



## Guideline

### Climate Resilience Technical Specifications

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## **Synopsis**

Edmonton's Climate Resilience Policy (City Policy C627) [1] and the Community Energy Transition Strategy have resulted in a need for additional and more robust analysis on greenhouse gas (GHG) emissions and costs for City of Edmonton projects. More specifically C627 provides a commitment for the City to lead climate solutions in its service delivery and corporate management, including a corporate climate resilience management plan for the buildings it owns, leases and funds. This plan covers the design and construction of emission neutral buildings. Further the Community Energy Transition Strategy outlines the City's commitment to be an emissions neutral corporation by 2040.

The use of this document is required for City staff and consultants when performing financial and GHG analysis for City owned buildings, facilities, and other assets. When information from this guideline is used, please ensure that the version of this document used is referenced in the analysis for proper documentation.

As the City of Edmonton continues implementation of the Energy Transition Strategy, many decisions will require a better understanding of the emissions and costs associated with alternative energy, energy efficiency, and project scope decisions. This document is intended to provide consistent information and methodologies to support calculations and forecasts for all City projects and includes:

- emissions factors,
- utility costs, and
- carbon costs (carbon tax and offsetting costs).

## **Emissions Factors**

Emissions factors are used to calculate the greenhouse gas emissions associated with the energy that a building uses. The emissions factors provide below are for:

- Grid electricity,
- City procured green electricity,
- Natural Gas,
- Renewable Natural Gas,
- Hydrogen,
- Other fuel sources.

## **Grid Electricity**

The emissions factor for the Alberta electricity grid changes over time as the province moves towards lower greenhouse gas electricity production. The electricity grid factors for each year can be found in Environment and Climate Change Canada's ("ECCC") National Inventory Report, and the ECCC's forecast [2,3]. The City of Edmonton has procured 100% renewable electricity for City operations starting in 2024, which has a grid factor of zero. The grid factors for 2013 - 2050 are presented in the

table below. Grid factors are expressed as kilograms of carbon dioxide equivalent per kilowatt hour (kg CO<sub>2</sub>e/kWh).

Table 1: Electrical Grid Factors 2013-2050

Year	Alberta Electrical Grid Factor <sup>1</sup> kg CO <sub>2</sub> e/kWh	City of Edmonton Grid Factor (With Green Electricity Purchase) kg CO <sub>2</sub> e/kWh
2013	0.88	0.88
2014	0.82	0.82
2015	0.89	0.89
2016	0.83	0.83
2017	0.80	0.80
2018	0.69	0.69
2019	0.68	0.68
2020	0.64	0.64
2021	0.47	0.47
2022	0.44	0.44
2023	0.38	0.38
2024	0.27	0
2025	0.24	0
2026	0.25	0
2027	0.23	0
2028	0.21	0
2029	0.21	0
2030	0.21	0
2031	0.19	0
2032	0.19	0
2033	0.18	0
2034	0.18	0

<sup>1</sup> From 2013-2020, the National Inventory Report value is used. From 2021-2050, the Environment and Climate Change Canada forecast value is used.

Year	Alberta Electrical Grid Factor <sup>1</sup> kg CO <sub>2</sub> e/kWh	City of Edmonton Grid Factor (With Green Electricity Purchase) kg CO <sub>2</sub> e/kWh
2035 <sup>2</sup>	0.17	0
2036	0.17	0
2037	0.17	0
2038	0.17	0
2039	0.17	0
2040	0.17	0
2041	0.17	0
2042	0.17	0
2043	0.17	0
2044	0.17	0
2045	0.17	0
2046	0.18	0
2047	0.18	0
2048	0.18	0
2049	0.17	0
2050	0.17	0

For the calculation of emissions due to forecasted electricity use, a result shall be reported for both the Alberta electrical grid factor for the year of analysis and the City of Edmonton green electricity emissions factor of zero. Use appropriate factors as a decision making tool based on the parameters for the project.

### Natural Gas

The emissions factor for natural gas is expected to remain stable at 0.053 tCO<sub>2</sub>e/GJ) [2]. The published factor is used, which includes all direct emissions from natural gas combustion. This factor does not include any upstream emissions from the production of natural gas, and reflects only the direct (Scope 1) emissions from natural gas use.

<sup>2</sup> The Federal Government has committed to an emissions neutral grid by 2035. This would mean the grid factor is zero. The details of this commitment have not yet been published.

## Renewable Natural Gas

Renewable natural gas (RNG) is not currently being used in City operations but an emissions factor is necessary for forecasting future emissions. Please consult the Environment and Climate Resilience section for an expected intensity value.

## Low Carbon Hydrogen

When comparing hydrogen to natural gas and electricity, use an emissions factor of zero, representing the direct (Scope 1) emissions only. Also calculate the upstream (scope 3) emissions. The upstream emissions factor for hydrogen fuel depends on the method of production. The most common low-carbon production method in Alberta is to produce hydrogen from natural gas and to use carbon capture, sequestration and/or storage methods to limit emissions (known as “blue hydrogen”). As the emissions factor depends on the production conditions, use a documented value provided by the supplier if available. If this number is not available, a value of 0.0364 tCO<sub>2</sub>e/GJ may be used, which represents a preliminary threshold for considering this hydrogen fuel as low carbon [4].

## Other fuels (diesel, gasoline, etc.)

Contact the Environment and Climate Resilience section for this information.

## Utility Costs

Historical utility costs are building specific and should be available for each project.

## Electricity

Energy-only electricity prices for 2020 to 2037 can be found in the table below. These prices include renewable attributes. After 2037, apply an escalation rate of 2%. Additionally, distribution, demand, rate riders and other costs for electricity are \$0.08/kWh in 2021 and can be escalated at a rate of 2% until 2024. In 2024 the distribution, demand, rate riders and other non-energy costs go to \$0.11/kWh and can be escalated at 2% per year after 2024. Use the energy-only electricity cost for solar generation, combined heat and power (CHP) generation, and electrical efficiency measure savings. For fuel switching comparative analysis, use the full market-rate (energy and distribution, demand, rate rider) electricity cost.

Table 2: Forecasted Energy-Only Electricity Prices

Year	Cost \$/kWh
2020	\$0.08
2021	\$0.08
2022	\$0.08
2023	\$0.08

Year	Cost \$/kWh
2024	\$0.12
2025	\$0.12
2026	\$0.12
2027	\$0.12
2028	\$0.12
2029	\$0.14
2030	\$0.14
2031	\$0.14
2032	\$0.14
2033	\$0.14
2034	\$0.18
2035	\$0.20
2036	\$0.20
2037	\$0.20

## Natural Gas

Energy-only natural gas prices for 2020 to 2037 can be found in the table below. After 2037, apply an escalation rate of 2%. Additionally, the associated distribution costs for natural gas are \$2.00/GJ in 2021 and can be escalated at a rate of 2%. Carbon pricing cost on natural gas is calculated separately and shall be added to the total cost. Carbon pricing information is found in the next section.

Table 3: Forecasted Energy-Only Natural Gas Prices

Year	Cost \$/GJ
2020	\$2.12
2021	\$3.41
2022	\$5.07
2023	\$3.17
2024	\$3.44
2025	\$3.84

Year	Cost \$/GJ
2026	\$4.05
2027	\$4.16
2028	\$4.37
2029	\$4.48
2030	\$4.56
2031	\$4.65
2032	\$4.75
2033	\$4.85
2034	\$4.94
2035	\$5.04
2036	\$5.14
2037	\$5.25

Please connect with Utility Supply Management ([usmrequests@edmonton.ca](mailto:usmrequests@edmonton.ca)) with any questions on utility costs.

The discount rate to be used is the average 30-year Alberta Capital Finance Authority (ACFA) borrowing rate over the last 12 months (<https://acfa.gov.ab.ca/loan-form-script/rates.html>).

Connect with the Environment and Climate Resilience section for information on district energy utility, renewable natural gas and hydrogen costs.

## **Carbon Costs**

### **Carbon Price**

Carbon pricing by the federal government represents an additional cost associated with a building's emissions. The fuel charge rates are \$20 per tonne of CO<sub>2</sub>e in 2019, rising by \$10 per tonne annually to \$50 per tonne in 2022 and then by \$15 per tonne annually until 2030 [5,6]. The equivalent cost per GJ of natural gas can be found in the table below.

Table 4: Carbon Pricing on Natural Gas

Year	\$/tonne CO <sub>2</sub> e	\$/GJ
2019	20	1.05
2020	30	1.58
2021	40	2.10
2022	50	2.62
2023	65	3.33
2024	80	4.10
2025	95	4.86
2026	110	5.63
2027	125	6.40
2028	140	7.17
2029	155	7.93
2030	170	8.70

There are no carbon pricing increases announced after 2030. It can be assumed that the price remains a constant \$170 per tonne CO<sub>2</sub>e.

Contact the Environment and Climate Resilience section for carbon pricing for other fuels.

### Carbon Offsets

Carbon offsetting is likely to be required for emissions neutral City operations by 2040. The current best estimate of the cost of offsetting is \$144.50/tonne (85% of the estimated \$170/tonne carbon pricing cost). This cost incremental should be included in cost forecasts for fossil fuel use after 2040 and should be broken out as a separate operational impact labeled as “emissions offsetting after 2040”. For more information, contact the Environment and Climate Resilience section.


Example Uses and Calculations - Please contact the Climate Resilient Building Team

### References

1. [City of Edmonton C627 Climate Resilience Policy](#)
2. [Environment and Climate Change Canada - 2022 National Inventory Report](#)
3. [Environment and Climate Change Canada - Greenhouse gas emissions projections](#)
4. [Hydrogen Strategy for Canada](#)
5. [Government of Canada - Pan-Canadian Approach to Pricing Carbon Pollution](#)



6. [Government of Canada - Order Amending Schedule 4 to the Greenhouse Gas Pollution Pricing Act: SOR/2022-211](#)

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