Leading Practices on Energy Disclosure and Data Analysis to Support Benchmarking

Webinar for Clean Air Partnership

January 25, 2023

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EUROPEAN UNION

1. What are the EU's current building energy disclosure requirements?

2. Which Member States / Countries have the most stringent energy disclosure requirements?

3. Which policies were just implemented or will be implemented shortly?

EUROPEAN UNION

The Energy Performance of Buildings Directive (EPBD) sets energy performance requirements for buildings in the European Union

Member states are required to:

- Establish energy performance certification systems for buildings
- Ensure that certain types of buildings (e.g., buildings with a useful floor area greater than 1,000 sq.m. [10,763 sq.ft]) disclose their energy performance data
- Develop and implement national energy efficiency action plans with specific measures and targets for improving the energy performance of buildings

EUROPEAN UNION

EPBD Benchmarking - Energy Performance Certificate

Buildings must undergo an energy performance assessment based on the calculated energy performance of the building on factors such as:

- Insulation
- Heating and cooling systems
- Use of renewable energy sources

Energy Performance Certificate:

- Must be displayed in a prominent location
- Provides information about the building's energy efficiency
- Allows comparison with other buildings

EUROPEAN UNION

Individual Member State Requirements

Mandatory Energy Reporting and Benchmarking Programs

United Kingdom (prior to Brexit) has a mandatory energy performance certificate (EPC) mandate that requires the disclosure of energy performance data for non-domestic buildings with a useful floor area of more than 500 sq.m. (5,381 sq.ft).

In Germany, the Energy Saving Ordinance (EnEV) requires the disclosure of energy performance data for non-residential buildings with a useful floor area of more than 1000 sq.m. (10,763 sq.ft).

EUROPEAN UNION

Individual Member State Requirements

Voluntary Energy Reporting and Benchmarking Programs

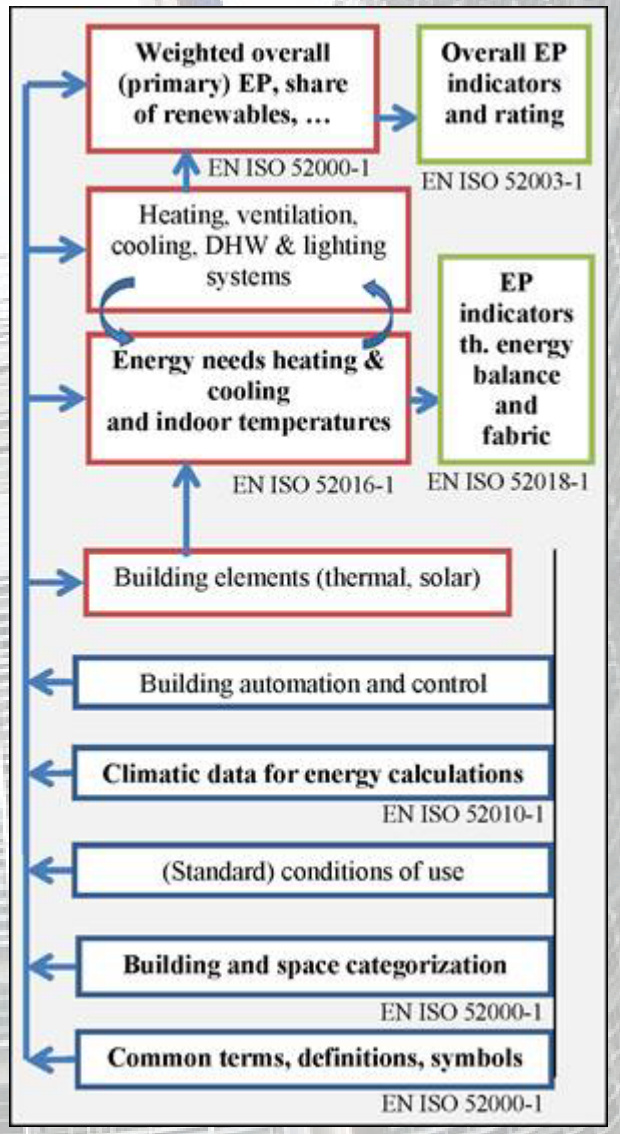
In France - "Label BBC Effinergie” allows buildings to self-certify their energy performance and disclose their energy usage data on an annual basis

EUROPEAN UNION

EPBD – Update 2018 Standards

EU Member States obliged to describe their national calculation methodology and will need to explain where and why they deviate from the ISO standards:

- EN ISO 52000-1
- EN ISO 52003-1
- EN ISO 52010-1
- EN ISO 52016-1
- EN ISO 52018-1



EUROPEAN UNION

Upcoming Disclosure and Benchmarking Requirements

Renovation Wave Program 2020

EPBD to address carbon emissions over the full lifecycle of a building through mandatory calculation and disclosure of this information for new construction, to inform citizens and business and raise awareness

2027 - Large buildings of over 2000 sq.m. (21,527 sq.ft.)

2030 - All buildings

UNITED STATES

1. What are USA's current building energy disclosure requirements?

2. Which States have the most stringent energy disclosure requirements?

3. Which policies were just implemented or will be implemented shortly?

UNITED STATES

US Energy Policy Act of 2005 (EPAct)

Energy Policy Act of 2005 (EPAct)

- Requires that large commercial buildings (i.e., those greater than 50,000 sq.ft. [4,644 sq.m.]) disclose their energy use data to the U.S. Department of Energy (DOE)

- Established the Energy Star program, which is a voluntary labeling program that recognizes buildings that are highly energy efficient

UNITED STATES

Individual State Law and Local Mandates

California

Assembly Bill 1103 - Requires non-residential building owners or operators to disclose the energy consumption data consistent with the ENERGY STAR rating system to buyers, lenders, and lessees

July 1, 2013 - Buildings over 50,000 sq.ft (4,645 sq.m.)

January 1, 2014 - Buildings over 10,000 sq.f. (929 sq.m.)

July 1, 2014 - Buildings equal to or greater than 5,000 sq.ft. (464 sq.m)

Assembly Bill 802 - California Energy Benchmarking Program - a statewide building energy use benchmarking and public disclosure program for commercial and multi-family residential buildings larger than 50,000 sq.ft. (5,645 sq.m.)

UNITED STATES

Individual State Law and Local Mandates

New York

Benchmarking Law - Local Law 84 of 2009 / Local Law 133 of 2016

Requires mixed-use and residential buildings of 25,000 sq.ft. (2,322 sq.m.) or larger to submit energy and water consumption data to the City annually

UNITED STATES

Individual State Law and Local Mandates

Washington

SB 5854 - 2009-10

Requires all non-residential and qualifying public agency buildings to maintain records of energy data with an energy star rating system.

Resulting metrics will be disclosed to a prospective buyer, lessee, or lender. Benchmarking will be required to demonstrate compliance with the ANSI/ASHRAE/IES Standard 100-2018.

UNITED STATES

Looking Ahead

According to a report from Moody's Investors Service, 30 U.S. municipalities are implementing stricter standards for reporting as well as reducing emissions and increasing energy efficiency in commercial real estate.

These standards will affect cities across various regions, including San Francisco, New York, Atlanta, Denver, Chicago, Los Angeles, Miami, and Houston

UNITED STATES

Looking Ahead

In addition to adhering to stricter standards, building owners in New York City, San Francisco, Washington D.C., Boston, and St. Louis may also face fines for failing to comply with newly implemented or revised local regulations that aim to reduce greenhouse gas emissions and/or energy consumption in large buildings.

San Francisco

Starting on December 2022, properties that do not meet the new requirements will be subject to a fine of $100 per day, up to a maximum of 25 days within a 12-month period.

New York City

Starting in 2024, properties that exceed established greenhouse gas emission limits for commercial buildings larger than 25,000 gross sq.ft. (2,322 sq.m.) will be fined $268 per metric ton over the limit. The standards will become even stricter starting in 2030.

Washington D.C.

Privately owned buildings larger than 50,000 sq.ft. (4,645 sq.m.) will need to meet new emission and energy consumption standards by the end of 2026, or face a penalty of $10 per square foot, up to a maximum of $7.5 million.

CANADA

1. What are Canada's current building energy disclosure requirements?

2. Which Provinces have the most stringent energy disclosure requirements?

3. Which policies were just implemented or will be implemented shortly?

CANADA

National Energy Code of Canada for Buildings (NECB)

Main building energy disclosure requirement is the National Energy Code of Canada for Buildings (NECB), which sets energy performance standards for new and renovated buildings across Canada

Disclosure requirements in Canada are primarily focused on new and renovated buildings and are implemented at the national level through the NECB and the Energy Star for New Homes program.

Some provinces and territories may have additional requirements that apply to a wider range of buildings, or that are more stringent than the national requirements

CANADA

Overview of Provincial Mandatory and Voluntary Building Energy Disclosures

BRITISH COLUMBIA

2019
Voluntary energy benchmarking initiative in 7 cities

2023
City of Vancouver - Plans for a mandatory benchmarking requirement

ALBERTA

2017
City of Edmonton launches an existing benchmarking program

2021
Calgary's Commercial Building Energy Benchmarking program

MANITOBA

2020
City of Winnipeg – voluntary energy benchmarking and disclosure program launched (BEDP)

ONTARIO

2017
Ontario's Energy & Water Reporting and Benchmarking (EWRB) came into effect

NOVA SCOTIA

2019
Energy benchmarking industry pilot program launched

QUEBEC

2018
Building Energy Challenge launched

ALBERTA

Home Energy Rating and Disclosure

Mandatory Home Energy Rating and Disclosure: No

Home Energy Labelling Voluntary Or Pilot Program: Yes (City Of Calgary; City Of Edmonton)

ALBERTA

Mandatory Large Building Energy Rating and Disclosure: No

Voluntary Building Benchmarking and Transparency Program: Yes (City of Calgary; City of Edmonton)

Alberta's Municipal Climate Change Action Centre established a voluntary building-benchmarking program for municipal buildings.

ALBERTA

Edmonton - Building Energy Benchmarking Program

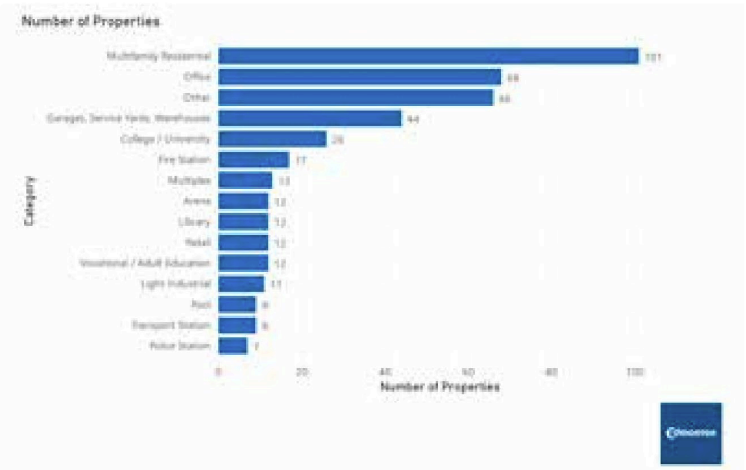
Voluntary disclosure program for buildings over 1000 sq.ft. (929 sq.m.) – 419 properties (704 individual buildings) participated in 2020

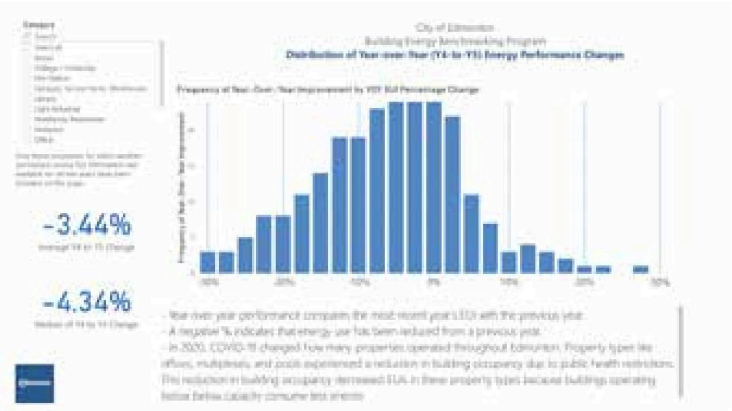
Property owners receive rebates of up to $6000 / building for building energy audits

Data is published in an annual energy benchmarking report, a municipal dashboard and on GRID - an online interactive dashboard tool

ALBERTA

Edmonton – Online Municipal Dashboard





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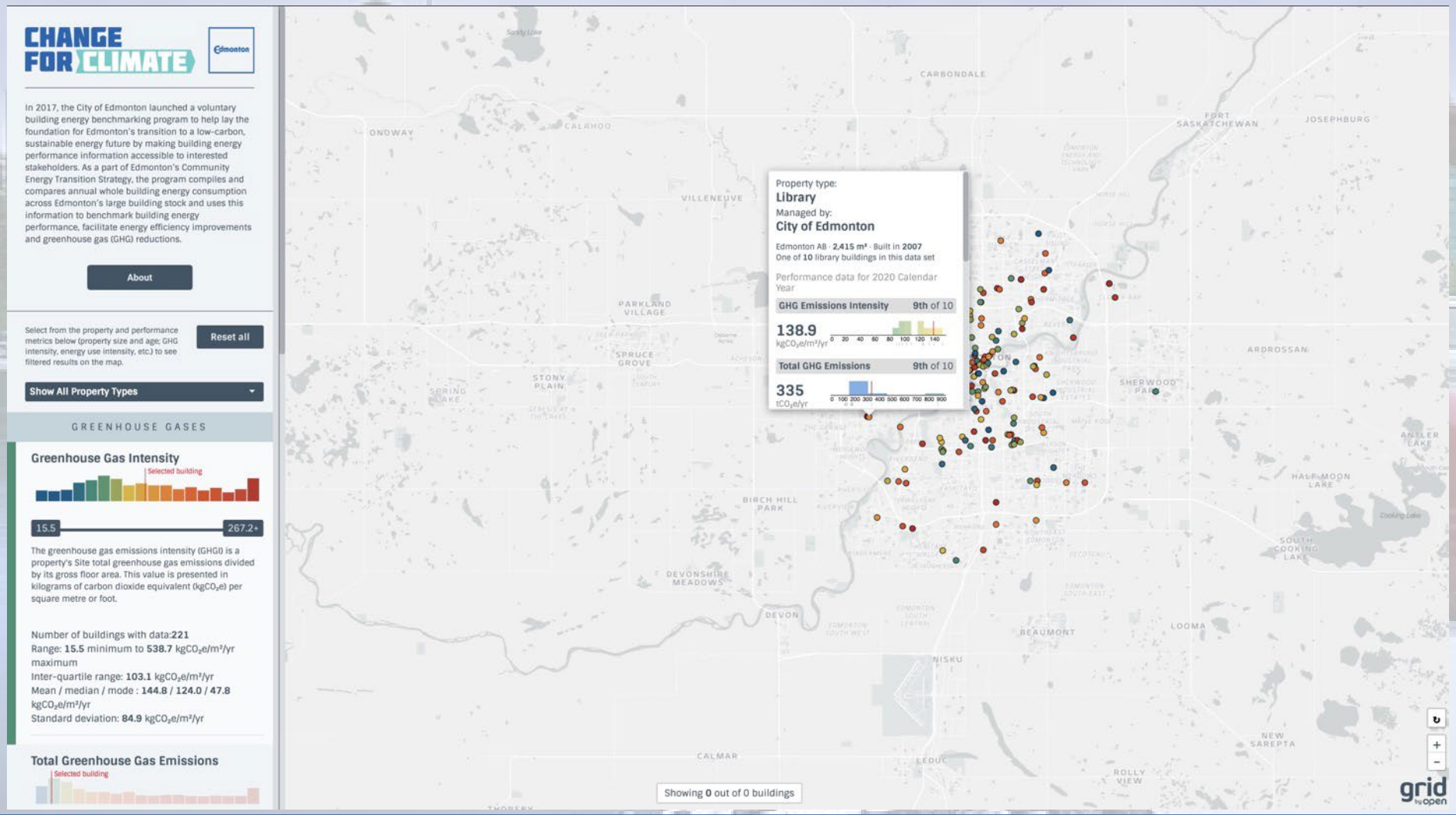
ALBERTA

Edmonton – GRID



ALBERTA

Calgary – Commercial Building Energy Benchmarking Program

Voluntary disclosure program for buildings of any size

Property owners receive an energy performance scorecard

Data is mapped on GRID as an Energy Performance Map - 192 buildings mapped in 2021

ALBERTA

Calgary – Energy Performance Scorecard

Calgary

Energy Performance Scorecard

Calgary Public Building

205 8 AV SE

Reporting Period: **2019 Calendar Year**

Property Type: **Office**

Square Footage: **15,195m²**

Year Built: **1931**

Total GHG Emissions — **131 out of 244** properties

938 tCO_2e

244 properties in City of Calgary

How your property ranks

13 / 244
GHG Intensity in Calgary

2 / 92
GHG Intensity for Office properties in Calgary

Source EUI — **6 out of 244** properties

200 kWh/m²

Site EUI — **4 out of 244** properties

144 kWh/m²

Energy Star Score — 150 properties

No data

GHG Emissions Intensity — **13 out of 244** properties

62 $kgCO_2e/m^2$

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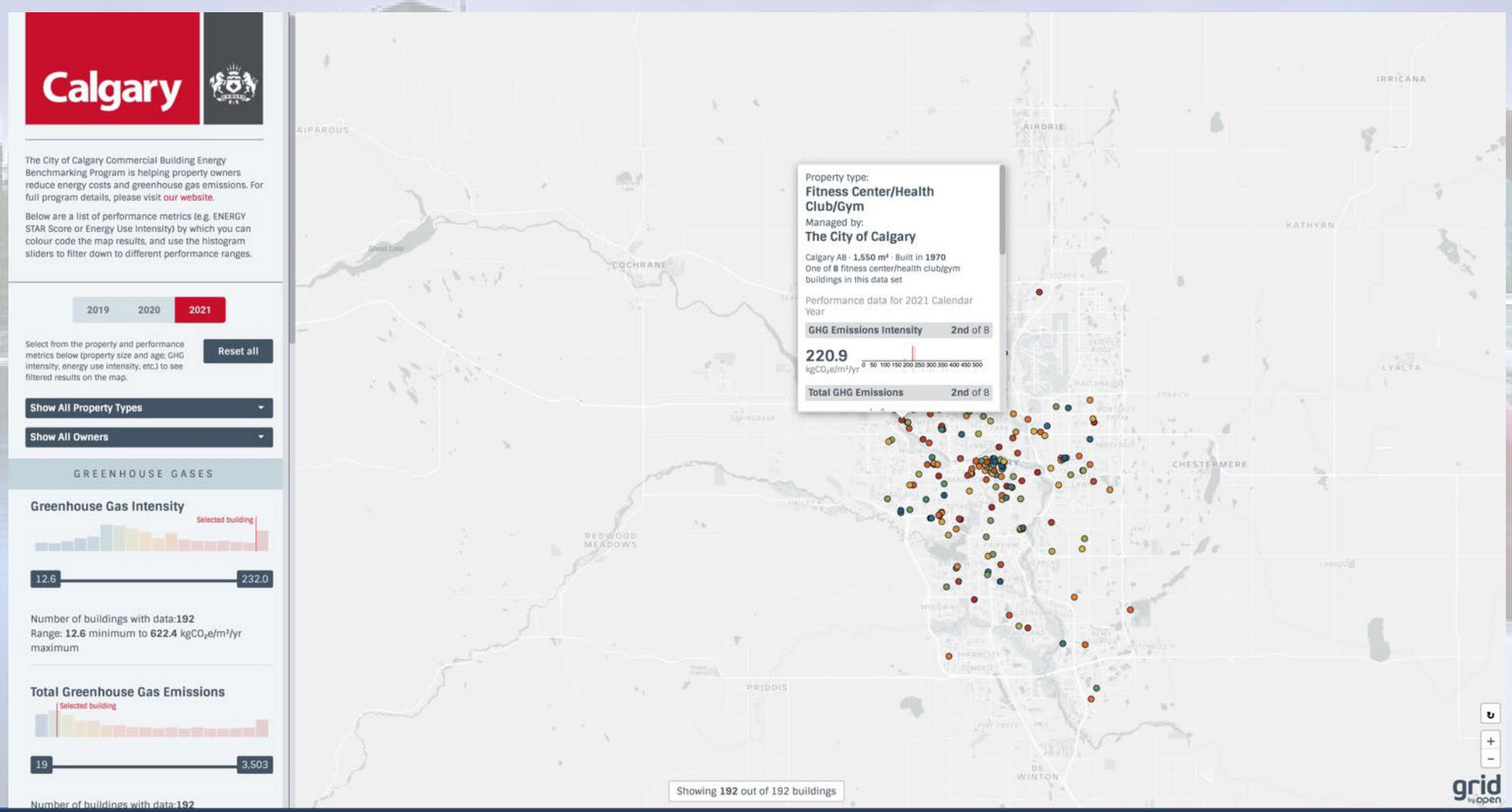
ALBERTA

Calgary – GRID



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BRITISH COLUMBIA

Home Energy Rating and Disclosure

Mandatory Home Energy Rating and Disclosure: Yes

Home Energy Labelling Voluntary Or Pilot Program: Yes

BRITISH COLUMBIA

Mandatory Large Building Energy Rating and Disclosure: No

Voluntary Building Benchmarking and Transparency Program: Yes (City of Vancouver)

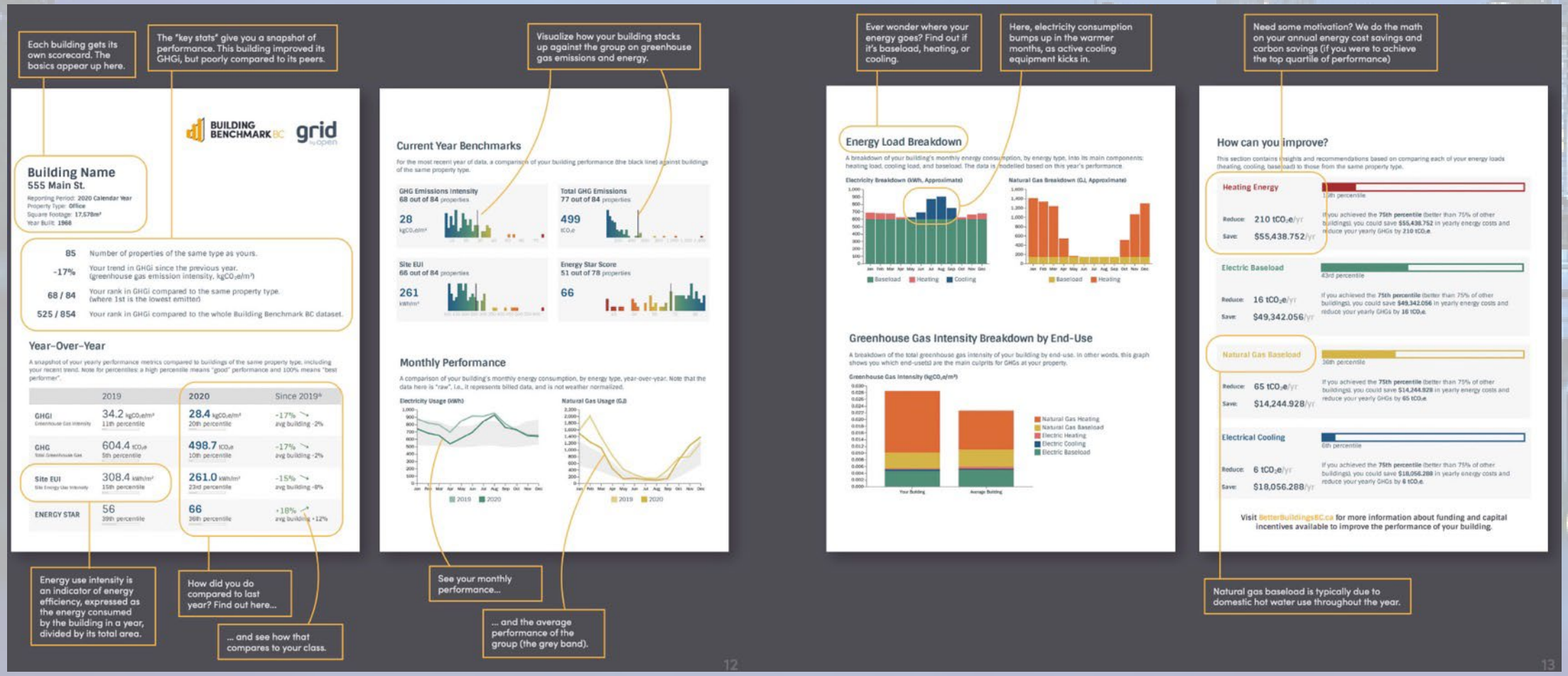
BC Hydro has workshops and an energy benchmarking program for commercial and residential properties with at least 20 units – participants of benchmarked facilities are provided an annual review to track progress for the organization

In 2020, Building Benchmark BC launched a voluntary benchmarking and disclosure program for both residential and commercial/industrial buildings – 551 buildings participated in 2020 and 1163 buildings participated in 2021

Building Benchmark BC participants receive a performance scorecard. Public results are provided in an annual report and also mapped on GRID

BRITISH COLUMBIA

Building Benchmark BC - Scorecard



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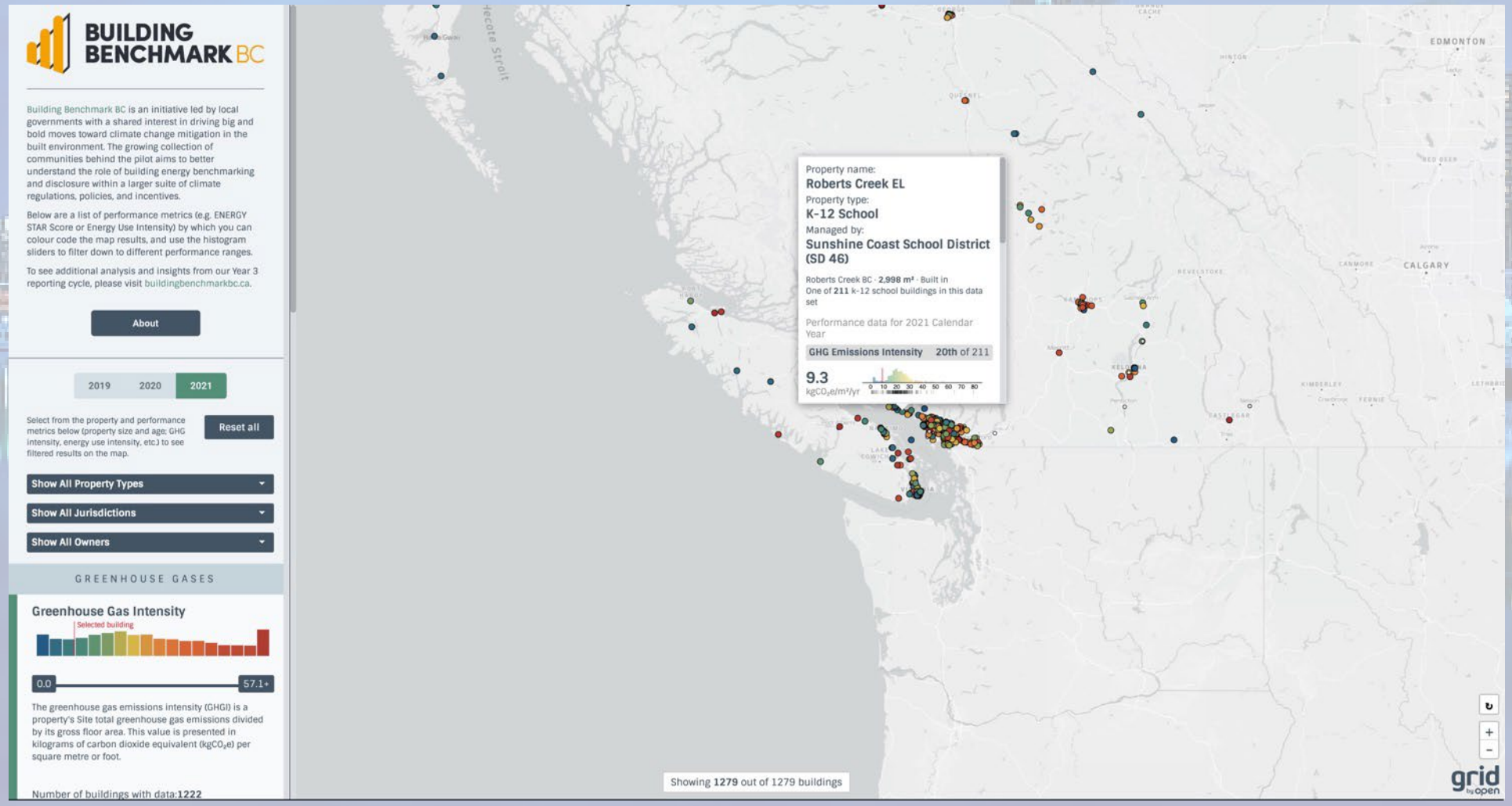
BRITISH COLUMBIA

Building Benchmark BC – GRID

Buildings from 12 Municipalities

in BC are mapped in GRID



BRITISH COLUMBIA

City of Vancouver

As part of its Energy Retrofit Strategy for Existing Buildings, the City of Vancouver currently administers a mandatory building benchmarking program for municipal buildings with voluntary participation from large public sector, institutional, commercial, and residential buildings

Starting in 2023, Vancouver will require commercial and multifamily buildings larger than 5,000 sq.m. (53,819 sq.ft.) to benchmark and report their energy and emissions performance.

BRITISH COLUMBIA

Timeline

2021

In March, the Province of British Columbia announced a sector-specific target range for buildings and communities. By 2030, industry must reduce emissions from buildings and communities between 59 and 64 per cent below 2007 levels.

In November, the province increased its climate ambition with the Roadmap to 2030, an update to its CleanBC plan. The Roadmap includes a number of building-sector commitments, which we have detailed in this timeline.

2022

City of Vancouver staff will bring forth recommendations on building energy benchmarking in large commercial and multifamily buildings.

In partnership with industry associations, the City of Vancouver will launch programs to support building owners on building energy benchmarking.

2023

The City of Vancouver will require owners of commercial and multi-family buildings larger than 5,000 square meters to benchmark and report the energy and emissions performance of their properties.

2024

The Province of British Columbia aims to release a "retrofit" building code that will require increased building performance at the time of alterations.

2025

The Province of British Columbia will require greenhouse gases across the economy to drop 16 per cent below 2007 levels. It will also review its buildings and communities target and consider narrowing its percentage range.

The City of Vancouver will implement its first building performance standards to reduce climate pollution from existing buildings. Initially, limits will only apply for detached homes and commercial office and retail buildings larger than 10,000 square metres. The rules will target the city's worst performing buildings that can be improved with simple, low-cost, and high-savings measures.

2030

The Province of British Columbia will require all new buildings to be zero carbon, and all new space and water heating equipment will "meet the highest standards for efficiency." The government has since defined this as 100 per cent or greater, which essentially eliminates replacement fossil fuel furnaces and boilers.

Metro Vancouver will require all existing buildings in the region to reduce their greenhouse gas emissions 35 per cent below 2010 levels.

2032

All new buildings in British Columbia will be required to achieve a net-zero energy ready performance level.

2050

British Columbia will meet net-zero emissions across the economy.

MANITOBA

Home Energy Rating and Disclosure

Mandatory Home Energy Rating and Disclosure: No

Home Energy Labelling Voluntary Or Pilot Program: No

MANITOBA

Mandatory Large Building Energy Rating and Disclosure: Yes (City of Winnipeg - Government Buildings)

Voluntary Building Benchmarking and Transparency Program: Yes

Manitoba's 2013 Green Buildings Program, regular energy and water use tracking for government buildings (mandatory)

Efficiency Manitoba offers free-of-charge Energy Efficiency Assessments of industrial, commercial and agricultural facilities

MANITOBA

Manitoba Hydro Services:

EnerTrend - creates energy profiles for large industrial and commercial operations and identifies cost-saving measures.

Free energy efficiency screening studies for commercial buildings - identify energy efficiency opportunities but also benchmark building consumption to industry averages to encourage savings.

MANITOBA

Building Energy Disclosure Project (BEDP) – City of Winnipeg Initiative 2020

Building owners disclose key building energy metrics for inclusion on the public Disclosure Map - 160 buildings participated in the first year of the BEPD.

Participating Building Types (number of buildings – total floor space)	
Aquatic Centre (8 – 45,300 m^2)	Museum (1 – 27,000 m^2)
Bank Branch (9 – 4,175 m^2)	Office (17 – 196,800 m^2)
Casino (2 – 39,000 m^2)	Recreation Complex (3 – 38,700 m^2)
Community Centre (3 – 5,700 m^2)	Retail-Convenience Store (28 – 22,100 m^2)
Fire-Paramedic Station (30 – 21,000 m^2)	Theatre (1 – 2,600 m^2)
Ice Arena (8 – 22,900 m^2)	University (4 – 31,500 m^2)
K-12 School (37 – 186,900 m^2)	Warehouse (2 – 27,100 m^2)
Library (8 – 9,200 m^2)	

MANITOBA

BEPD Performance Scorecard

Winnipeg

Energy Performance Scorecard

Mandarin Building

Registered by: City of Winnipeg
Address: 185 King Street / 223 James Street
Building Type: Office Properties
Gross Floor Area: 7646 m²

EJ This **Energy Performance Scorecard** is based on the reported energy use information for 2017-2019, and shows how your building compares to similar buildings in Winnipeg.

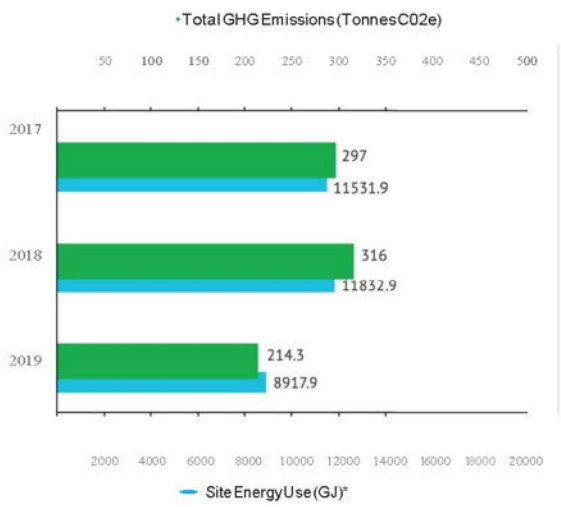
Energy Performance

Your ENERGY STAR score

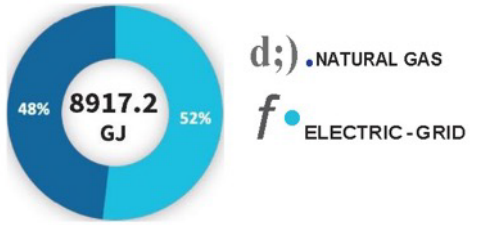
58

How your building ranks against other office buildings

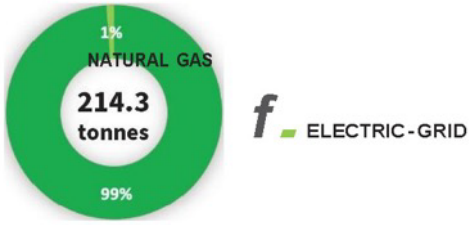
Site energy use and greenhouse gas (GHG) emissions



Site Energy Use (% GJ)**



Site Emissions (% tonnes)



For the year 2019

Savings

By performing **10%** better than 2019, your building could save **$12702** on utility bills and reduce **21** tonnes C02 equivalent.

21 tonnes C02e = Carbon offsetted by 974 trees

Calculated 22Kg/year as the average absorption per tree

For more detail on your property's energy and GHG profile, contact the City of Winnipeg's Office of Sustainability.

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MANITOBA

Building Energy Disclosure Map

Map

Search an address

Filter by:

Building category:

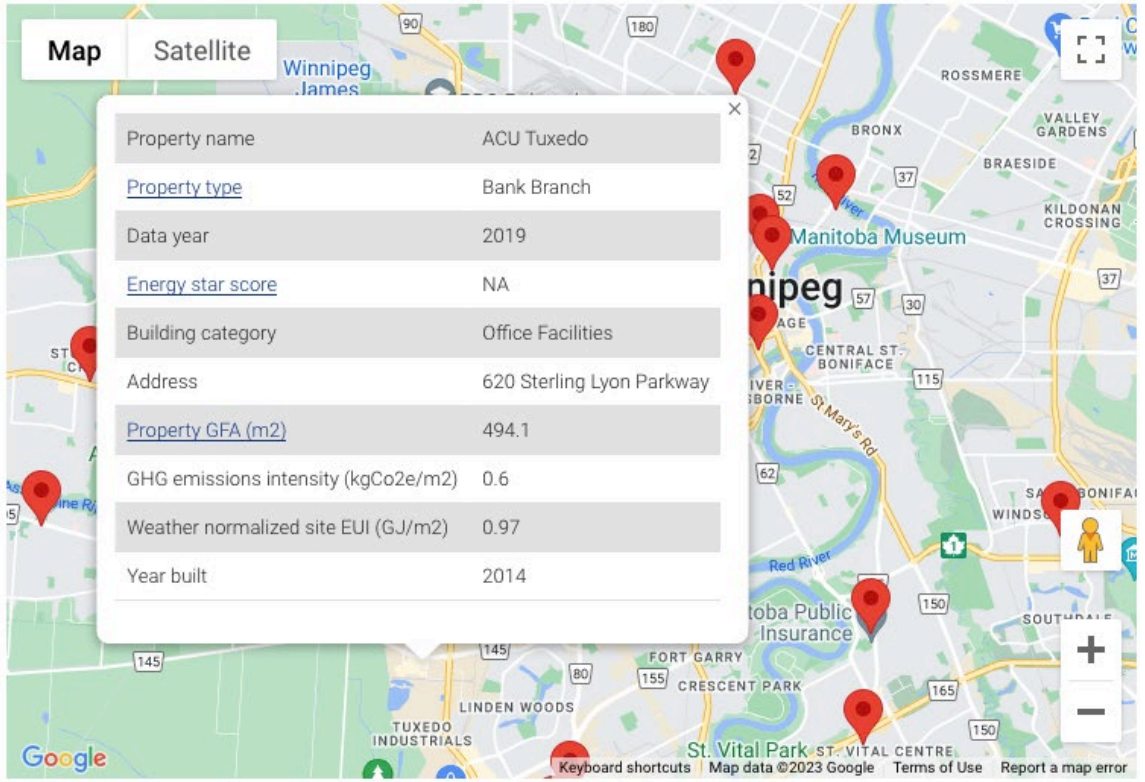
Office Facilities

Property type:

All

Building size (sq. m):

Minimum size	Maximum size
All	All



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NEW BRUNSWICK

Home Energy Rating and Disclosure

Mandatory Home Energy Rating and Disclosure: No

Home Energy Labelling Voluntary Or Pilot Program: No

NEW BRUNSWICK

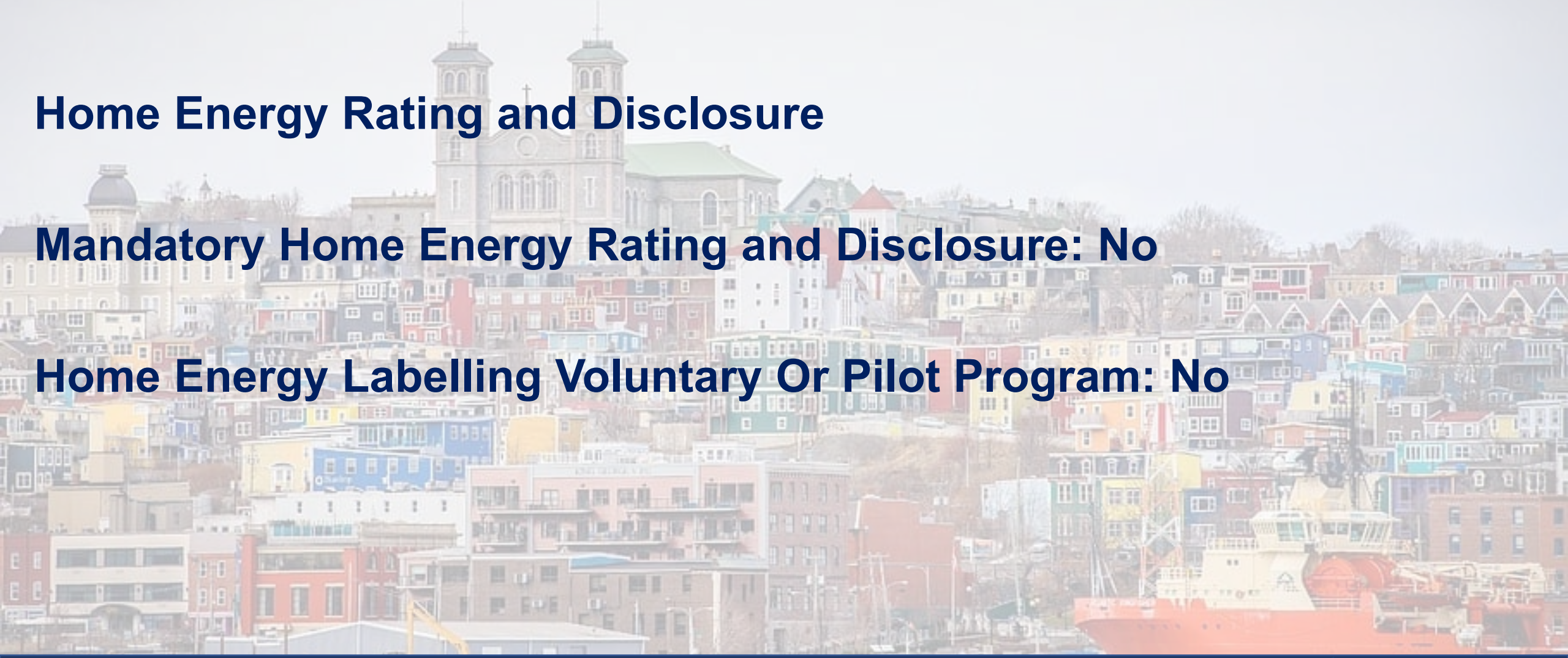
Mandatory Large Building Energy Rating and Disclosure: Yes (Government Buildings)

Voluntary Building Benchmarking and Transparency Program: No

New Brunswick's 2016 Climate Action Plan requires energy performance identification for all publicly funded new construction and major building renovations.

Only aggregate GHG emissions are disclosed publicly

NEWFOUNDLAND AND LABRADOR

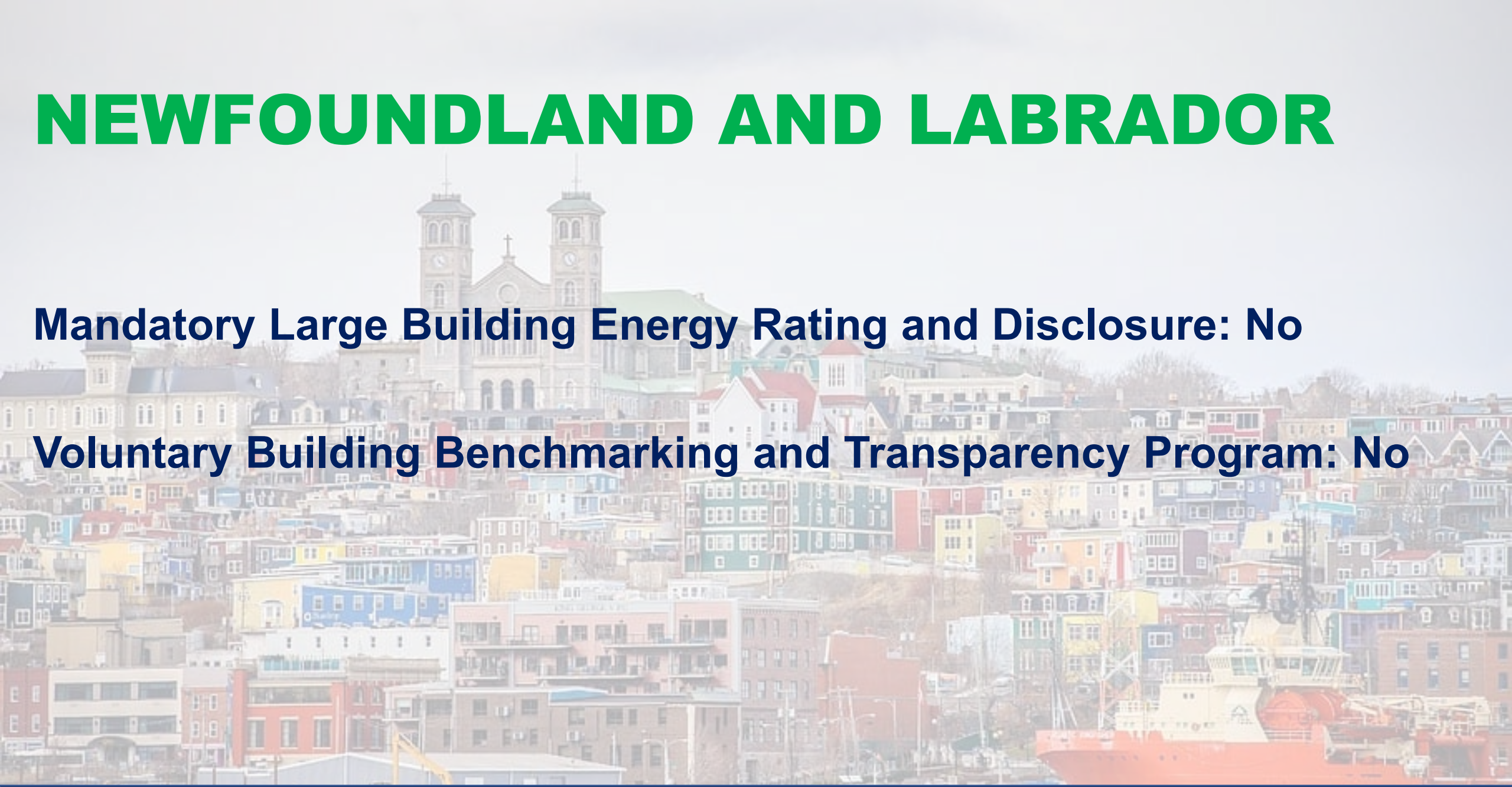


Home Energy Rating and Disclosure

Mandatory Home Energy Rating and Disclosure: No

Home Energy Labelling Voluntary Or Pilot Program: No

NEWFOUNDLAND AND LABRADOR



Mandatory Large Building Energy Rating and Disclosure: No

Voluntary Building Benchmarking and Transparency Program: No

NOVA SCOTIA

Home Energy Rating and Disclosure

Mandatory Home Energy Rating and Disclosure: No

Home Energy Labelling Voluntary Or Pilot Program: Yes

NOVA SCOTIA

Mandatory Large Building Energy Rating and Disclosure: No

Voluntary Building Benchmarking and Transparency Program: Yes

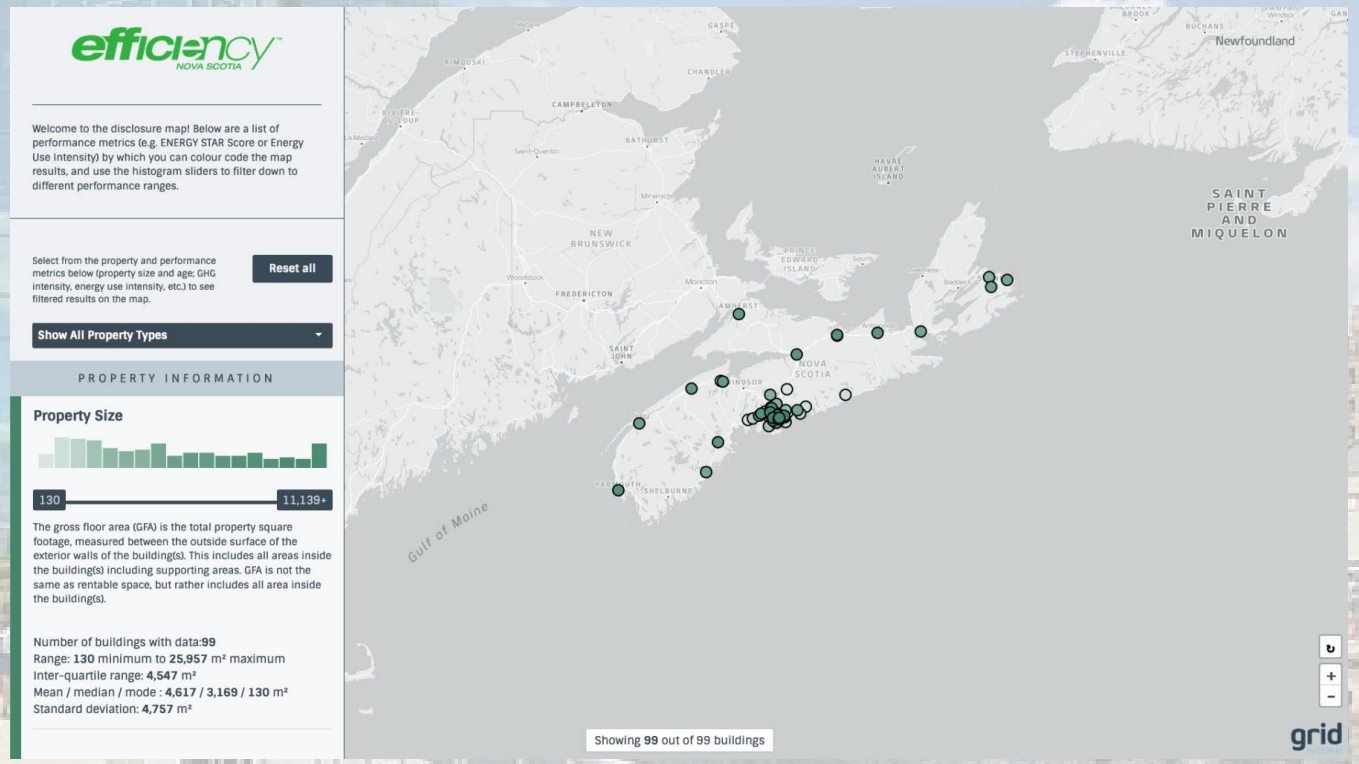
Efficiency Nova Scotia's Onsite Energy Management program was launched in 2020

Energy Conservation Program - Building Recommissioning Project

Department of Public Works benchmarks 80 department owned buildings in Energy Star Portfolio Manager

NOVA SCOTIA

Disclosure data and benchmarking will be used in the Standard Energy Efficiency Data (SEED) Platform and also displayed in the GRID Benchmarking & Disclosure Platform



NORTHWEST TERRITORIES

Home Energy Rating and Disclosure

Mandatory Home Energy Rating and Disclosure: None Identified

Home Energy Labelling Voluntary Or Pilot Program: None Identified

NORTHWEST TERRITORIES

Mandatory Large Building Energy Rating and Disclosure: None Identified

Voluntary Building Benchmarking and Transparency Program: None Identified

NUNAVUT

Home Energy Rating and Disclosure

Mandatory Home Energy Rating and Disclosure: None Identified

Home Energy Labelling Voluntary Or Pilot Program: None Identified

NUNAVUT

Mandatory Large Building Energy Rating and Disclosure: None Identified

Voluntary Building Benchmarking and Transparency Program: None Identified

PRINCE EDWARD ISLAND

Home Energy Rating and Disclosure

Mandatory Home Energy Rating and Disclosure: No

Home Energy Labelling Voluntary Or Pilot Program: No

PRINCE EDWARD ISLAND

Mandatory Large Building Energy Rating and Disclosure: No

Voluntary Building Benchmarking and Transparency Program: No

QUEBEC

Home Energy Rating and Disclosure

Mandatory Home Energy Rating and Disclosure: No

Home Energy Labelling Voluntary Or Pilot Program: No

QUEBEC

Mandatory Large Building Energy Rating and Disclosure: Yes

Voluntary Building Benchmarking and Transparency Program: Yes

The Building Energy Challenge (Défi-Énergie en immobilier) launched in May 2018 as a 4-year competition program for commercial and institutional buildings to voluntarily disclose energy-use data to competitors – 214 Buildings participated

Reported data is not currently made public but the next iteration of the program (launched in 2022) plans to require public disclosure.

QUEBEC

Transition Énergétique Québec (TEQ)

TEQ has been carrying out an annual inventory of energy consumption and greenhouse gas emissions attributable to the Government of Quebec since 2009-2010

Aggregated data on Government buildings energy use is published in an annual energy report

Plans to make disclosure of commercial, institutional and Government building use data mandatory in the 2023/28 timeframe

QUEBEC

Montreal

September 2021 - adopted regulation that requires the owners of large commercial, institutional and residential buildings buildings to disclose their energy consumption data to the City annually

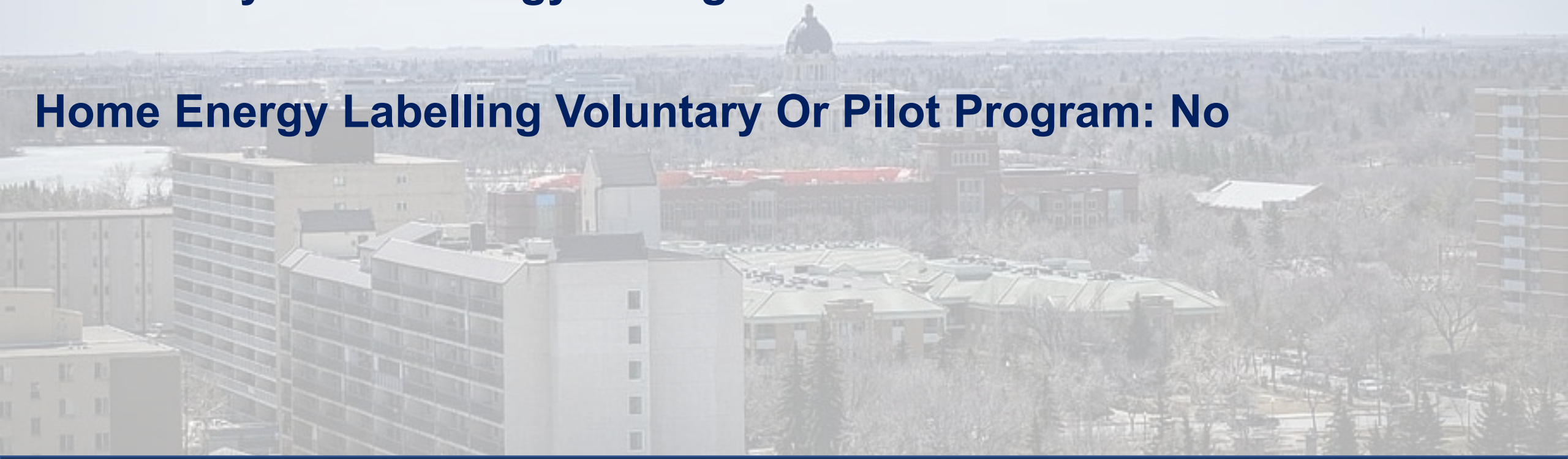
The City plans to expand the number of buildings included in the regulation's scope in the near future

SASKATCHEWAN

Home Energy Rating and Disclosure

Mandatory Home Energy Rating and Disclosure: No

Home Energy Labelling Voluntary Or Pilot Program: No



SASKATCHEWAN

Mandatory Large Building Energy Rating and Disclosure: No

Voluntary Building Benchmarking and Transparency Program: Yes (City of Regina Municipal Buildings)

The City of Regina participates in the Municipal Benchmarking Network of Canada to report municipal headquarter buildings energy use

Some buildings in Saskatchewan have voluntarily participated in building benchmarking

As of 2016 - 275 benchmarked buildings in Saskatchewan, covering 1,250,000 m2 (13,454,888 sq.ft.).

YUKON

Home Energy Rating and Disclosure

Mandatory Home Energy Rating And Disclosure: Yes (New Homes In Whitehorse)

Home Energy Labelling Voluntary Or Pilot Program: No

YUKON

Mandatory Large Building Energy Rating and Disclosure: No

Voluntary Building Benchmarking and Transparency Program: No

ONTARIO

Home Energy Rating and Disclosure

Mandatory Home Energy Rating and Disclosure: No

Home Energy Labelling Voluntary Or Pilot Program: Yes (Experience With a Pilot Project)

ONTARIO

Mandatory Large Building Energy Rating and Disclosure: Yes

Voluntary Building Benchmarking and Transparency Program: No

Energy and Water Usage of Large Buildings in Ontario (EWRB) - Requires annual reporting on water and energy use for commercial, industrial, and multi-residential buildings with more than 10 units and buildings that are 100,000 square ft (9,290 sq.m.) or larger

Reported in reported through Energy Star Portfolio Manager

Data must be verified in the first year and every five years

ONTARIO

July 1, 2018 - First reporting period for commercial and industrial buildings 250,000 sq.ft. (23,225 sq.m.) and larger (not including residential buildings)

July 1, 2019 – Reporting required for buildings 100,000 sq.ft. (9,290 sq.m.) and larger (including multi-unit residential buildings).

July 1, 2020 - Original the deadline for reporting for buildings that are 50,000 sq.ft. (4,645 sq.m.) or larger

October 28, 2019 - An amendment to O.Reg 506/18 proposed to stop the further rollout of the program to buildings under 100,000 sq.ft. (9,290 sq.m.). This proposal stalled, but roll-out deferred until July 1, 2023.

Data disclosed in Ontario's Data Catalogue as Open Data

ONTARIO

What is Disclosed

- **Building Identifiers**
  - City
  - First three digits of the postal code
  - EWRB ID
- **Building Characteristics**
  - Primary property use type
  - Secondary property use type(s)
  - Third-party performance certifications
- **Performance Metrics**
  - Whether the reporter ran the Data Quality Checker and the date it was run
  - Weather-normalized electricity use intensity (kWh/ft^2, GJ/m^2)
  - Weather-normalized natural gas use intensity (GJ/m^2, m^3/m^2, m^3/ft^2)
  - Source energy use intensity ($ekWh/ft^2$, GJ/m^2)
  - Weather-normalized source energy use intensity ($ekWh/ft^2$, GJ/m^2)
  - Site energy use intensity ($ekWh/ft^2$, GJ/m^2)
  - Weather-normalized site energy use intensity ($ekWh/ft^2$, GJ/m^2)
  - Indoor water use intensity (m^3/m^2, m^3/ft^2)
  - Greenhouse gas emissions intensity ($kgCO_2/ft^2$, $kgCO_2e/m^2$)
  - ENERGY STAR score

ONTARIO

What is Not Disclosed

- **Building Characteristics**
  - Property Gross Floor Area – Self-reported
  - Gross floor area of specific property use types
  - Occupancy rate
  - Property notes

- **Reporter Identifiers**
  - Assessment Roll Number
  - Property Data Administrator name
  - Property Data Administrator email address
  - Portfolio Manager property ID
  - Portfolio Manager parent property ID (when multiple buildings are reported together)
  - Name of legal owner

- **Total Usage Data and Greenhouse Gases**
  - Electricity use (either grid-purchased or generated from onsite renewable systems)
  - Weather-normalized electricity use (same as above)
  - Natural gas use
  - Weather-normalized natural gas use
  - Fuel oil use (#1, 2, 4, 5 and 6)
  - Diesel use
  - District energy use (steam, hot water or chilled water)
  - Kerosene use
  - Propane use
  - Wood use
  - Coke use
  - Source energy use
  - Weather-normalized source energy use
  - Site energy use
  - Weather-normalized site energy use
  - Water use
  - Total greenhouse gas emissions

ONTARIO

EWRB Dataset – Latest Update Nov 8 2021 – 3611 Buildings

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
1	EWRB_ID	City	Postal_Code	PrimProp TypCalc	PrimProp TypSelf	Largest_PropTyp	All_Prop_Types	Thrd_Party_Cert	WN_Sit_Elc_Int1	WN_Sit_Elc_Int2	WN_Sit_Gas_Int1	WN_Sit_Gas_Int2	WN_Sit_Gas_Int3	All_Water_Int1	All_Water_Int2	Ind_Water_Int1	Ind_Water_Int2	Site_EUI1	Site_EUI2	Source_EUI1	Source_EUI2	WN_Site_EUI1	WN_Site_EUI2	WN_Source_EUI1	WN_Source_EUI2	GHG_Emiss_Int1	GHG_Emiss_Int2	Ener_Star_Score	Ener_Star_Certs	Data_Qual_Check	Data_Qual_Date
2	100037	Hawkesbu	K6A	Retail Stor	Strip Mall	Retail Stor	Retail Stor	Not Availa	0.612251	15.8	0.454151	12.17563	1.131153	0.286445	0.026612	Not Availa	Not Availa	24.71	1.548065695	39.95	1.012927091	26.14	1.603478	41.38	22.60421	2.1	Not Availa	Not Availa	Yes	2022-06-28	
3	100066	Rockland	K4K	Strip Mall	Strip Mall	Strip Mall	Strip Mall	Not Availa	0.705251	18.2	0.567689	15.21954	1.413941	0.647049	0.060113	0.647049	0.060113	30.92	1.87976638	48.51	1.315177715	33.94	1.997567	51.55	30.13895	2.8	Not Availa	Not Availa	No	Not Available	
4	100088	Cornwall	K6H	Conventio	Conventio	Conventio	Conventio	Not Availa	0.670376	17.3	0.340613	9.131721	0.848365	0.741173	0.068857	Not Availa	Not Availa	26.44	1.670515948	43.11	1.054002175	27.2	1.699966	43.87	23.6806	2.2	Not Availa	Not Availa	No	Not Available	
5	100099	Cornwall	K6H	Multifamil	Multifamil	Multifamil	Multifamil	Not Availa	0.441751	11.4	0.113538	3.043907	0.282788	0	0	Not Availa	Not Availa	14.16	0.955189472	24.65	0.566526169	14.62	0.991615	25.59	9.68752	0.9	60	Not Availa	No	Not Available	
6	100101	Cornwall	K6H	Strip Mall	Strip Mall	Strip Mall	Strip Mall	Matt Morr	0.2325	6	0.567689	15.21954	1.413941	1.175526	0.10921	1.175526	0.10921	19.11	0.962939488	24.85	0.792826636	20.46	1.021065	26.35	26.90978	2.5	Not Availa	Not Availa	Yes	2022-06-30	
7	100107	Cornwall	K6H	Non-Refrig	Non-Refrig	Non-Refrig	Non-Refrig	Not Availa	0.275126	7.1	0.113538	3.043907	0.282788	0.097383	0.009047	Not Availa	Not Availa	10.23	0.661076364	17.06	0.406488339	10.49	0.672314	17.35	8.611129	0.8	74	Not Availa	Yes	2022-06-29	
8	100110	Cornwall	K6H	Distributio	Distributio	Distributio	Distributio	Not Availa	Not Availa	Not Availa	Not Availa	Not Availa	Not Availa	0.012224	0.001136	Not Availa	Not Availa	1.41	0.086412678	2.23	Not Available	Not Availa	Not Availa	Not Availa	1.076391	0.1	100	Not Availa	Yes	2022-06-29	
9	100137	Cornwall	K6H	Retail Stor	Enclosed M	Retail Stor	Retail Stor	Not Availa	1.147002	29.6	0.454151	12.17563	1.131153	1.082625	0.100579	Not Availa	Not Availa	42.06	2.736918149	70.63	1.658115922	42.79	2.766756	71.4	33.36812	3.1	Not Availa	Not Availa	Yes	2022-05-20	
10	100148	Cornwall	K6J	Retail Stor	Enclosed M	Retail Stor	Retail Stor	Not Availa	0.565751	14.6	0.113538	3.043907	0.282788	0.220029	0.020441	Not Availa	Not Availa	18.32	1.252790086	32.33	0.716488979	18.49	1.26054	32.53	11.8403	1.1	Not Availa	Not Availa	Yes	2022-05-20	
11	100153	Cornwall	K6J	Other	Mixed Use	Other	Other	Not Availa	0.414626	10.7	0.908302	24.35126	2.262306	0.232661	0.021615	Not Availa	Not Availa	32.33	1.659278425	42.82	1.29347767	33.38	1.699966	43.87	45.20843	4.2	Not Availa	Not Availa	No	Not Available	
12	100189	Ottawa	K1M	Multifamil	Multifamil	Multifamil	Multifamil	Not Availa	0.182125	4.7	1.02184	27.39516	2.545094	0.949793	0.088239	Not Availa	Not Availa	25.03	1.160564895	29.95	1.159402393	29.92	1.342303	34.64	39.82647	3.7	37	Not Availa	No	Not Available	
13	100193	Ottawa	K1M	Multifamil	Multifamil	Multifamil	Heated Sw	Not Availa	0.213125	5.5	0.454151	12.17563	1.131153	0.761953	0.070788	Not Availa	Not Availa	15.5	0.81878919	21.13	0.669988883	17.29	0.878852	22.68	20.45143	1.9	57	Not Availa	No	Not Available	
14	100194	Ottawa	K1M	Autre - Hé	Autre - Hé	Autre - Hé	Autre - Hé	Not Availa	0.197625	5.1	0.794764	21.30735	1.979517	0.731801	0.067987	Not Availa	Not Availa	22.45	1.069889708	27.61	1.010602086	26.08	1.208227	31.18	34.44452	3.2	Not Availa	Not Availa	Oui	2022-06-02	
15	100199	Ottawa	K1K	Multifamil	Multifamil	Multifamil	Multifamil	Not Availa	0.383626	9.9	1.475991	39.57079	3.676247	2.304602	0.214105	Not Availa	Not Availa	41.53	1.989816607	51.35	1.893328908	48.86	2.275792	58.73	63.50708	5.9	2	Not Availa	No	Not Available	
16	100203	Ottawa	K1K	Multifamil	Multifamil	Multifamil	Multifamil	Not Availa	0.166625	4.3	0.340613	9.131721	0.848365	0.931865	0.086573	Not Availa	Not Availa	12.54	0.65875136	17	0.544051123	14.04	0.708739	18.29	17.22226	1.6	86	Not Availa	Yes	2022-06-15	
17	100213	Ottawa	K1K	Multifamil	Multifamil	Multifamil	Multifamil	Not Availa	0.503751	13	0.794764	21.30735	1.979517	2.592678	0.240868	2.592678	0.240868	29.25	1.621690847	41.85	1.307040198	33.73	1.796841	46.37	35.52091	3.3	9	Not Availa	Yes	2022-05-19	
18	100234	Ottawa	K1K	Multifamil	Multifamil	Multifamil	Heated Sw	Not Availa	0.255751	6.6	0.681226	18.26344	1.696729	1.485197	0.137979	Not Availa	Not Availa	21.75	1.095852262	28.28	0.984639532	25.41	1.239228	31.98	31.21534	2.9	53	Not Availa	No	Not Available	
19	100236	Ottawa	K1K	Multifamil	Multifamil	Multifamil	Multifamil	Not Availa	0.189875	4.9	0.681226	18.26344	1.696729	1.16697	0.108415	Not Availa	Not Availa	18.55	0.912951884	23.56	0.822276697	21.22	1.010602	26.08	26.90978	2.5	66	Not Availa	No	Not Available	
20	100252	Ottawa	K1N	Multifamil	Multifamil	Multifamil	Multifamil	Not Availa	0.418501	10.8	0.908302	24.35126	2.262306	1.130298	0.105008	Not Availa	Not Availa	31.89	1.646878399	42.5	1.310527705	33.82	1.721666	44.43	44.13204	4.1	5	Not Availa	Yes	2022-03-21	
21	100254	Ottawa	K1N	Multifamil	Multifamil	Multifamil	Multifamil	Not Availa	0.089125	2.3	0.681226	18.26344	1.696729	0.763583	0.070939	0.763583	0.070939	17.61	0.773451596	19.96	0.739351526	19.08	0.832352	21.48	30.13895	2.8	89	Not Availa	No	Not Available	
22	100255	Ottawa	K1N	Other	Other	Other	Other	Not Availa	0.554126	14.3	0.454151	12.17563	1.131153	0.26811	0.024908	Not Availa	Not Availa	25.85	1.543415686	39.83	1.055164678	27.23	1.593403	41.12	26.90978	2.5	Not Availa	Not Availa	Yes	2022-06-29	
23	100256	Ottawa	K1N	Other - Lo	Other - Lo	Other - Lo	Other - Lo	Not Availa	0.310001	8	0.340613	9.131721	0.848365	0.34023	0.031608	0.34023	0.031608	15.24	0.888151833	22.92	0.614576268	15.86	0.916439	23.65	16.14587	1.5	Not Availa	Not Availa	Yes	2022-07-21	
24	100259	Ottawa	K1N	Multifamil	Multifamil	Multifamil	Heated Sw	Not Availa	0.22475	5.8	0.681226	18.26344	1.696729	1.316508	0.122308	Not Availa	Not Availa	21.34	1.051677171	27.14	0.878851814	22.68	1.101665	28.43	31.21534	2.9	Not Availa	Not Availa	Yes	2022-05-09	
25	100266	Ottawa	K1N	Multifamil	Multifamil	Multifamil	Multifamil	Not Availa	0.352626	9.1	0	0	0	6.009243	0.558277	6.009243	0.558277	9.35	0.708738963	18.29	0.353013229	9.11	0.691689	17.85	3.229173	0.3	82	Not Availa	Yes	2022-06-01	
26	100269	Ottawa	K1N	Multifamil	Multifamil	Multifamil	Multifamil	Not Availa	0.22475	5.8	Not Availa	Not Availa	Not Availa	0.968129	0.089942	0.968129	0.089942	5.83	0.444075917	11.46	0.225912966	5.83	0.444076	11.46	2.152782	0.2	100	Not Availa	No	Not Available	
27	100283	Ottawa	K1N	Multifamil	Multifamil	Multifamil	Multifamil	Not Availa	0.127875	3.3	0.340613	9.131721	0.848365	1.837244	0.170686	1.837244	0.170686	11.02	0.552963641	14.27	0.458800947	11.84	0.583576	15.06	16.14587	1.5	95	Not Availa	Yes	2022-07-04	
28	100297	Ottawa	K1N	Autre - Hé	Autre - Hé	Autre - Hé	Autre - Hé	Not Availa	Not Availa	Not Availa	Not Availa	Not Availa	Not Availa	0.464914	0.043192	0.127128	0.011811	22.51	1.152814879	29.75	Not Available	Not Availa	Not Availa	Not Availa	31.21534	2.9	Not Availa	Not Availa	Oui	2022-06-24	
29	100306	Ottawa	K1N	Enclosed M	Enclosed M	Enclosed M	Enclosed M	Not Availa	0.899002	23.2	0.227075	6.087814	0.565576	0.645827	0.059999	Not Availa	Not Availa	28.55	1.970441567	50.85	Not Available	Not Availa	Not Availa	Not Availa	18.29865	1.7	Not Availa	Not Availa	Yes	2022-05-12	
30	100308	Ottawa	K1N	Office	Office	Office	Office	Not Availa	0.352626	9.1	0.340613	9.131721	0.848365	0.268925	0.024984	0.268925	0.024984	17.58	1.024552115	26.44	0.725788998	18.73	1.067565	27.55	19.37504	1.8	90	Not Availa	Yes	2022-03-09	
31	100314	Ottawa	K1N	Multifamil	Multifamil	Multifamil	Multifamil	Not Availa	0.275126	7.1	0	0	0	6.814794	0.633115	Not Availa	Not Availa	7.5	0.559938656	14.45	0.288300595	7.44	0.554126	14.3	3.229173	0.3	95	Not Availa	Yes	2022-05-18	
32	100315	Ottawa	K1N	Multifamil	Multifamil	Multifamil	Heated Sw	Not Availa	0.290626	7.5	0.567689	15.21954	1.413941	1.180823	0.109702	Not Availa	Not Availa	19.9	1.060589689	27.37	0.811039174	20.93	1.09469	28.25	25.83339	2.4	86	Not Availa	Yes	2022-03-30	
33	100341	OTTAWA	K1K	Strip Mall	Strip Mall	Strip Mall	Strip Mall	Not Availa	0.864127	22.3	1.02184	27.39516	2.545094	0	0	Not Availa	Not Availa	47.1	2.703980581	69.78	1.915803954	49.44	2.757456	71.16	52.74316	4.9	Not Availa	Not Availa	No	Not Available	
34	100356	Ottawa	K1K	Enclosed M	Enclosed M	Enclosed M	Enclosed M	Not Availa	0.589001	15.2	0.227075	6.087814	0.565576	0.882562	0.081993	Not Availa	Not Availa	20.31	1.352765292	34.91	0.830026713	21.42	1.39694	36.05	15.06948	1.4	Not Availa	Not Availa	Yes	2022-06-22	
35	100359	Ottawa	K1N	Multifamil	Multifamil	Multifamil	Heated Sw	Not Availa	0.236375	6.1	0.454151	12.17563	1.131153	1.129076	0.104895	Not Availa	Not Availa	18.08	0.940464441	24.27	0.731214009	18.87	0.965264	24.91	24.757	2.3	87	2021	Yes	2022-06-02	
36	100403	Ottawa	K1P	Office	Office	Office	Office, Par	Not Availa	0.651001	16.8	0.567689	15.21954	1.413941	0.309263	0.028731	0.309263	0.028731	30.04	1.795678706	46.34	1.223340025	31.57	1.854579	47.86	31.21534	2.9	47	Not Availa	No	Not Available	
37	100406	Ottawa	K1A	Office	Office	Office	Office, Res	Not Availa	0.809877	20.9	0.113538	3.043907	0.282788	0.259553	0.024113	Not Availa	Not Availa	21.95	1.600378303	41.3	0.890476838	22.98	1.669353	43.08	9.68752	0.9	38	Not Availa	Yes	2022-06-22	
38	100407	Ottawa	K1P	Office	Office	Office	Food Servi	Not Availa	1.061752	27.4	0.340613	9.131721	0.848365	0.427427	0.039709	Not Availa	Not Availa	36.31	2.435055026	62.84	1.454678002	37.54	2.47923	63.98	25.83339	2.4	8	Not Availa	Yes	2022-06-22	

SYSCONVERGE
ARCHITECTURAL ENGINEERING

ONTARIO

Toronto2030 Platform

Project under the Toronto 2030 District which is part of a member network of 22 Districts in cities across North America working to achieve the Architecture 2030 Challenge and meet the Paris Climate Agreement targets

Developed by CUI in collaboration with Ryerson University, University of Toronto, Toronto Hydro and an Advisory Panel of building industry experts

The Toronto 2030 Platform is designed to help users:

- Understand how downtown Toronto is progressing towards reaching emissions reductions targets
- Benchmark their buildings
- Connect to conservation programs
- Commit to the District 2030 goals

ONTARIO

Toronto2030 Platform – Data Sources

Annual Energy Use (2017)

Energy Type	Source	GHG Emissions Factor (2017)
Electricity	Toronto Hydro	32 grams CO_2e / kWh
Natural Gas	Enbridge Inc.	1874.6 grams CO_2e / m^3
Steam (District Heat)	Enwave Energy Corporation	73.8 grams CO_2e / lb
Deep Lake Water Cooling	Enwave Energy Corporation	41.3 grams CO_2e / ton-h
Water*	City of Toronto	114.4 grams CO_2e / m^3

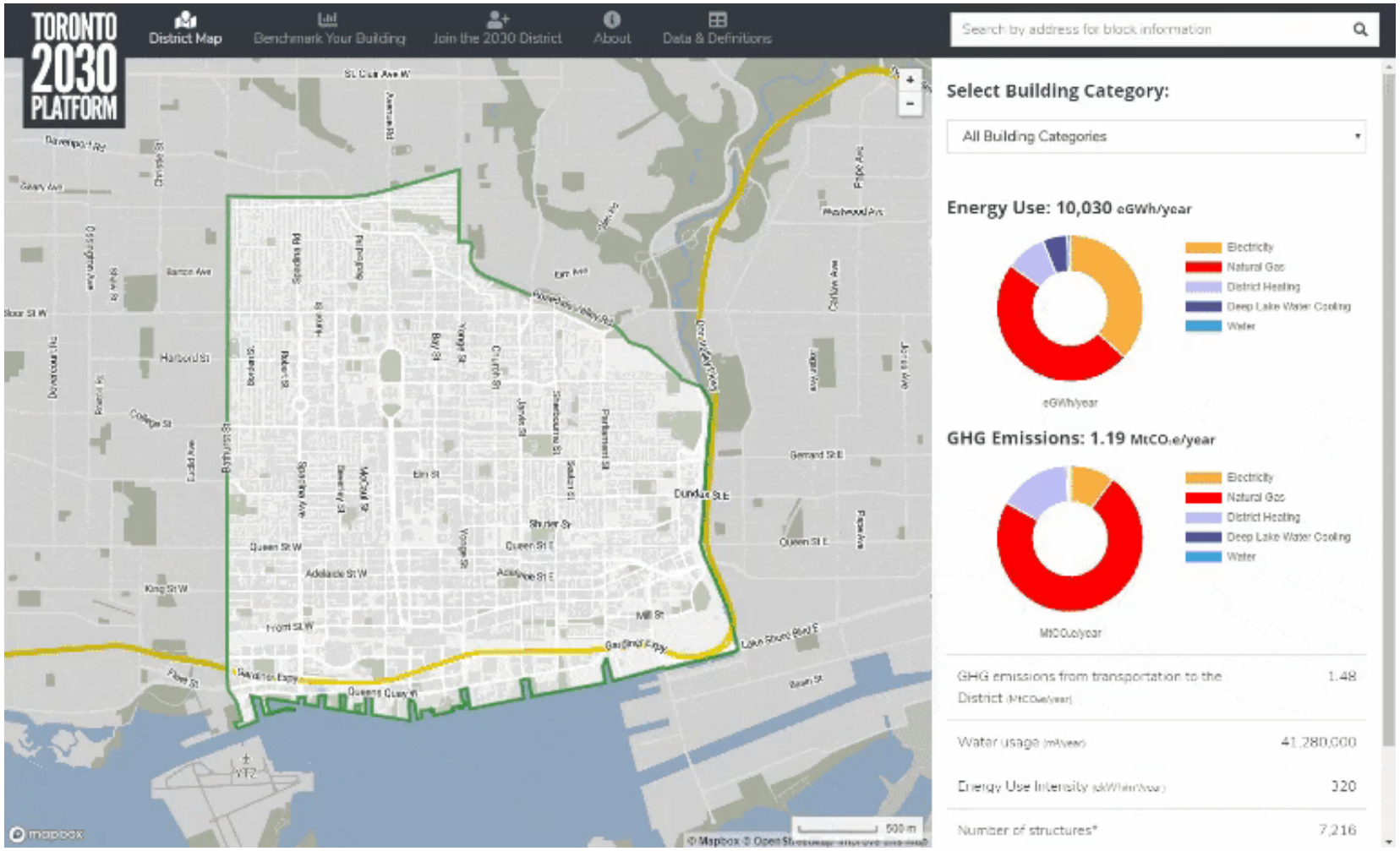
* Water GHG Emissions Factor is based on the average City of Toronto emissions for water pumping and treatment and sewage pumping and treatment.

Additional Data Sources:

- Building Energy Models based on ASHRAE 90.1 (2004) - Sources: Jenn McArthur, Ryerson University; ASHRAE
- Commercial Buildings Energy Consumption Survey (2003): Sources: US Energy Information Administration; Bob Bach (conversion to Toronto climate zone)
- Transportation Models based on Transportation for Tomorrow Survey (2011)- Sources: Marianne Hatzopoulou, University of Toronto; Ontario Ministry of Transportation
- Energy Use and Total Floor Area for Institutional Buildings (2016) - Source: Ontario Ministry of Energy, Broader Public Sector GHG Emissions
- Building Age, Occupancy Type, and Total Floor Area (2017) - Source: Municipal Property Assessment Corporation
- Building Outlines and 3D Massing (2017) - Source: City of Toronto, Planning Division
- Address Points (2017)- Source: City of Toronto, Information & Technology Division

ONTARIO

Toronto2030 Platform



SYSCONVERGE
ARCHITECTURAL ENGINEERING

Canada Green Building Council

Disclosure Challenge

Launched in 2019 – the challenge called on real-estate leaders to publicly disclose the performance of their Canadian building portfolio, including available energy, GHG emissions, and water data

FIRST PHASE

5 participants
715 buildings
11 million m^2 of building space
$50 billion in managed real estate assets

SECOND PHASE

10 participants
935 buildings
17.3 million m^2 of building space
$110 billion in managed real estate assets

THIRD PHASE

12 participants
914 buildings
17 million m^2 of building space
$110 billion in managed real estate assets

Canada Green Building Council

Disclosure Challenge – Key Findings

1. The real estate sector is ready and willing to share building performance data.
2. Barriers still exist, and more so for certain building types.
3. Data drives emissions reductions
4. More jurisdictions are exploring whole-building data approaches. Ontario already mandates energy and water reporting for some buildings, with cities like Edmonton, Winnipeg, Ottawa, and Montreal, and the Province of Nova Scotia exploring voluntary approaches.

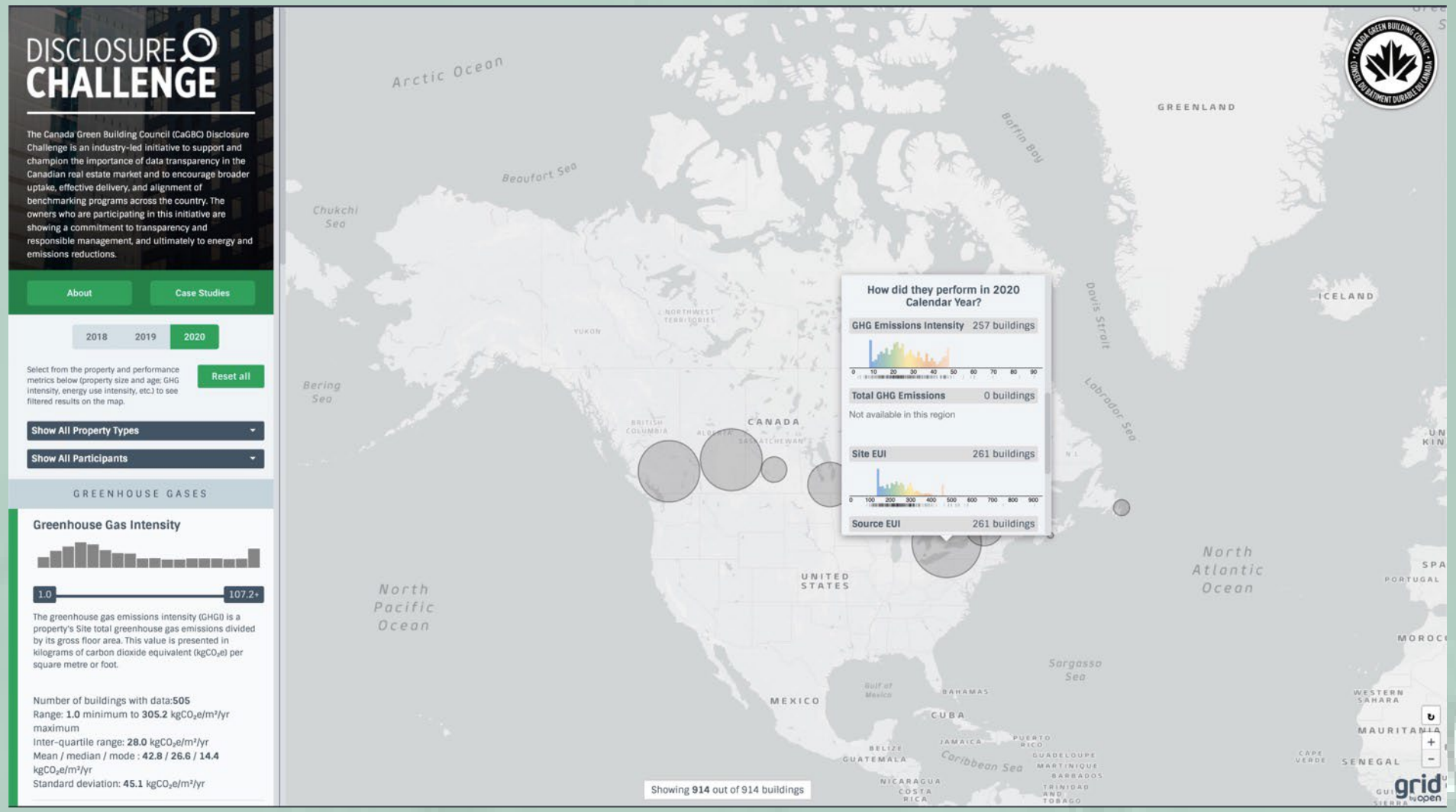
Canada Green Building Council

Disclosure Challenge – Recommendations for Policy Makers

1. Implement national building energy data disclosure guidelines that align to the Disclosure Challenge's ask
2. Support the use of Energy Star Portfolio Manager for data collection and benchmarking with direct connections to utility data
3. Mandate building data sharing as a prerequisite to access support program approval
4. Develop a user-friendly system for energy efficiency and GHG emissions intensity labelling that works for all buildings and owners

Canada Green Building Council

Disclosure Challenge – GRID



What Results Can Disclosure and Benchmarking Bring

EUROPEAN UNION

The EU Building Stock Observatory (BSO)

Established in 2016 to provide a better understanding of the energy performance of the building sector through reliable, consistent and comparable data and consists of:

The BSO Database:

The 250 indicators feeding into the BSO database are organized according to ten thematic areas:

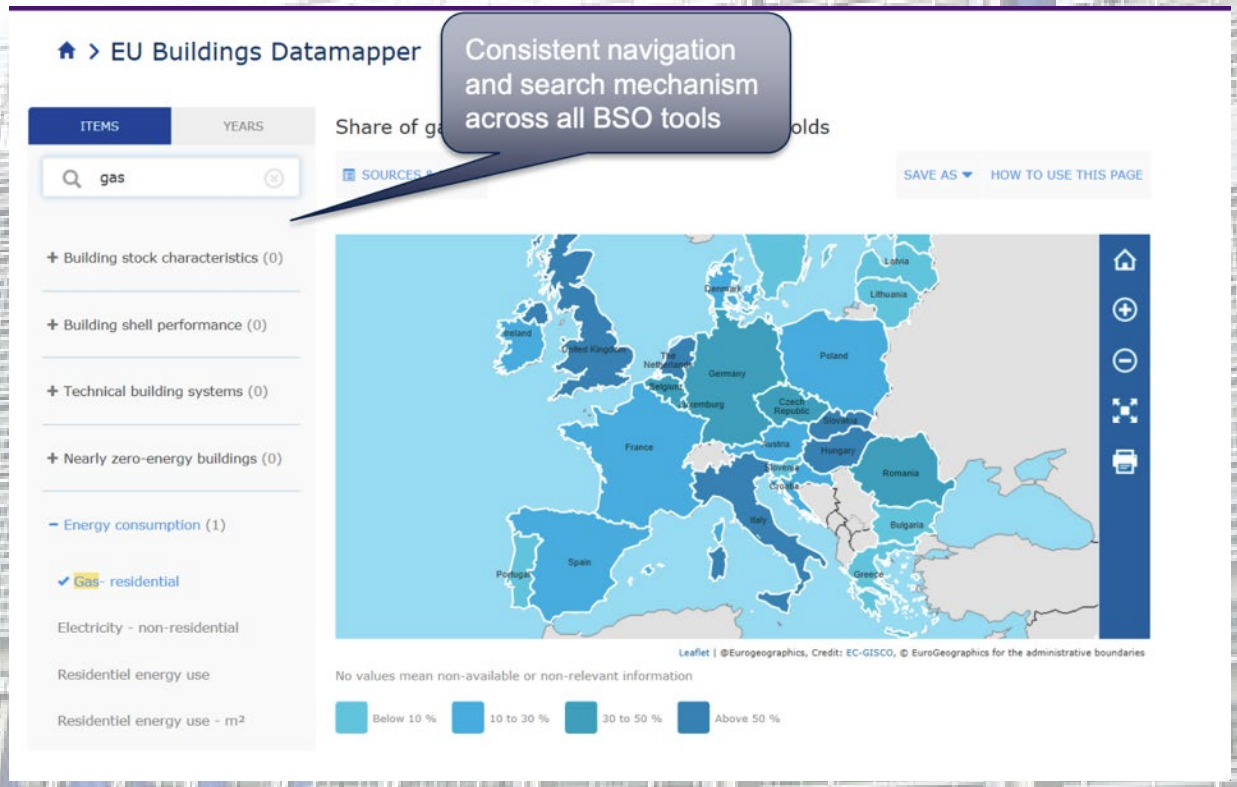
- building stock characteristics
- building shell performance
- technical building systems
- nearly Zero-Energy Buildings
- building renovation
- energy consumption
- certification
- financing
- energy poverty
- energy market

EUROPEAN UNION

The EU Building Stock Observatory (BSO)

The BSO Datamapper:

Uses maps and graphs to present indicators and allows users to compare the related information and data between EU countries



SYSCONVERGE
ARCHITECTURAL ENGINEERING

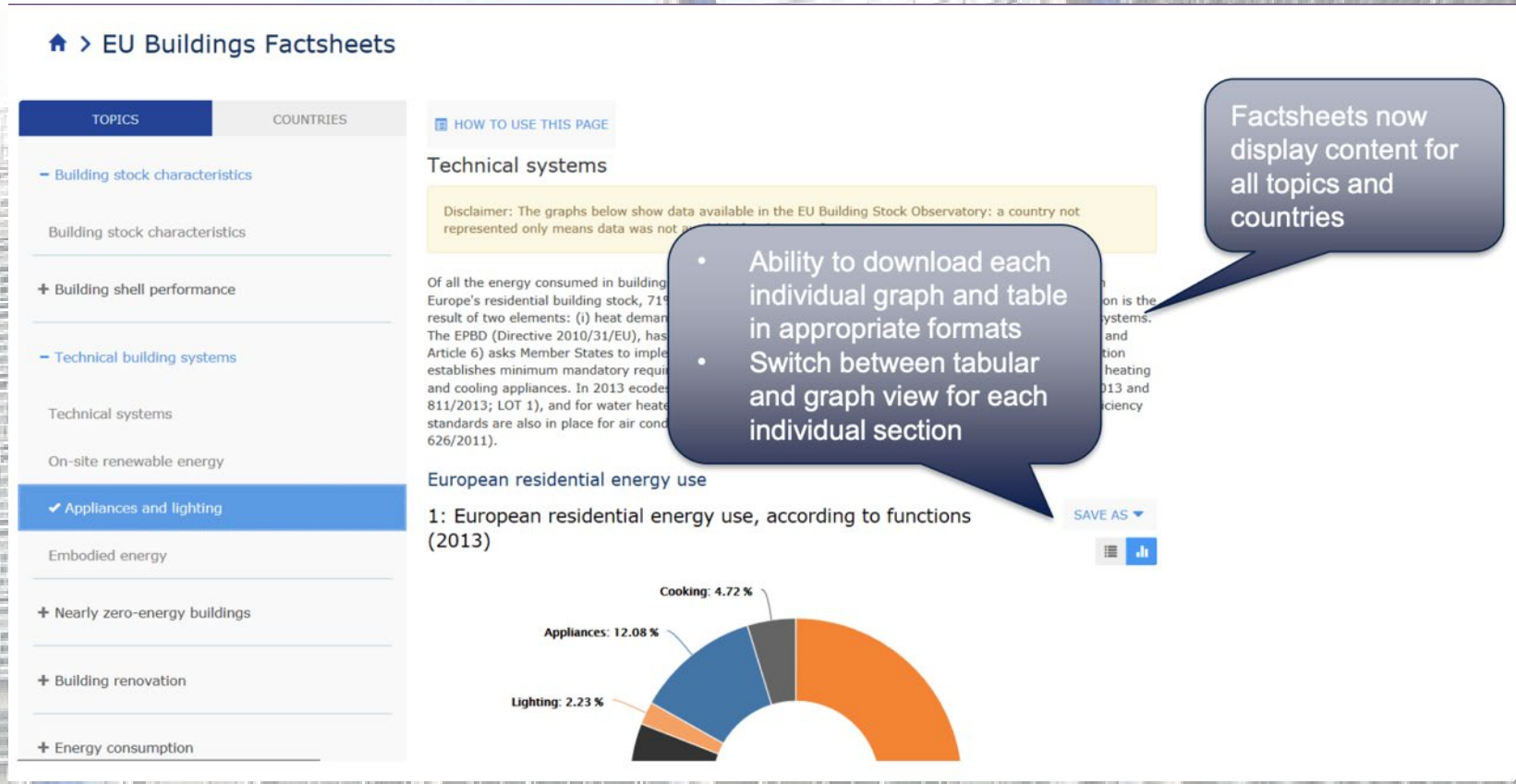
EUROPEAN UNION

The EU Building Stock Observatory (BSO)

The Factsheets:

BSO produces both thematic and country-specific factsheets that address the most relevant issues such as

- indicators and recommendations in relation to implementation of EU buildings legislation
- key statistics
- analysis
- policy context



UNITED STATES

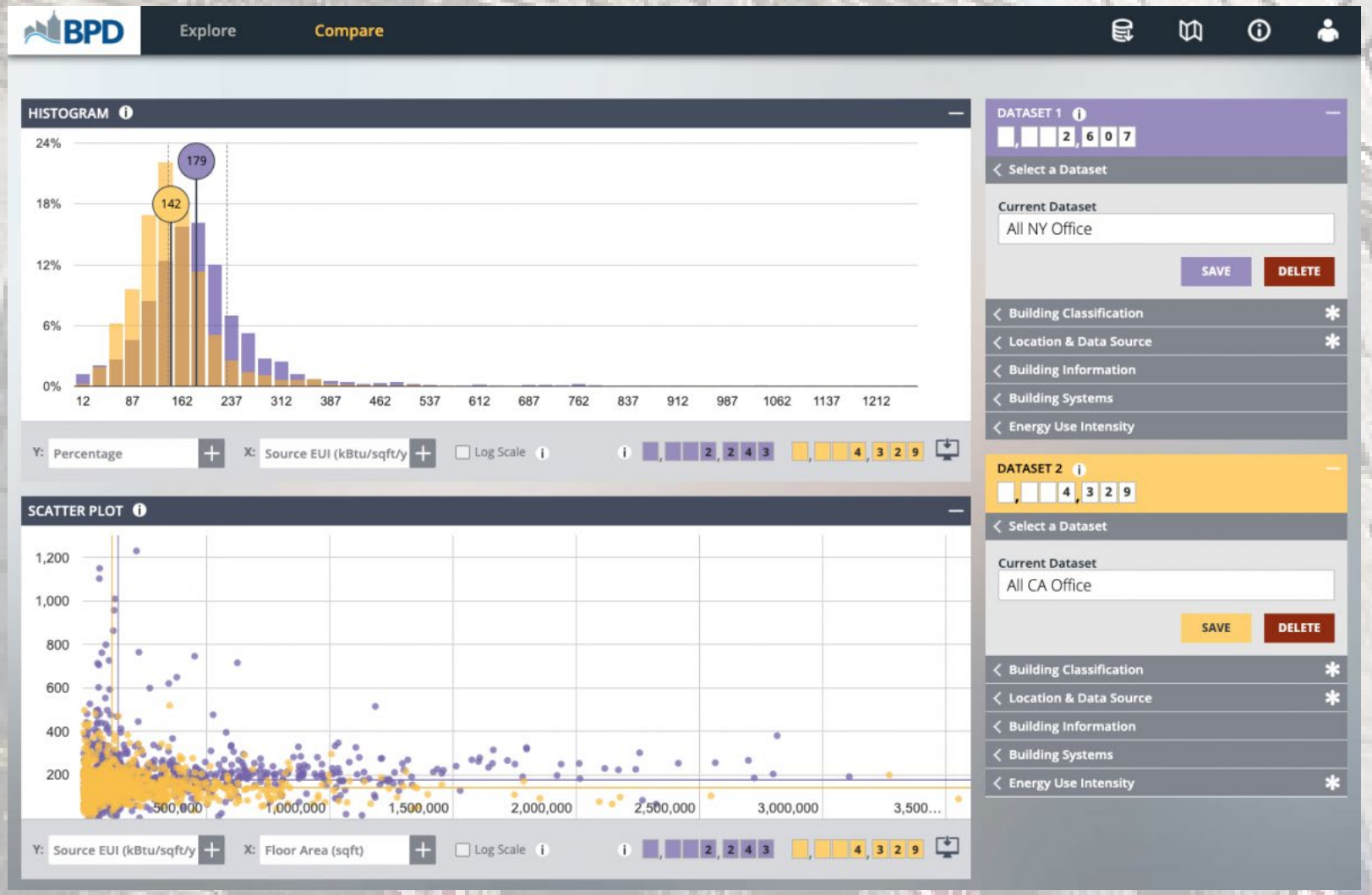
Building Performance Database (BPD) - Lawrence Berkeley National Laboratory (LBNL)

Largest dataset of information about the energy-related characteristics of commercial and residential buildings

BPD combines, cleanses and anonymizes data collected by federal, state and local governments, utilities, energy efficiency programs, building owners and private companies, and makes it available to the public

UNITED STATES

Building Performance Database (BPD)



UNITED STATES

Building Performance Database (BPD)

UNITED STATES

Building Stock Tools for Energy Analysis and Simulation - Archetypes

ComStock & ReStock - National Renewable Energy Laboratory (NREL)

Provides highly granular, bottom-up model that uses multiple data sources, statistical sampling methods, and advanced building energy simulations to estimate the annual sub-hourly energy consumption of the commercial building stock across the United States.

The Commercial Buildings Energy Consumption Survey (CBECS) - U.S. Energy Information Administration

The Commercial Buildings Energy Consumption Survey (CBECS) is a national sample survey that collects information on the stock of U.S. commercial and institutional buildings, including their energy-related building characteristics and energy usage data (consumption and expenditures).

Provides microdata file that contains 6,720 records. They represent commercial buildings from the 50 States and the District of Columbia. Each record corresponds to a single responding, in-scope sampled building. The sample represents an estimated 5.6 million total buildings in the United States.

CANADA

The Open Database of Buildings (ODB) – Statistics Canada

ODB brings together 65 datasets originating from various government sources of open data – 4.4 million records as of Feb 2019

The database aims to enhance access to a harmonized collection of building footprints across Canada

OBJECTID [1]	Shape [1]	Longitude	Latitude	CSDUID	CSDNAME	Data_prov	Build_ID	Shape_Length	Shape_Area
1	Polygon	-115.561757	51.18907	4815035	Banff	Banff	48150350000001	16.560241	16.963528
2	Polygon	-115.569331	51.171372	4815035	Banff	Banff	48150350000002	87.531972	330.625531
3	Polygon	-115.569616	51.178173	4815035	Banff	Banff	48150350000003	104.044015	573.938947

[1] Field indexed automatically by the GIS software used during processing.

CANADA

The Open Database of Buildings (ODB) – Statistics Canada

Current Data Sources

Alberta	British Columbia	New Brunswick	Northwest Territories
1. Airdrie	1. Chilliwack	1. Fredericton	1. Yellowknife
2. Banff	2. Courtenay	2. Moncton	
3. Canmore	3. Kamloops	3. Saint John	
4. Chestermere	4. Kelowna		
5. Cochrane	5. Nanaimo		
6. Edmonton	6. New Westminster		
7. Grande Prairie	7. North Vancouver		
8. Lethbridge	8. Prince George		
9. Strathcona County	9. Saanich		
	10. Squamish		
	11. Surrey		
	12. Vancouver		
	13. Victoria		
	14. Whistler		
	15. White Rock		

Nova Scotia	Ontario	Quebec	Saskatchewan
1. Cape Breton	1. Barrie	1. Longueuil	1. Regina
2. Halifax	2. Brampton	2. Montreal	
3. Nova Scotia	3. Brantford	3. Québec	
	4. Burlington	4. Repentigny	
	5. Caledon	5. Rimouski	
	6. Cambridge	6. Rouyn-Noranda	
	7. Durham Region	7. Shawinigan	
	8. Guelph	8. Sherbrooke	
	9. Hamilton		
	10. Huron County		
	11. Kingston		
	12. Kitchener		
	13. Muskoka		
	14. Newmarket		
	15. Niagara Falls		
	16. Niagara Region		
	17. Norfolk County		
	18. Oakville		
	19. Ottawa		
	20. St. Catharines		
	21. Toronto		
	22. Waterloo		
	23. Waterloo Region		
	24. Welland		
	25. York Region		

CANADA

Building Stock Tools for Energy Analysis and Simulation

National Energy Use Database (NEUD) – National Resources Canada (NRCan)

Open database that provides a statistical overview of Canada's sectoral energy use and GHG emissions as well as information on major activities and relevant indicators influencing energy use. It covers five sectors at an aggregate level: Residential, Commercial / Institutional, Industrial, Transportation and Electricity generation.

Download

Total End-Use Sector - Energy Use Analysis

	2000	2017	2018	2019
Total End-Use				
Total Energy Use (PJ)	**8,042.13**	**9,267.73**	**9,612.85**	**9,683.24**
Total Energy Use without "Other"[1] (PJ)	**7,692.18**	**8,812.20**	**9,141.56**	**9,221.68**
Energy Use by Sector (PJ)				
Residential	1,384.44	1,479.64	1,540.65	1,536.41
Commercial/Institutional	990.30	1,151.56	1,181.00	1,203.57
Industrial	3,166.92	3,611.64	3,748.68	3,779.54
Passenger Transportation	1,275.42	1,446.05	1,497.28	1,512.20
Freight Transportation	908.94	1,152.58	1,205.08	1,219.58
Off-Road[2]	81.54	119.54	122.06	123.93
Agriculture	234.57	306.72	318.09	307.99

CANADA

Building Stock Tools for Energy Analysis and Simulation - Archetypes

Housing Technology Assessment Platform (HTAP) – National Resources Canada (NRCan)

HTAP is a collection of data and tools that automate and extend the HOT2000 residential energy simulation tool. This platform is currently used to develop housing reference archetypes.

Building Technology Assessment Platform (BTAP) – National Resources Canada (NRCan)

NRCan is currently developing commercial building archetype framework, based upon the U.S. National Renewable Energy Laboratory's Openstudio software development kit.

CANADA VS USA

Building Stock Tools for Energy Analysis and Simulation and Archetypes

Building stock data	USA	Canada
Archetype data	17	10*
Open Timeseries data	59	NA
Available Open Building Data points	275	41
Building energy model Archetypes	350,000	Ongoing*
Residential archetype model files type	EnergyPlus	HOT2000
Commercial archetype model file type	EnergyPlus	EnergyPlus
*NRCan currently in development of building energy model archetypes for the residential sector		

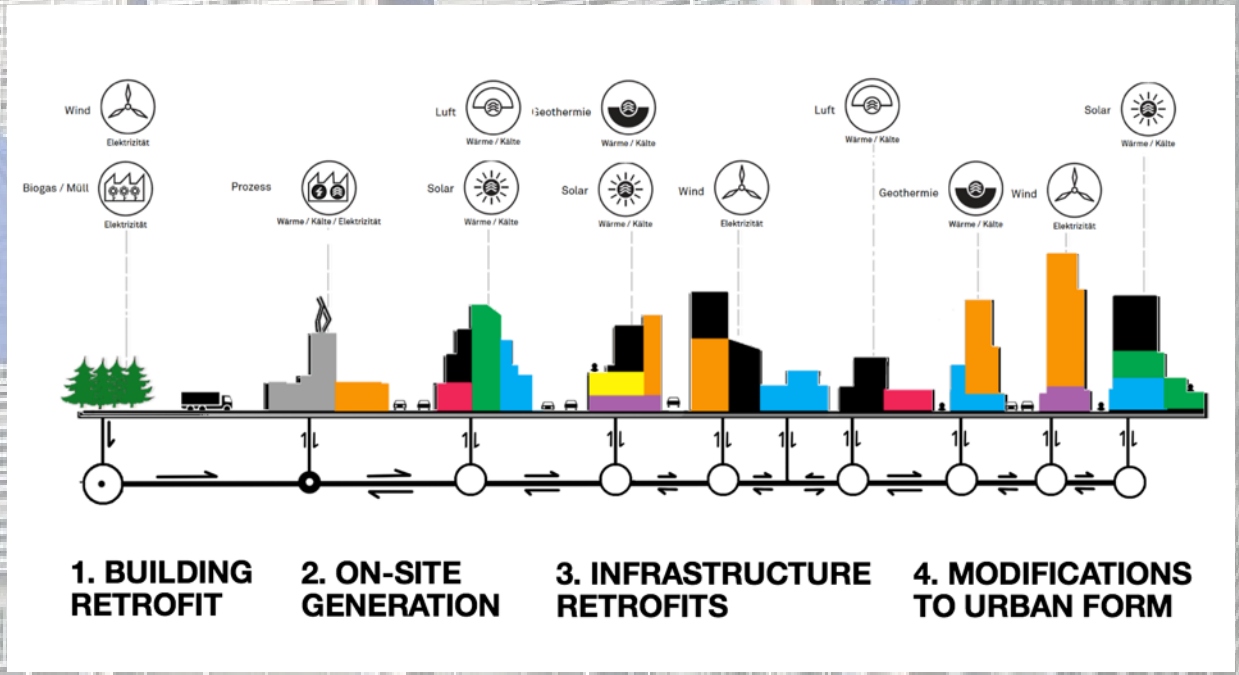
What is Possible with Accessible Reliable Open Data and Archetypes?

EUROPEAN UNION

City Energy Analyst (CEA)

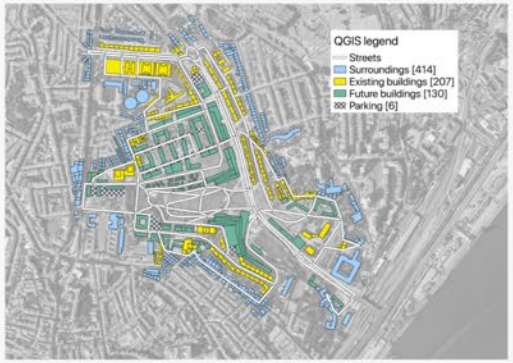
Urban simulation engine created to assess multiple energy efficiency strategies in city districts. The CEA offers tools for the analysis of the carbon, financial and environmental benefits of the following strategies:

- Building Retrofits: Appliances and lighting, building envelope, HVAC systems (incl. Control strategies)
- Integration of Local Energy Sources: renewable and waste-to-heat energy sources
- Infrastructure Retrofits / District Energy Networks: decentralized and centralized thermal micro-grids and conversion technologies
- Modifications to Urban Form: new zoning, changes in occupancy and building typology

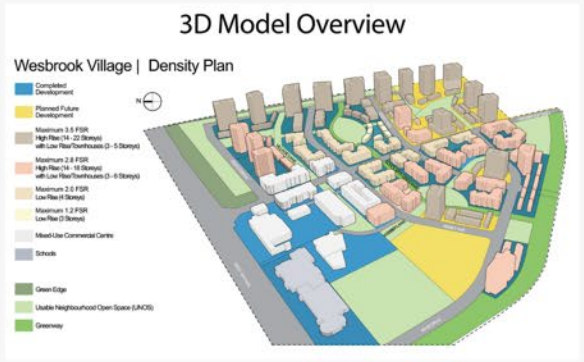


EUROPEAN UNION

City Energy Analyst (CEA)

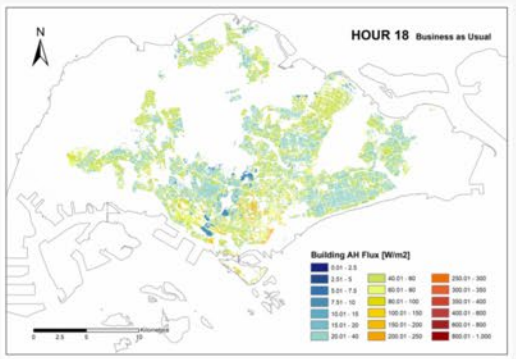


Lisbon - Vale de Santo António



Vancouver - Wesbrook Village

Amsterdam - Buiksloterham



Singapore - Cooling Singapore

UNITED STATES

CityBES: An Open Data and Computing Platform for Urban Buildings

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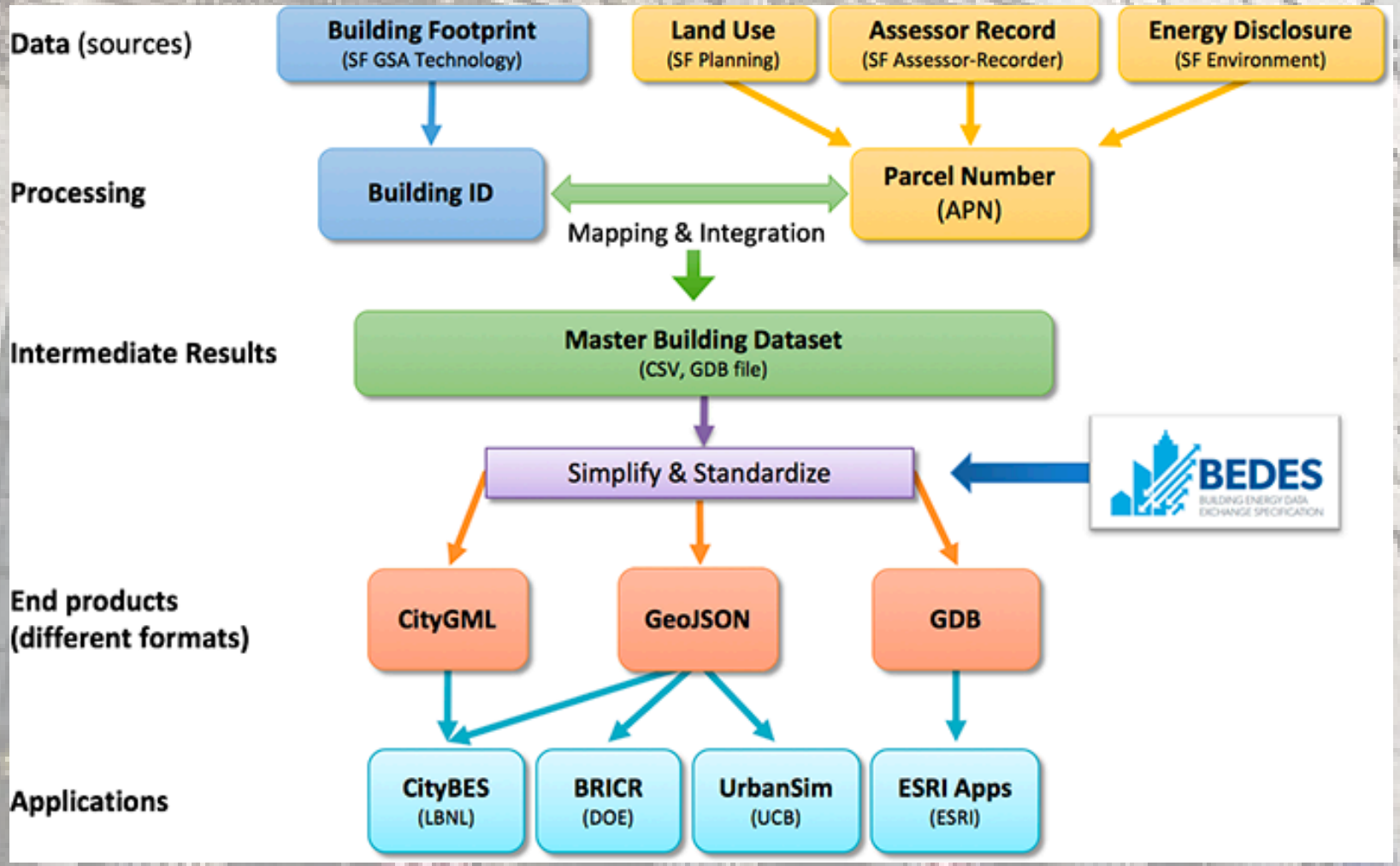
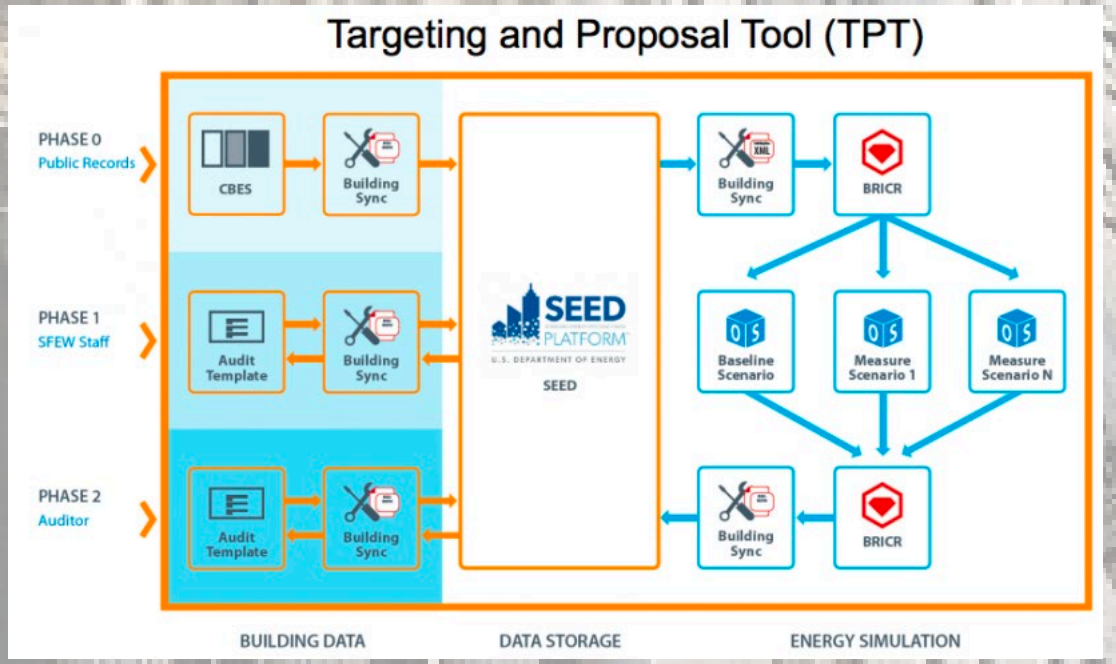
San Francisco - Open City Models



UNITED STATES

BayREN Integrated Commercial Retrofits (BRICR)

PROVIDER	INPUTS	PROCESS	OUTPUTS	CUSTOMERS
Lab Staff	**BuildingSync Phase 0** Public records	**Lead Identification**	Leads	*Energy Program Staff*
Energy Program Staff	**BuildingSync Phase 1** Program participation (protected data) Rebate and financing options	**Energy Audit** Observe building attributes and operations **Proposal Preparation** Develop measure packages and financing options	Energy savings opportunity Retrofit packages	*Energy Program Staff*
Building Owner / Decision Maker *Contractors* *Energy Program Staff*	**BuildingSync Phase 2** Budget and constraints ECMs chosen Quality assurance scope	**Proposal Evaluation** **Financing and Installation** **Post-installation Documentation**	ICP Project Development Specification Post-installation data Updated building record (future lead)	*Loan Provider* *Energy Program Staff* *Building Owner / Decision Maker*
		Measurement and Verification **Updated Building Record (Future Lead)**	Realized energy savings	



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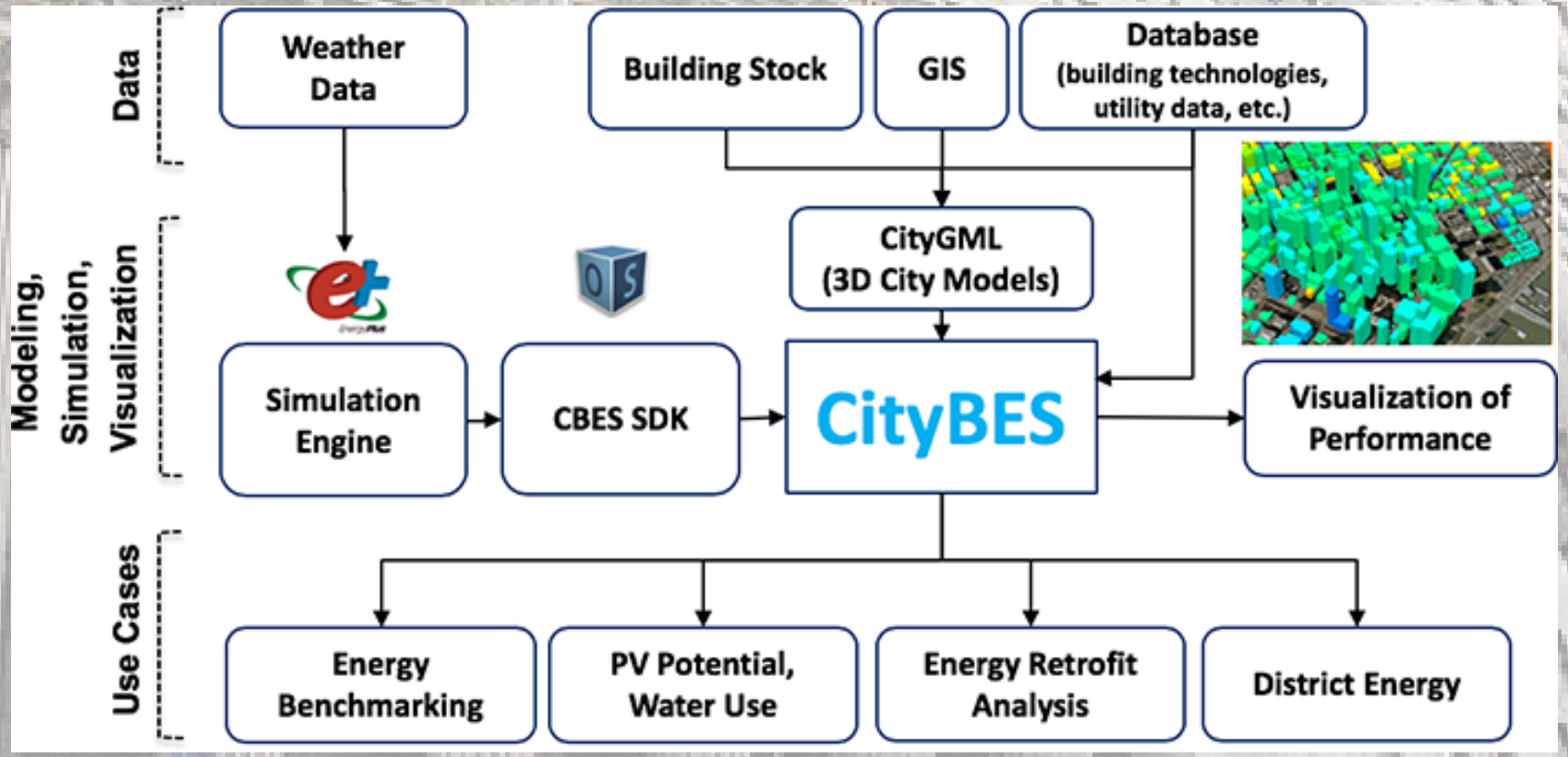
CityBES: An Open Data and Computing Platform for Urban Buildings

San Francisco

CityBES Architecture



UNITED STATES

CityBES: An Open Data and Computing Platform for Urban Buildings

San Francisco

Building Type	Building Count	Floor area (10^3 m^2)	Simulated annual site energy use (GWh)
Small office	143	152	28
Medium office	99	463	79
Small retail	233	120	38
Medium retail	65	138	41
Total	**540**	**873**	**186**

540 Buildings Selected

Associated EUI

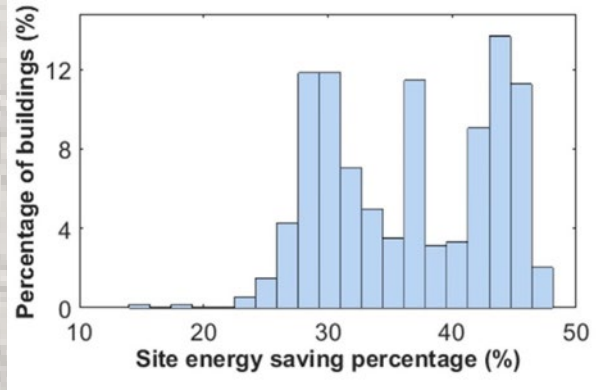
ECM Packages

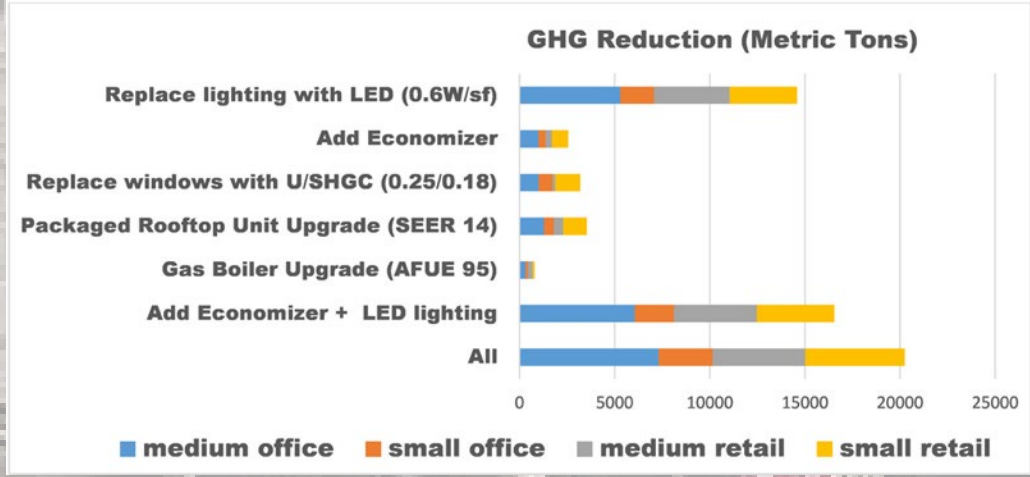
Category	Name	Description
HVAC - Heating	Gas Boiler Upgrade (AFUE 95)	Replace existing heating system with high-efficiency gas boiler with an annual fuel utilization efficiency of 95 (AFUE 95)
HVAC - Cooling	Packaged Rooftop Unit Upgrade (SEER 14)	Replace RTU with a higher-efficiency unit with reheat, SEER 14. Cooling only includes standard controls, curb, and economizer.
Envelope - Window	Replace windows with U/SHGC (0.25/0.18)	Replace existing window glass and frame with high-performance windows (U-factor: 0.25 Btu/(h·ft^2·°F), SHGC: 0.18. SHGC and U-factor are 30% below Title 24 values.
HVAC - Economizer	Add Economizer	Install economizer for existing HVAC system (includes temperature sensors, damper motors, motor controls, and dampers).
Lighting	Replace lighting with LED (0.6 W/ ft^2)	Replace existing lighting with LEDs at 6.5 W/m^2 [2.4 Btu/h/ft^2]. LEDs consume less power and last longer than fluorescent lamps.

UNITED STATES

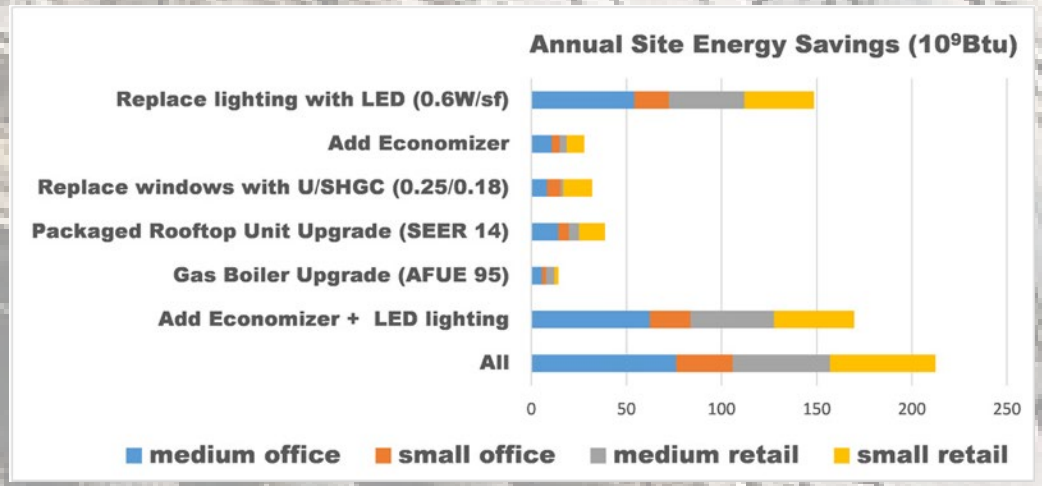
CityBES: An Open Data and Computing Platform for Urban Buildings

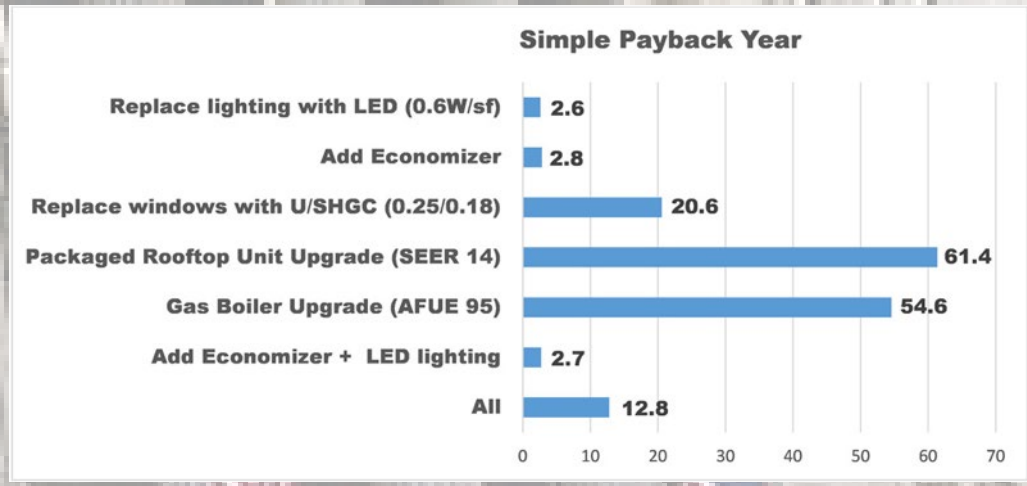
San Francisco





Further Analysis





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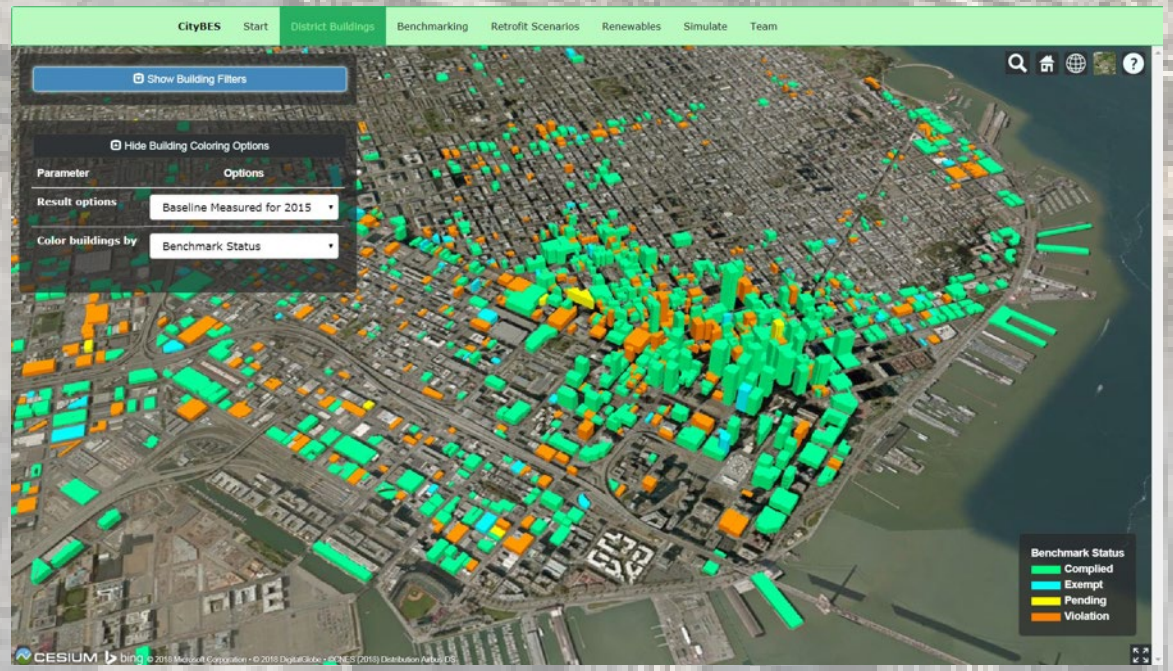
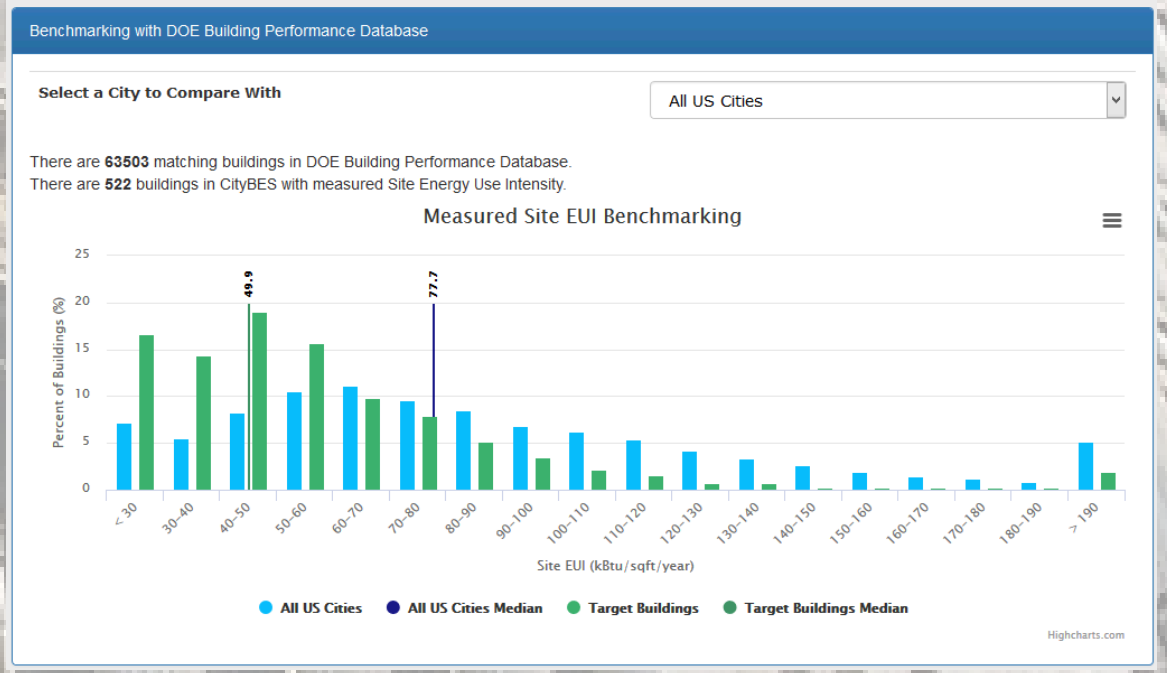
CityBES: An Open Data and Computing Platform for Urban Buildings



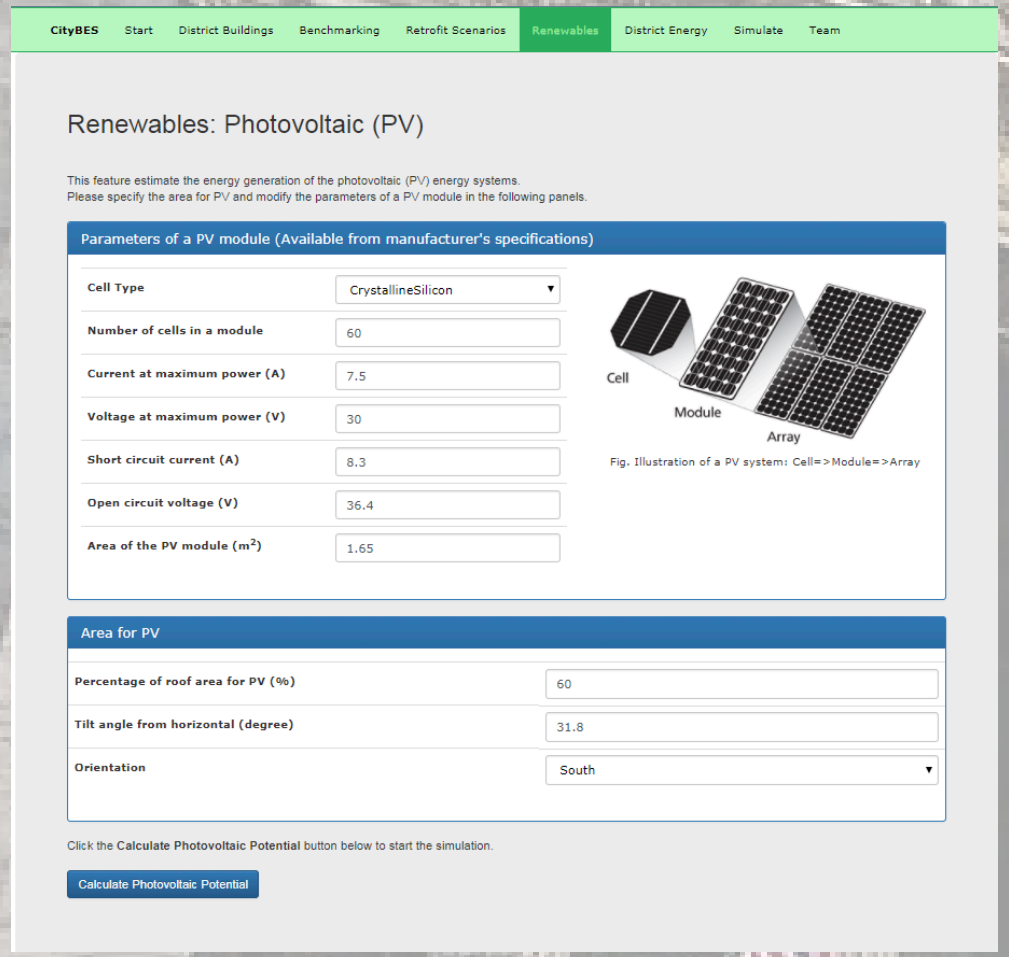
Visualizing Building Energy from City Ordinance

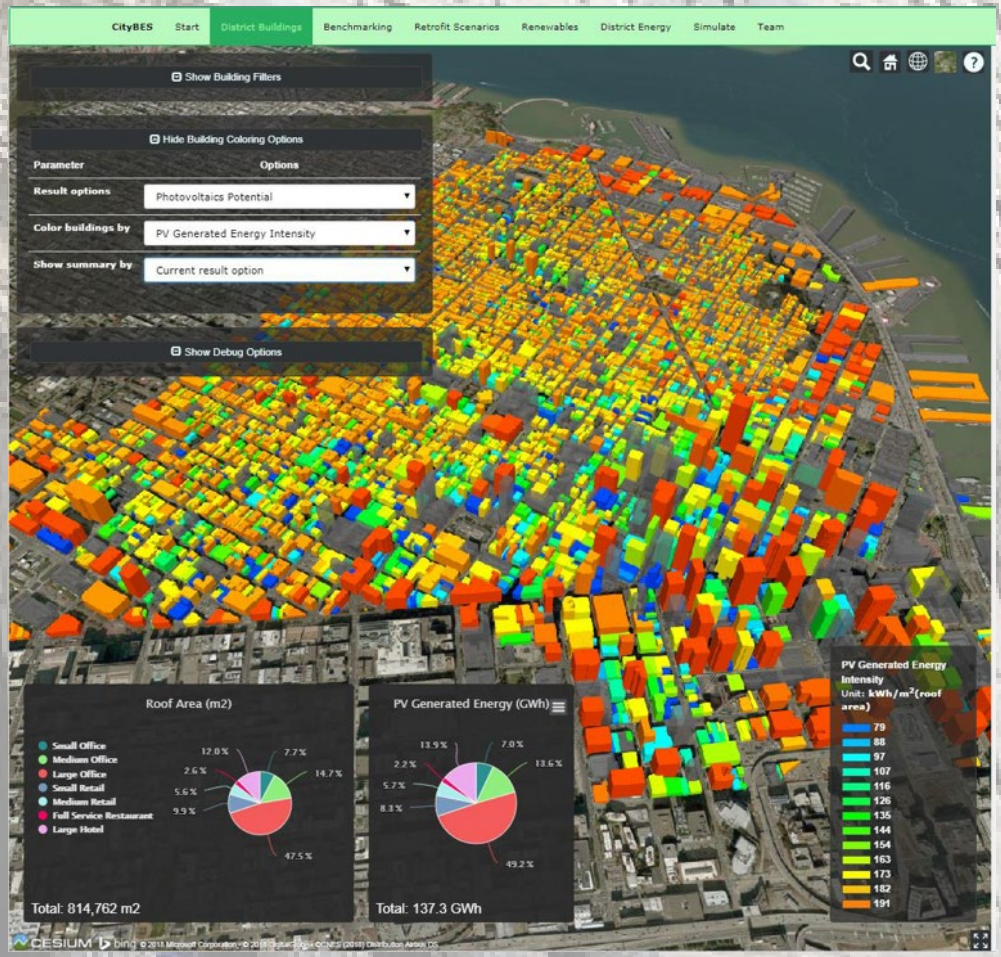


Viewing Benchmark Performance of City Buildings

UNITED STATES

CityBES: An Open Data and Computing Platform for Urban Buildings





Evaluating the photovoltaic potential of 8,665 buildings in Northeast San Francisco

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CANADA

Canadian Energy End-use Mapping (CEE Map)

Project is to develop an online map containing building energy end-use and efficiency opportunities and associated data

Initiated in 2019 and is ongoing in 2023

Two main collaborators are the City of Kelowna, British Columbia and Fortis Gas and Electric

The project prioritizes two use cases:

- Municipal housing retrofit program planning
- Utility conservation planning and offsetting capital costs along transmission and distribution networks

CANADA

Building Energy Mapping and Analytics Concept Development Study (BEMA CDS)

BEMA CDS was conducted in support of CEE MAP and because

“Mapping and analysis of the energy consumption of buildings is currently undertaken in Canada by local municipalities, energy utilities, and federal agencies independently and for various purposes and across different scales.

These groups derive energy usage using many different sources and methods, yet fundamentally the data are the same: understanding of the building stock–the numbers, floor areas, and other characteristics of various building archetypes and how they impact energy usage.

Despite this commonality, there is little to no coordination between these groups, resulting in differing methodologies, duplication of effort, lost energy savings, and lost opportunities for decarbonization, climate change mitigation, and climate resilience.”

CANADA

BEMA CDS - Challenges in Advancing Building Energy Analysis

- Utility perspective on conservation, demand side management, regulation is underrepresented in the responses.
- Lack of awareness among stakeholders and building professionals of the potential for mapping and spatial data analytics to facilitate the transition to a low-carbon built environment.
- Data access and sharing issues include availability, privacy, confidentiality, propriety.
- Repetitive non-standardized methods are applied to collection, exchange, integration of datasets.
- Data source methods and confidence are wide ranging and poorly documented, variously measured, modeled, inferred, estimated, assumed, etc.
- Lack of access to retrofit cost estimates presents a barrier to deriving benefits from energy mapping and modeling data.
- Lack of an overall data framework prevents connecting the scale and resolution of spatial data to particular use scenarios
- It remains a challenge to connect archetyping methods (clustering / classification) with different use case scenarios

CANADA

BEMA CDS – Identified Opportunities

- Data access technologies that account for privacy, confidentiality, anonymity, e.g. enclave processing, anonymization by aggregation + noise injection (differential privacy)
- Adaptive classification and archetyping based on sample modeling
- National systems for consistent energy data at multiple scales
- Data sharing policies and standards organized to support critical use cases and stakeholders, e.g. federation contracts, mandated reporting.
- National building data layer for comprehensive analysis of building types, energy performance, retrofit / upgrade technologies, costs, and benefits.
- Community-utility cooperation facilitated by regional/national authority to understand opportunities /costs / benefits of new technologies and energy sources, e.g. renewables

CANADA

Concordia University CERC CEE Map Project Contribution

CERC contributed to the CEE Map with its project to create a basis of knowledge on key topics, characterize data workflows and perform selected data cleaning and integration tasks

The work done by CERC primarily supported the development of the CEE Map prototype for Kelowna BC with findings shared with related initiatives such as the BEMA-CDS

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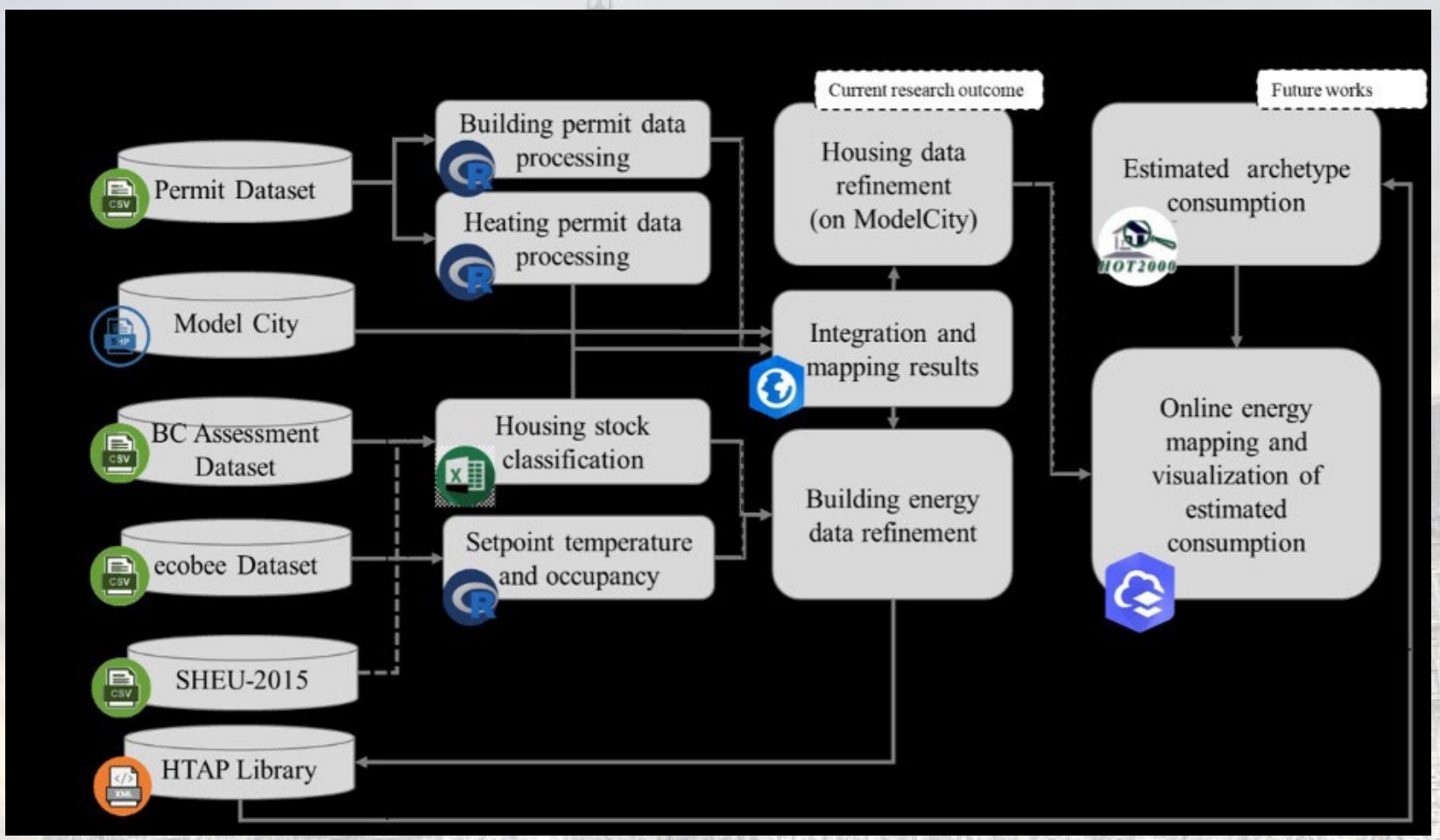
Concordia University CERC CEE Map Project Contribution

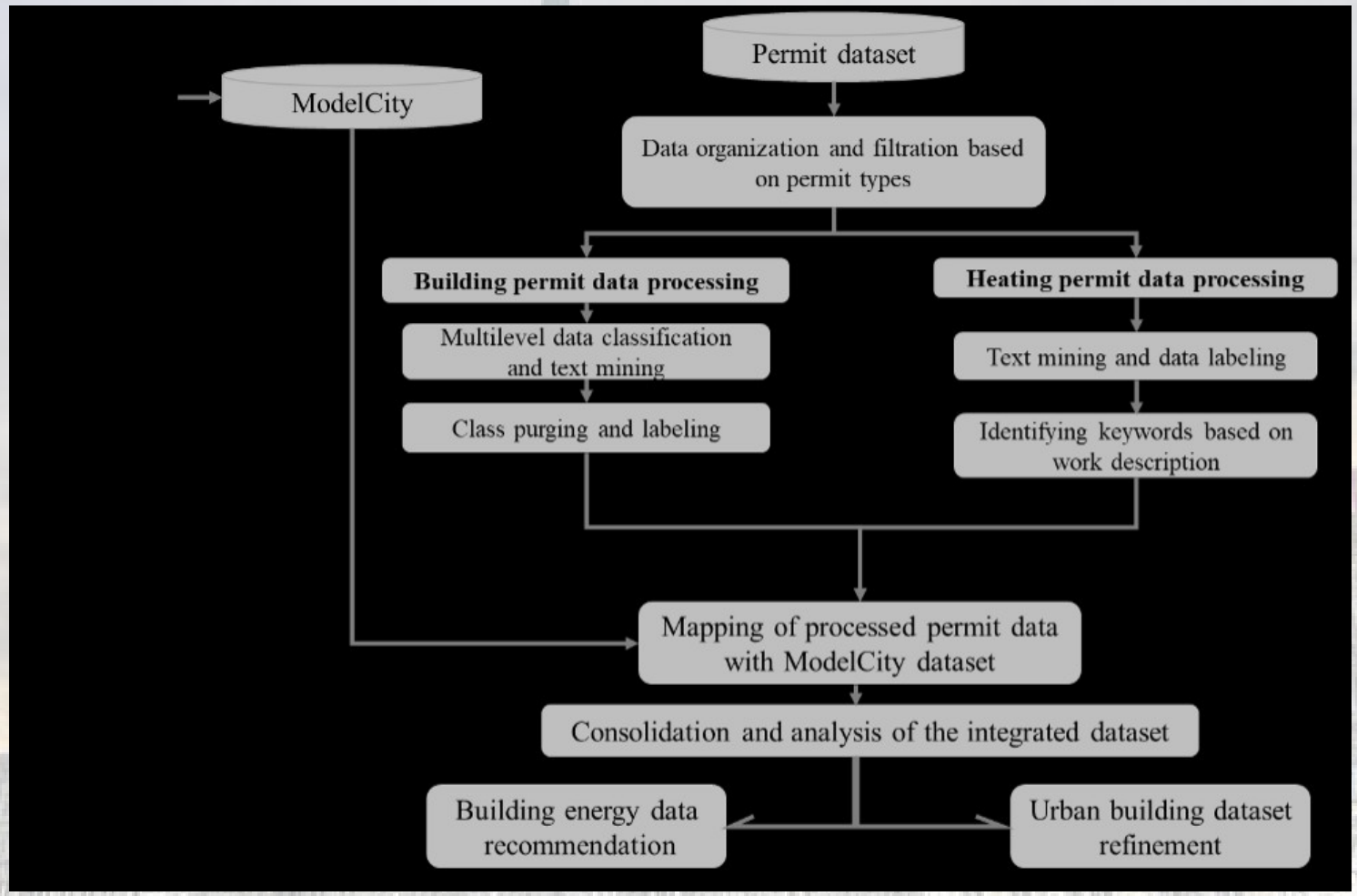
Workflow



CANADA

Concordia University CERC CEE Map Project Contribution

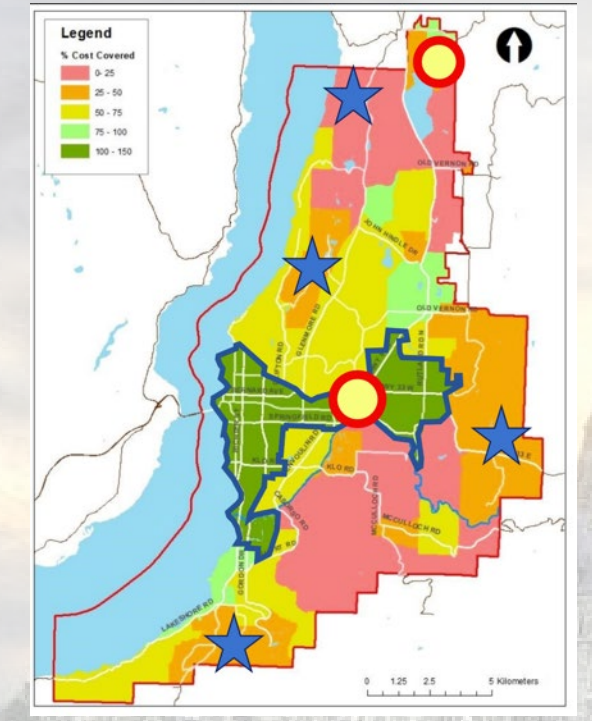
Workflow

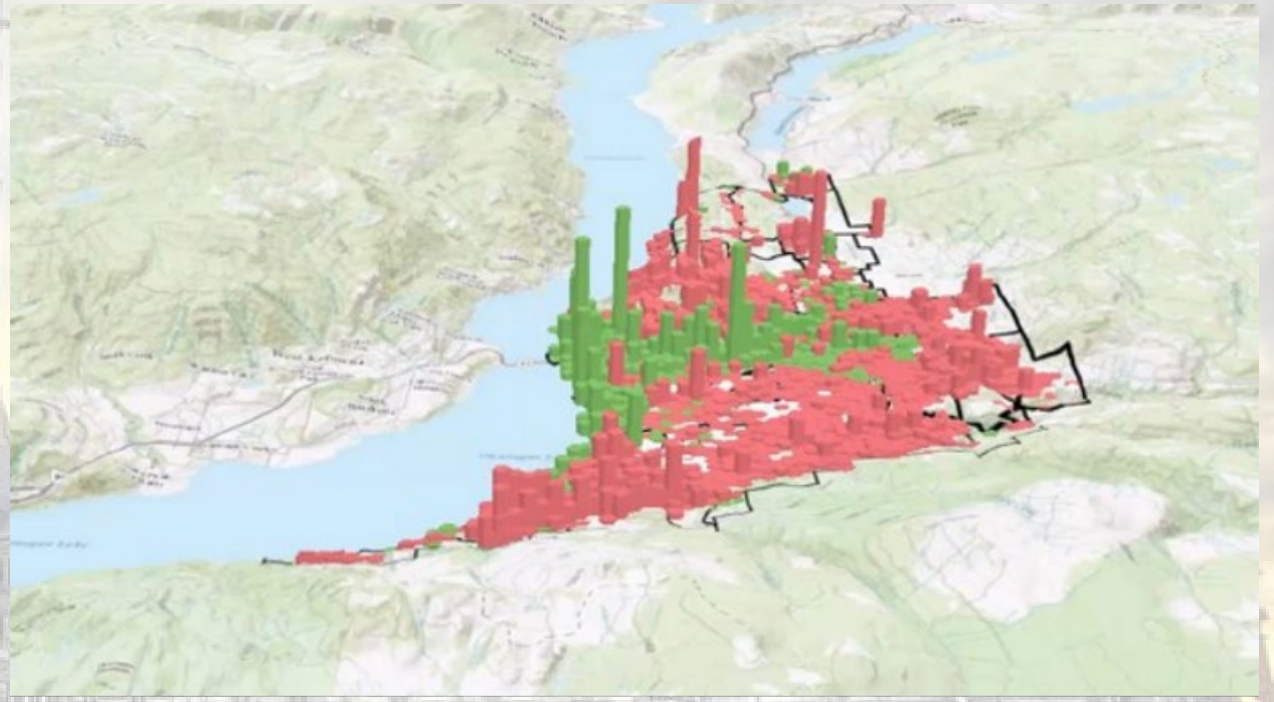


CANADA

Concordia University CERC CEE Map Project Contribution

Model City Infrastructure (MCI) is an analysis tool developed in 2020 to assist Kelowna staff, Council and the public as they consider the long-term infrastructure implications of land use decisions

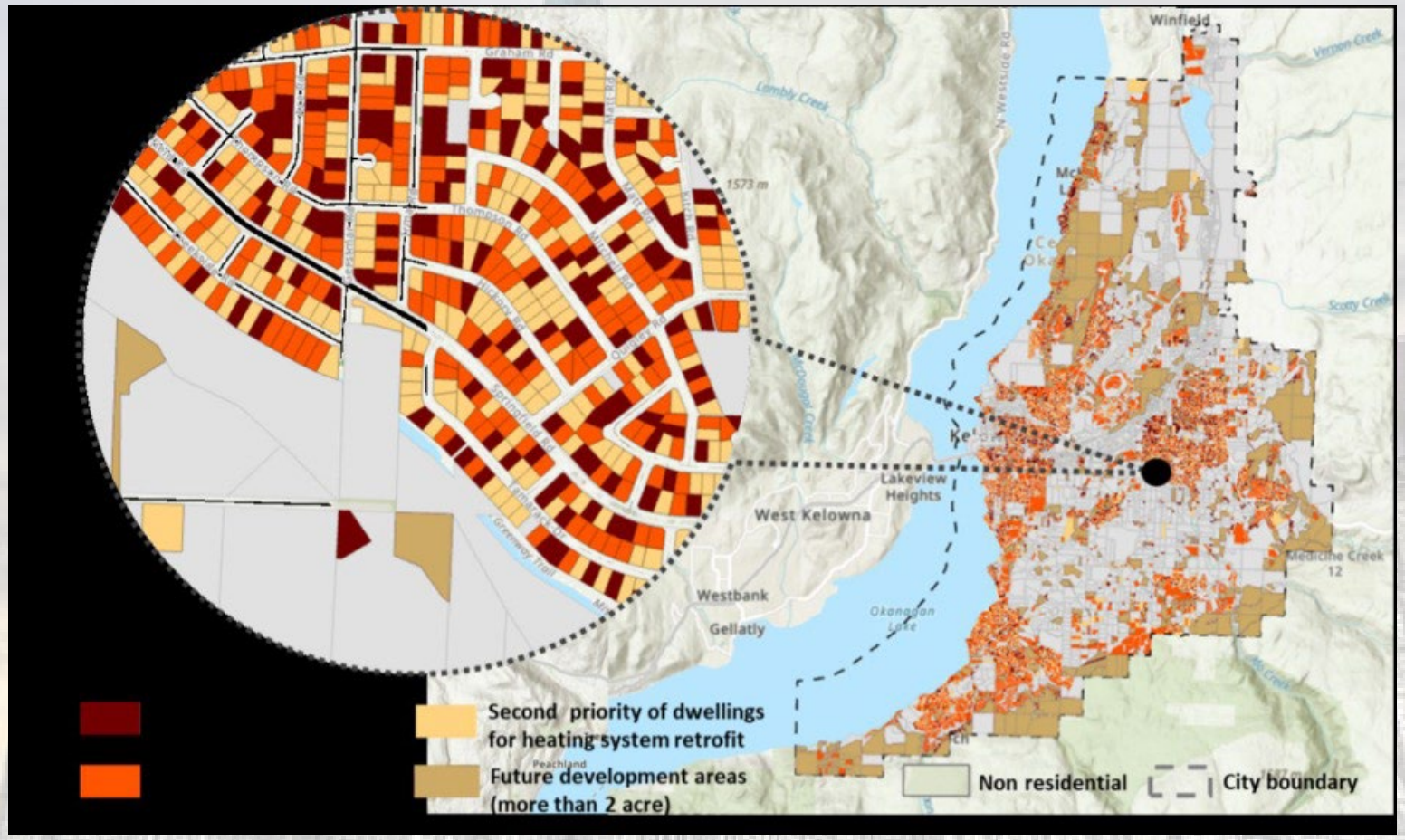




CANADA

Concordia University CERC CEE Map Project Contribution

Mapping model city data and heating permit results



CANADA

Concordia University CERC CEE Map Project Contribution – Recommendations from the Study

- Use standard terminology to collect and maintain datasets on buildings and their attributes specific to energy performance. Explore existing data dictionaries such as Building Energy Data Exchange Specification (BEDES) and Building Smart (Building Smart) for this purpose
- Collect and maintain building attributes in Model City at the building level, enabling aggregation to the parcel level. Currently unique IDs are assigned at the parcel scale (KID). Assess the value and applicability of adopting the unique numeric identifiers assigned to buildings by Statistics Canada in the Open Database of Buildings (ODB)
- Collect and maintain heating and building permit data systematically using digital geo-referenced mobile applications
- Increase the fidelity of heating permit data collection by defining additional attributes to be collected
- Provide real-time integration between the issued permits and the major datasets containing building information, such as Model City
- Integrate data on furnace and hot water tank replacements from other related sources to fill the missing work descriptions and support improved targeting of candidate dwellings for mechanical system replacements.

Canada - Challenges and Recommendations

CANADA

What are the challenges for Canada's open data regarding Building Energy Usage and GHG Emissions?

- Limited data availability: There is often a lack of consistent, comprehensive data on building energy use and GHG emissions available to the public
- Data quality: There may be concerns about the accuracy and completeness of the data that is available, which can limit its usefulness
- Data security and privacy: There is a need to balance the need for open data with the need to protect sensitive information and the privacy of individuals
- Legal and policy barriers: There may be legal and policy barriers that prevent the release of certain types of data, or that make it difficult for people to access and use the data that is available
- Limited resources: There may be limited resources available to maintain and update open data portals and platforms, which can make it difficult to keep the data current and relevant

CANADA

Recommendations

- Implement and enforce national building energy data disclosure guidelines
- Energy Star Portfolio Manager for data collection and benchmarking with direct connections to utility data
- Mandate building data sharing as a prerequisite to access support program approval
- Develop or adopt data exchange standards for energy auditing and benchmarking
- Maintain a consistent, accessible and queryable Open Building Stock Performance Database for Canada with relevant energy related fields

We’d Love to Hear From You.

Contact us at:

info@sysconverge.com
416 920 4274

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