lifetime reduction. Based upon these results, offering a \$350 top-up has the potential to double the annual number of heat pump retrofits in Richmond, leading to a ratio of \$17 per tCO_{2e} lifetime reduction⁷. For comparison, the current carbon price is significantly higher, at \$80 per tonne. This comparison highlights the great cost-benefit of this initiative in reducing GHG emissions in ground-oriented homes.

⁶ From data provided by the Province, or shared by municipalities. Corresponds only to households that accessed CleanBC rebates through fuel switching projects.




⁷ Excluding 'free riders'. 'Free riders' are defined as households that would have installed heat pumps even if a top-up incentive was not offered. Estimated at 57 homes per year for Richmond.

Based on the data analyzed, offering the highest top-up tier (\$2,000/heat pump) does not seem to significantly increase the number of heat pump retrofits. In our research, Municipality #5, which offered higher top-ups, showed a similar level of heat pump installations compared to municipalities offering \$350 per heat pump.

Recommended Top-up Incentive Approach for Richmond

Staff recommend adopting a \$350 municipal heat pump top-up amount, rather than the \$2,000 top-up incentive level. Recommended top-up for electrical service upgrades⁸ is \$500 per home. This is based upon the following objectives: (a) benefitting as many local residents as possible on an annual basis; and (b) achieving GHG emission reductions at the lowest effective cost-per-tonne. Table 1 shows CleanBC incentives and additional top-up available to residents through the proposed program.⁹ The recommended initial duration of the project is two years, thereby allowing time to assess the impact of this initiative.

Table 1: CleanBC Incentives and Proposed Top-Ups available to Richmond residents¹⁰

			
Offer	Space Heating Heat Pump	Heat Pump Water Heater	Electrical Service Upgrade
Clean BC Better Homes	Up to \$6,000	Up to \$1,000	Up to \$500
Clean BC Income Qualified	Up to \$9,500	Up to \$3,500	Up to \$3,500
Municipal Top-up*	\$350	\$350	\$500

*subject to Council approval

Note that administrative costs to process top-up rebates are covered by the Province, and the municipality only covers the municipal rebate amount. BC Hydro administers the delivery of the top-up incentive to applicants, through a one-window application process that allows customers to apply for and receive the CleanBC rebate at the same time as the municipal top-up. Municipalities can also adjust the number of incentives between space heating, water heating and electrical service upgrades on a quarterly basis if needed.

Table 2 provides a detailed breakdown of the proposed budget for the next two years, including forecasted uptake of each incentive, referred to as ‘projects’ within the table. Year 1 is from July 1, 2024 until March 31, 2025. Year 2 is from April 1, 2025 until March 31, 2026.

⁸ Electrical upgrade top-up is only eligible when installing a heat pump.

⁹ Fuel switching projects only. Incentives are available when CleanBC registered contractors install eligible models.

¹⁰ Each household can access all three top-ups simultaneously, with a limit of one per top-up category.

Table 2: Municipal Top-ups – Allocation of Proposed Incentives in Year 1 and 2

PROJECT – YEAR 1	NUMBER OF PROJECTS	COST
Space Heating Heat Pumps	120	\$ 42,000
Heat Pump Water Heaters	10	\$ 3,500
Electrical Service Upgrades	25	\$ 12,500
Community Awareness Campaign	N/A	\$ 2,000
Total of Heat Pump projects	130	\$ 60,000
PROJECT - YEAR 2	NUMBER OF PROJECTS	COST
Space Heating Heat Pumps	135	\$ 47,250
Heat Pump Water Heaters	15	\$ 5,250
Electrical Service Upgrades	30	\$ 15,000
Community Awareness Campaign	N/A	\$ 2,500
Total of Heat Pump projects	150	\$ 70,000

Community Awareness Campaign

With Council endorsement to proceed with Richmond’s participation in the Clean BC municipal top-up incentive program, staff will develop a community awareness campaign to increase awareness of GHG emissions and occupant comfort benefits of electric heat pumps. This will include community outreach supported by information bulletins, digital communications, and printed posters in public libraries and community centers.

The community awareness campaign would be accompanied by new website content including CleanBC and municipal top-up incentives. Planned website content also includes heat pump basics and benefits, informative videos, details on required permits, noise bylaws, and available incentives, all aimed at supporting residents in making informed decisions. Ensuring strong local take-up of these incentives are best supported by online information about heat pump technologies, and how local homeowners can participate in the program. Municipalities with a high ratio of retrofits per household have typically created a webpage that consolidates multiple resources.

Next Steps

With Council approval, the City would enter into a Municipal Contribution Agreement with the Province and BC Hydro for the first year of the program. Staff forecast that the City could start offering top-ups as soon as July 1, 2024. The City would be required to enter into a new agreement for the second year, starting April 1 2025. Staff would present to Council, at the end of Year 1, a summary report highlighting the impact, successes and challenges of the program. A final report is planned to be presented by the end of Year 2.

Financial Impact

Staff recommend that the Local Government Climate Action Program revenue of \$130,000 be used to fund this rebate program. It is estimated that \$60,000 would be disbursed in the first year of the program, from July 1, 2024 to March 31, 2025, and \$70,000 in Year 2, from April 1st, 2025 to March 31, 2026.¹¹ If approved, the Consolidated 5 Year Financial Plan (2024-2028) will be amended accordingly.

At the end of each quarter, BC Hydro will issue a top-up report and invoice the City for the top-up rebates that have been paid out.

Conclusion

Based upon staff research, municipal top-up incentives offer the potential to double the current installation rate for electric heat pumps for existing ground-oriented buildings in Richmond. A steady transition away from existing fossil fuel heating systems to near-zero emission heat pump systems is necessary to achieve citywide GHG emission reduction targets for 2030 and 2050, as set out in the City's Official Community Plan, and Community Energy and Emissions Plan 2050. Electric heat pumps also offer the potential to lower household energy costs, and create a more comfortable and resilient living environment for occupants.



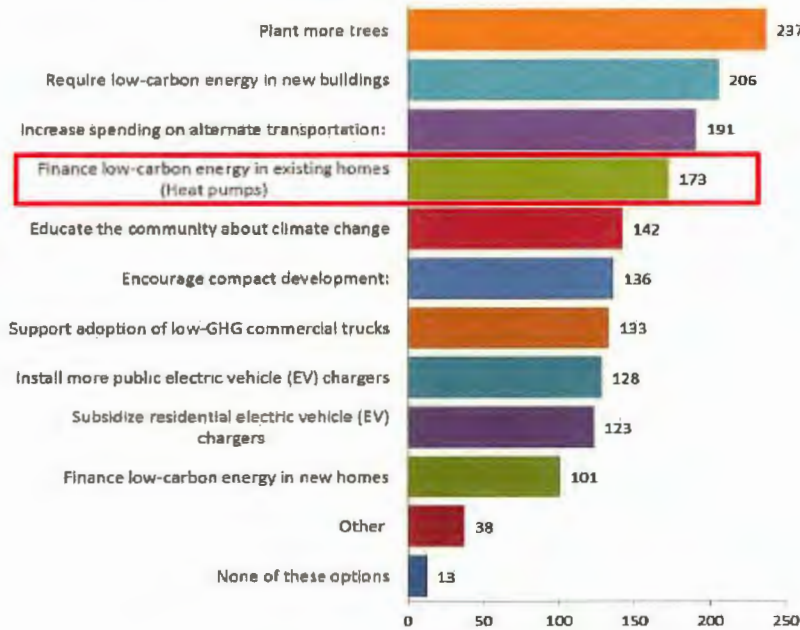
Gabriel Berenguer Vieira
Senior Climate Action Specialist
(604-247-4617)
GB

- Att. 1: CEEP 2050 survey results: residents' preference on the City's investment priorities
2: Ground-Oriented Residential: Building Count, Energy Use and Emissions by Age Cohort
3: Summary of heat pump retrofits across municipalities in the Lower Mainland and South Vancouver Island in existing ground-oriented homes(normalized by eligible homes)

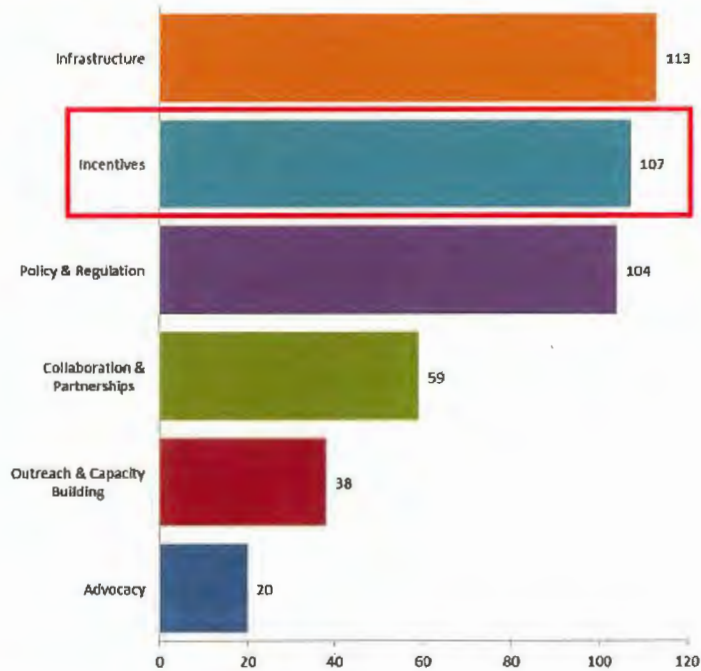
¹¹ Subject to provincial extension of CleanBC Better Homes incentive program. Current provincial budget is approved until March 31st, 2025.

CEEP 2050 survey results: residents' preference on the City's investment priorities *

Q37: I would choose the following to spend City funds on: (Alphabetical order - Please select up to five.)



Q9: Existing Buildings - Which activities should the City focus on? Select up to three.



* Let's Talk Richmond CEEP 2050 survey phase 1 conducted between July 17 and August 18, 2019. Phase 2 conducted between October 18 and November 17, 2019.

Ground-Oriented Residential: Building Count, Energy Use and Emissions by Age Cohort

Table A.1: Residential Single Detached Homes

Building Category	Buildings Count	Building Area (m ²)	Total EUI (kWh/m ² /yr)	GHGs (tCO ₂ e/yr)	GHG Emissions (%)
Residential Single Detached pre-1946	525	66,218	249.37	2,139	0.50%
Residential Single Detached 1946-1977	9164	1,406,677	196.54	35,816	8.34%
Residential Single Detached 1978-1995	11138	2,807,333	143.87	52,324	12.19%
Residential Single Detached 1996-2010	4554	1,449,002	109.37	20,529	4.78%
Residential Single Detached 2011-2016	2425	953,152	96.01	11,856	2.76%
Total	27,806	6,682,382	N/A	122,664	28.57%

Table A.2: Residential Single Attached Homes

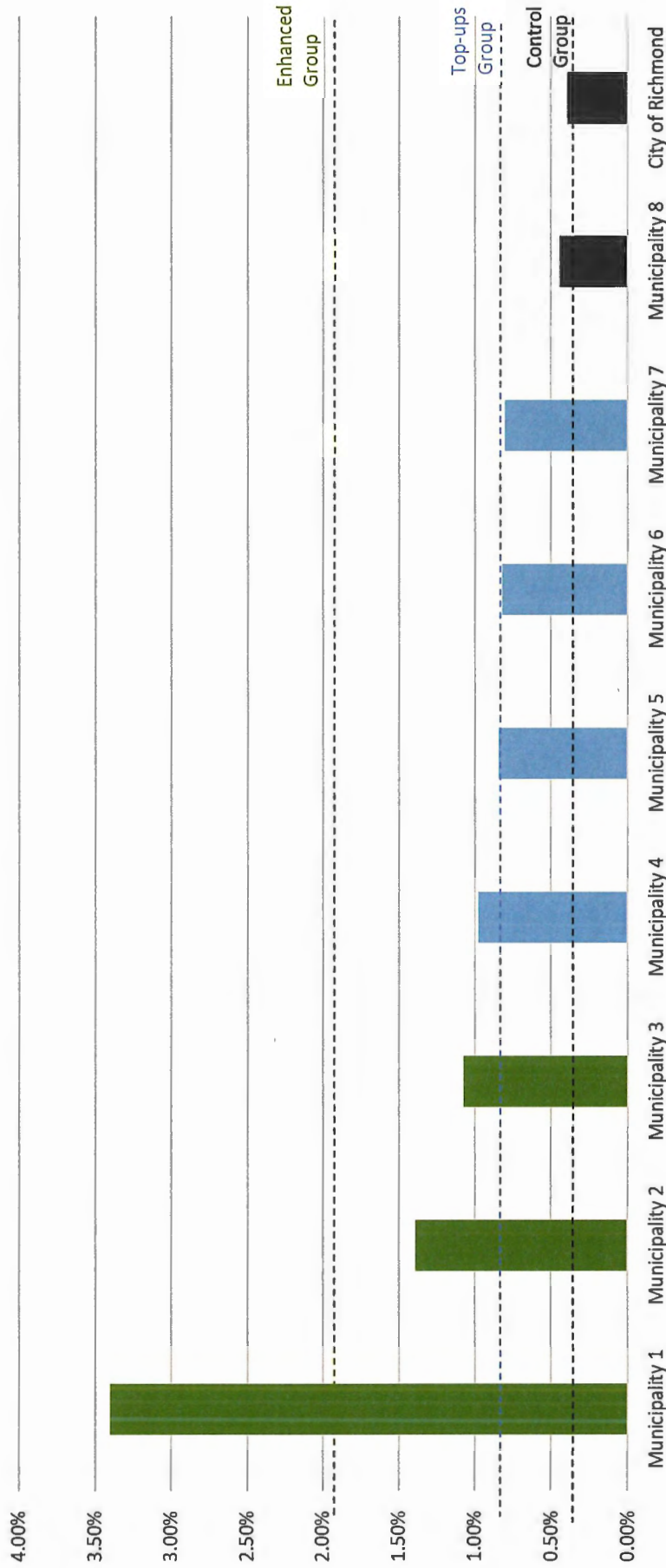
Building Category	Buildings Count	Building Area (m ²)	Total EUI (kWh/m ² /yr)	GHGs (tCO ₂ e/yr)	GHG Emissions (%)
Residential Single Attached pre-1946	9	438	289.37	16	0.00%
Residential Single Attached 1946-1977	3112	399,558	221.4	11,433	2.66%
Residential Single Attached 1978-1995	5314	761,697	162.83	16,030	3.73%
Residential Single Attached 1996-2010	5876	771,151	127.95	12,752	2.97%
Residential Single Attached 2011-2016	1358	174,016	111.29	2,503	0.58%
Total	15,669	2,106,860	N/A	42,734	9.94%

Table A.3: All Ground Oriented Homes

Building Category	Building Count	Building Area (m ²)	Total EUI (kWh/m ² /yr)	Total GHGs (tCO ₂ e/yr)	GHG Emissions (% of all buildings)
Total	43,475	8,789,242	N/A	165,398	38.51%

ATTACHMENT 3

Summary of heat pump retrofits across municipalities in the Lower Mainland and South Vancouver Island in existing ground-oriented homes (normalized by eligible homes¹²)



- Control group: City of Richmond & Municipality 8
- Top-Ups Group: Municipalities 4-7
- Enhanced Group: Municipalities 1-3

¹² Due to confidentiality, municipalities were not identified in this report. Eligible homes data estimated based on Statistics Canada website (2016 Census).