Recommendations for Regional Energy Benchmarking

Informing a roadmap for benchmarking energy and emissions associated with Complex Buildings in the CRD

Prepared by Christopher Moore, UBC Sustainability Scholar, 2020

Prepared for Matt Greeno, Community Energy Specialist, Capital Regional District

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Abbreviations

BOMA BC	Building Owners and Managers Association of British Columbia
CAGBC	Canada Green Building Council
CRD	Capital Regional District
EUI	Energy Use Intensity
FAQ	Frequently Asked Questions
GHG	Greenhouse Gas
NRCAN	Natural Resources Canada
US DOE	United States Department of Energy
US EPA	United States Environmental Protection Agency

Executive Summary

Energy benchmarking can be defined as measuring the yearly energy use of a building and comparing it relative to other similar buildings in similar climates. At a regional level, benchmarking involves widespread reporting of energy use by buildings and often public disclosure of energy use data. A regional benchmarking program aims to create a large body of comparative energy use data and get as many buildings participating as possible to add to the data. This data can give building owners information about their energy performance to encourage improvements, give governments actual data to inform future policy decisions, support energy efficiency research with real information, and bring energy efficiency into the real estate market.

With these goals in mind, this report created a framework of recommendations for a successful regional benchmarking program for complex buildings, specific to the characteristics of the capital region. These recommendations considered the successes of existing policies, the recommendations of organizations that promote energy efficiency, and advice provided by industry professionals. The recommendations are presented in three categories: essential components that are key to the success of any program; important considerations that are very valuable but not fundamental; and finally, optional additions that can contribute positively to a program but are not necessary for success. These recommendations are summarized in the following table.

The purpose of these recommendations is to give policy makers and future program administrators in the Capital Regional District (CRD) an overview of the key factors for consideration.

Recommendations for a Regional Benchmarking Program
Essential Components
Provide useful and localized information to building owners & operators
Use Portfolio Manager
Make Participation Mandatory
Expand program over time with a phased approach
Determine clear benchmarking criteria
Include data input quality control measures
Make data available for use
Important Considerations
Consider Public Disclosure
Align policy format and requirements with municipal and/or provincial programs
Perform audits to ensure reliability
Work with utilities to make data easily available
Assist building owners with analyses and conclusions
Provide information to building owners regarding the next steps
Optional Additions
Recognize and applaud high-performing buildings
Consider benchmarking more than just energy
Accredit or advertise external benchmarking professionals
Consider financial incentives
Hold launch events, workshops, and benchmark-a-thons

Introduction & Background

What are the objectives of this report?

This report seeks to collect, summarize, and synthesize recommendations for a successful regional benchmarking program for complex buildings, specific to the characteristics of the capital regional. Ideally, all come together to provide a comprehensive program to achieve widespread energy benchmarking in the region. This report considers the successes of existing policies, the recommendations of organizations that promote energy efficiency, and advice provided by industry professionals. It considers the many aspects required for a successful benchmarking program.

What is energy benchmarking?

Simply put, energy benchmarking is measuring the yearly energy use of a building and comparing it relative to other similar buildings in similar climates. It can further be expanded to include greenhouse gas (GHG) emissions and water use. At a regional level, benchmarking involves widespread reporting of energy use by buildings and often public disclosure of energy use data.

What are Complex Buildings?

This report defines complex buildings as Part 3 buildings under the BC building code. The BC Government Guide "Understanding BC's Building Regulatory System" (2015) explains Part 3 buildings as follows:

- Size: All buildings over three storeys in height or over 600 square metres in footprint. Some buildings three storeys or less in height or under 600 square metres in area that are of a specific use.
- Description: Buildings intended for public gatherings, residential care, detention or high-hazard industrial activities. Some larger buildings intended for residential, commercial or medium-to-low hazard industrial activities.
- Examples: shopping malls, office buildings, condos, apartment buildings, hospitals, care facilities, daycares, schools, churches, theatres, restaurants

For the data analysis portion of this report, the data was filtered to include any building over 600 square meters and meeting a use description similar to the description of part 3 buildings given above. Table 1 summarizes the distribution of complex buildings in the jurisdictions of the capital region.

Table 1: Complex Building Quantities and Floor Areas in the Capital Region

Jurisdiction[1]	Complex Buildings	Total Floor Area (m^2)
Victoria	998	3,034,744
Saanich	416	1,976,293
Langford	206	697,364
Sidney	160	329,115
Central Saanich	122	258,499
Esquimalt	94	419,344
Colwood	66	205,760
Gulf Islands Rural	55	68,750
North Saanich	54	249,073
Oak Bay	52	653,519
Sooke	46	76,520
View Royal	42	139,693
Metchosin	9	60,011
Victoria Rural	4	50,666
Highlands	1	8,310
TOTAL	2325	8,227,661

What are the goals of a benchmarking program?

Before looking at recommendations, it is important to define the goals of a benchmarking program.

First, we should consider the broad end-goals of energy benchmarking as a process.

- Give building owners information about their actual and relative energy performance to encourage energy improvement
- Give governments actual data to inform future policy decisions
- Supporting energy efficiency research with real information
- Bring energy efficiency into the real estate market by letting buyers aware of energy efficiency before purchase and letting sellers market efficiency as an attractive feature

[1] Jurisdiction categories were assigned by BC Assessment. Gulf Islands Rural refers to the Southern Gulf Islands and Salt Spring Island electoral areas. Victoria Rural refers primarily to the Otter Point Rd neighbourhood outside Sooke. No complex buildings were identified in the Juan de Fuca Electoral Area.

Each of these high-level goals depends on data being accurate and widely available. The more buildings that benchmark, the more successfully the above goals can be achieved. Therefore, the objectives of an energy benchmarking program are as follows:

- Create a large body of comparative energy use data that is available for the goals above
- Get as many buildings participating as possible to add to the body of data
- Ensure data is accurate so results and analysis are reliable

The recommendations in this report act to support the achievement of these goals and objectives.

Why should regions consider energy benchmarking?

Benchmarking allows regions to make effective policy decisions related to energy efficiency. The accuracy and availability of energy use data from energy benchmarking reduces the need for regions to make assumptions regarding energy use rates and can highlight details that have been overlooked. Furthermore, the U.S. EPA found that just the act of benchmarking has been shown to decrease energy use in buildings by 2.4% annually ("DataTrends: Benchmarking and Energy Savings", 2012).

How to use this report to help inform benchmarking policy decisions

This report presents recommendations in three categories:

1. Essential Components
2. Important Considerations
3. Optional Additions

Essential Components are program features that should be included in any benchmarking program and are essential to its function and success with respect to the goals of benchmarking described previously.

Important Considerations are key aspects that can greatly increase program effectiveness but are not absolutely necessary to achieve the core goals of benchmarking buildings.

Optional Additions are program feature that provide positive benefits beyond the basic scope of a benchmarking program. Often, they support building managers undergoing the benchmarking process for their buildings. These features help the program and those involved but are not necessary to achieve results.

These recommendations are realistic in that they are derived from existing policies or organizations that understand and work closely with industry. However, every jurisdiction has their own

limitations, financial or otherwise, on the scope of a benchmarking program. As such, these recommendations can be adjusted, trimmed, and adapted to the specific regional limitations of the CRD (or region in question).

What characteristics of the CRD are important to consider?

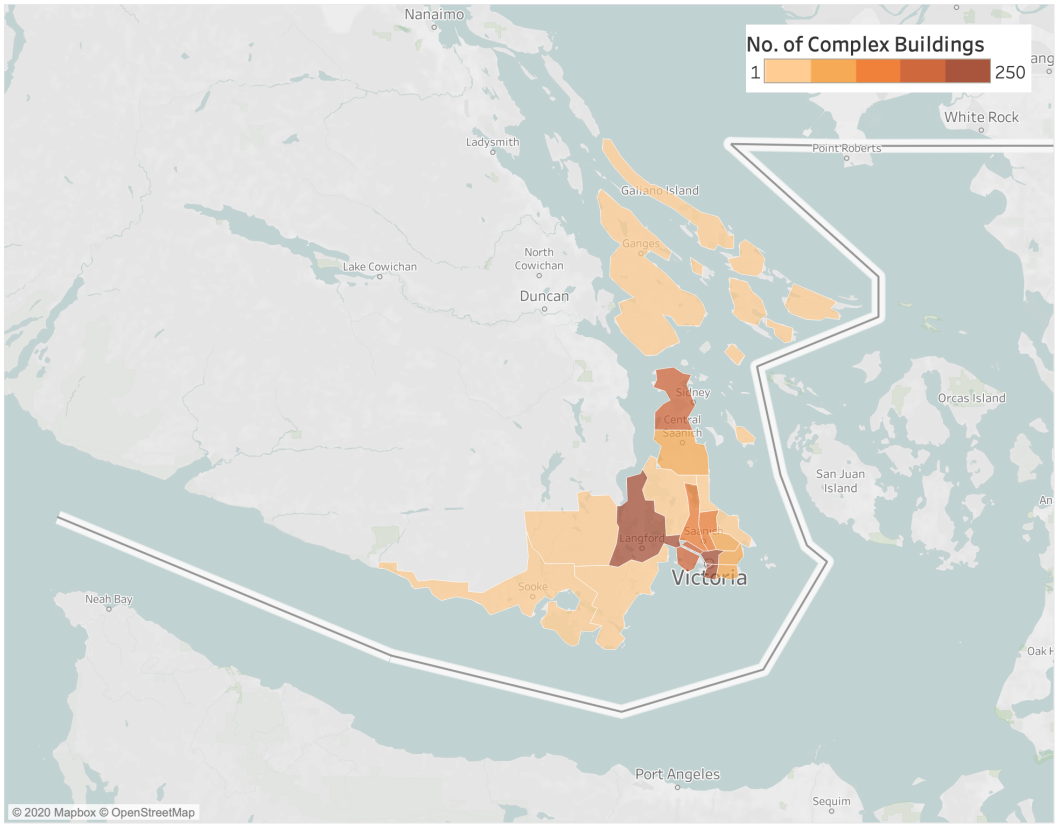


Figure 1: Distribution of Complex Buildings in the Capital Region by Postal Code[2]

The CRD is regional government for 13 municipalities on southern Vancouver Island and the Gulf Islands, serving more than 418,000 people. Figure 1 shows a heat map of complex buildings in the CRD. Regarding building benchmarking, there are several characteristics of the region that provide a unique challenge for a benchmarking program in the capital region:

1. Rural and island communities: the type and density of buildings in the capital region can vary greatly from a primarily urban region with a benchmarking program

[2] No complex buildings were identified in the Juan de Fuca Electoral Area

2. Historic buildings: as both the Provincial Capital and a historic area, there are many buildings dating to the early 20th century (see Figure 2) with 8% of complex buildings from before 1920.

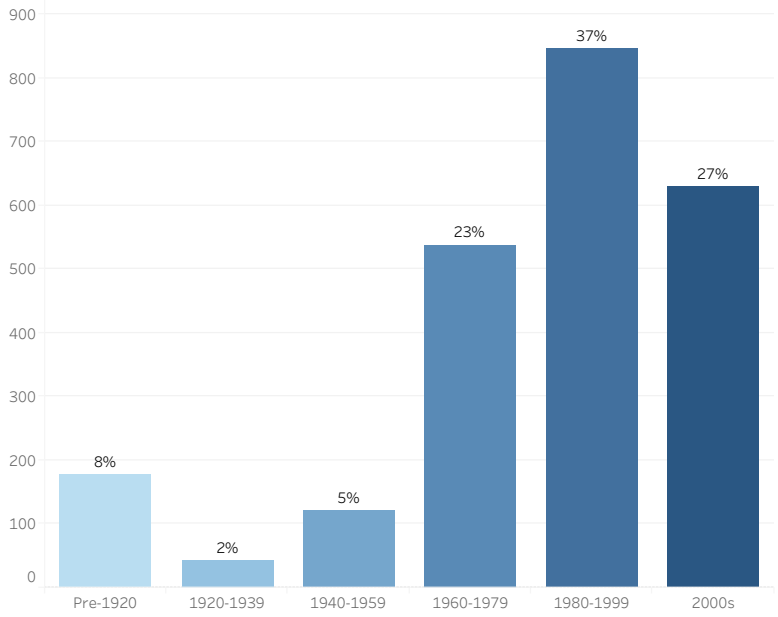


Figure 2: Complex Buildings in the Capital Region by Original Era of Construction

3. Multiple municipalities: the capital region contains 13 municipalities and 10 First Nations Reserves
4. Building stock: Every region has different types and distributions of buildings that need to be considered. Figure 3 shows the breakdown of building classes in the capital region.

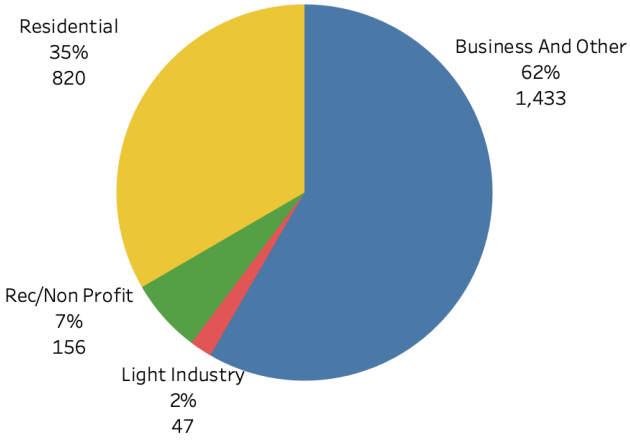


Figure 3: Distribution of Complex Buildings in the Capital Region by Building Class

Approach & Methodology

Creating this report involved 5 primary actions, visualized in Figure 4. In general, this report sought to collect available information about benchmarking programs and implementation, analyze building data specific to the CRD to contextualize and localize the information, and formulate recommendations to help guide future benchmarking program in the region. The details of these steps are described in the following sections.

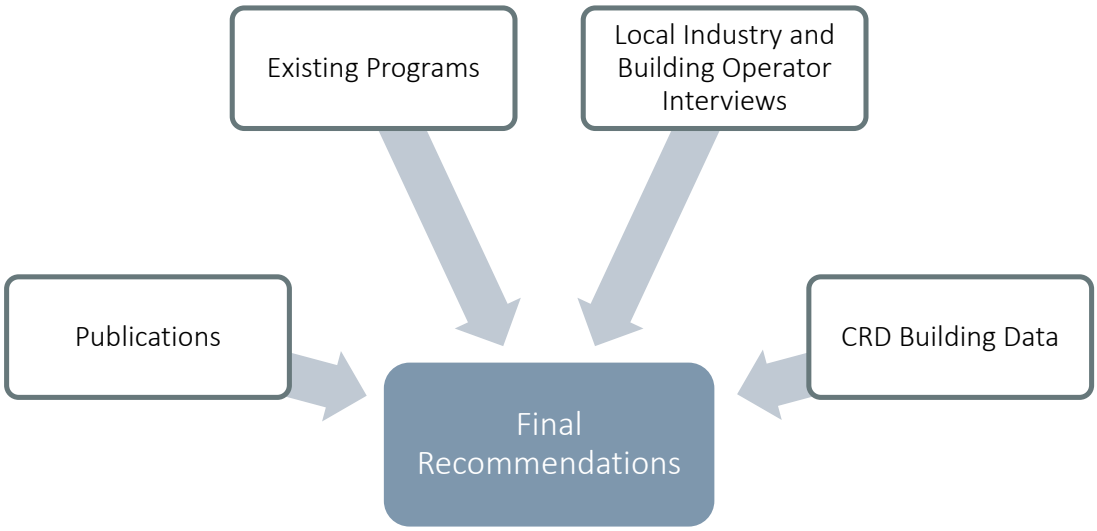


Figure 4: The report creation process

Analysis of Building Data for the Capital Regional District

In parallel with creating policy recommendations, this project involved analyzing building data provided by BC Assessment for buildings in the capital region. This analysis provided statistics around usage type, building size, and categorization that will prove useful for effective benchmarking policy decisions. The analysis results can be found in Appendix A and are used within this report to ground policy recommendations on specific regional data.

Examination of Recommendations Released by Various Organizations

As a concept, energy benchmarking is not new and is a topic discussed and prioritized by many organizations promoting energy efficiency including Natural Resources Canada, the Canadian Green Building Council, and the U.S. Department of Energy. The recommendations released by these organizations and others were collected and reviewed to inform the recommendations of this report. Two key documents are recommended by this report as essential reading for developing a benchmarking program:

- Energy Benchmarking, Reporting & Disclosure in Canada: A Guide to a Common Framework, Canada Green Building Council
- Designing a Benchmarking Program, U.S. Office of Energy Efficiency & Renewable Energy

Review of Existing Benchmarking Policies in North America

Many cities, regions, provinces, and states in North America have instituted energy benchmarking policies. In order to build on the success and lessons of existing policies, the details of 19 programs were reviewed, summarized, and tabulated (See Appendix B). The common themes of these programs were identified and used to inform the recommendations of this report.

Discussions with Related Industry Professionals and Building Operators

To supplement, localize, and contextualize the data gathered for this report, several discussions were held with the following industry professionals involved with energy benchmarking in British Columbia:

- Dave Ramslie, OPEN Technologies (a benchmarking software provider)
- Katherine King, B.C. Hydro
- Tristan Cote, Cote Enterprises Ltd.

Development of Final Recommendations

The last step of this project was bringing all information together to produce recommendations for a regional benchmarking program for the capital region. These recommendations are based on existing policies in other regions, recommendations released by organizations and provided by professionals in interviews, and the author's judgment.

Limitations

While this report has strived to incorporate as many valuable input sources as possible, there are some aspects that were not considered in detail:

Data

In the data analysis of buildings in the capital region, individual buildings were not distinctly listed as part 3, and estimates were made to identify the complex buildings in the region based on floor area and described usage type. These estimates may not have captured 100% of the complex buildings in the capital region.

Economic

This report has not considered the economic restrictions in which the CRD operates and how those may be unique compared to other regions

Legal

The legal implications of the recommendations in this report have not been researched in detail.

While the public disclosure of energy information associated with addresses is common in many benchmarking programs, this report has not investigated the potential legal issues in British Columbia related to this disclosure of information.

Additionally, the municipal authority with regard to mandatory benchmarking is unclear and has not been investigated in this report.

Political

Policy and program creation at the CRD is the result of a political framework of cooperation between different local governments. In the case of benchmarking it also involves coordination with all levels of government (federal: work with NRCan to facilitate work with Portfolio Manager; provincial: coordination with the Municipal Affairs and Housing regarding potential legislative/regulatory changes). Political frameworks have not been incorporated in this report.

Recommendations

The following sections present key points of a successful benchmarking program. Ideally, all come together to provide a comprehensive and robust program to successfully achieve widespread energy benchmarking in the region. Not all recommendations should or could be created at a regional level but should be considered or understood. Within each recommendation section below, specific reference is given to the regional actions and support that are required. Each recommendation is presented with expected level of governmental implementation as well as a priority ranking, based on the author's interpretation of reports and existing programs.

Essential Components

The recommendations in this section are evaluated as essential to creating an effective benchmarking program. These essential aspects were either widespread in existing successful programs, high-lighted as necessary by experts or published reports, or specifically linked with achieving the primary goals of a benchmarking program as discussed earlier in this report. In developing a new benchmarking program, this report recommends that the follow items must be incorporated for success.

Provide useful and localized information to building owners & operators

Many publications examined for this report emphasized a current lack of knowledge as a barrier to benchmarking adoption. The Building Owners and Managers Association of BC (BOMA BC) highlighted knowledge as a barrier if staff "do not have the necessary skill set to perform the benchmarking duties…or interpret the benchmark results" ("From Energy Benchmarking to Conservation Projects", no date). A Natural Resources Canada report found that "many smaller organizations may not understand or see the benefits of energy benchmarking" ("Energy Benchmarking Primer", 2014, p.10).

Additionally, not just building operations staff should be targeted, but also senior staff of building owner and operator organizations. The website of Natural Resources Canada ("Energy Benchmarking: The Basics", 2019) highlights "lack of senior management support" as a top barrier to implementing benchmarking. Education should be focused on financial metrics, real-world proof, and successes of competitors according to the U.S. Department of Energy, Energy Star website ("Engage Upper Management", Energy Star, n.d.)

Based on examining existing benchmarking programs (see Appendix B), success at a local level involves systems of providing useful information to those undergoing the benchmarking process. This information can take many forms, as outlined in Table 2.

Table 2: Common Benchmarking Help Services

In-person Workshops or Info-Sessions
Technical Help Desk Phoneline
Online How-To Guides
Detailed Online FAQs
Online Webinars & Training
Contact List of Energy Professionals

It should be noted that useful information, such as video tutorials and FAQs, exists in many forms by many organizations and it makes sense for a regional government to simply connect local building staff with this existing information.

For local context, the building manager of a small Victoria building management company with 3 properties (Cote Enterprises Ltd.) was contacted and during the discussion explained they were currently not aware of the specifics of building benchmarking but, after explanation, were very interested in the possible benefits from such a program. This indicates that an information gap currently exists in the CRD amongst building owners and operators.

Use Portfolio Manager

In North America, Energy Star Portfolio Manager can be considered as the standard software program for energy benchmarking. Developed by the U.S. Environmental Protection Agency, it is also selected and supported by Natural Resources Canada (Energy Benchmarking Primer, 2014). It is also the software used by every benchmarking program examined for this report (Appendix B). Therefore, this report recommends that any benchmarking program should use Portfolio Manager for regional consistency and the assurance of a commonly used platform.

Make Participation Mandatory

Both mandatory and voluntary benchmarking programs exist in North America, however voluntary programs do not achieve similar levels of participation rates, or even similar orders of magnitude of participation. In the benchmarking programs examined for this report (Appendix B), voluntary programs do not achieve widespread benchmarking. Edmonton's voluntary program has 184 buildings participating after 3 years, and Benchmark BC, a province-wide voluntary program, has approximately 500 according to conversations with involved staff at OPEN Technologies. Winnipeg has around 100 properties registered after 2 years. Cities of similar size to Edmonton with

mandatory programs have considerably more participation such as Boston (1799 buildings), Denver (3016 buildings), Seattle (3538 buildings), San Francisco (1675 buildings). Many mandatory programs achieve participation rates of more than 80% of the eligible buildings participating (New York, Boulder, Boston, Cambridge, Denver, Portland). Figure 5 displays the per capita participation rates of North American benchmarking programs highlighting the difference between mandatory and voluntary programs. It should be noted that this is not a perfect comparison as it only corrects for population and not for program requirements, regional building characteristics, urban/rural density of regions, program duration, etc.

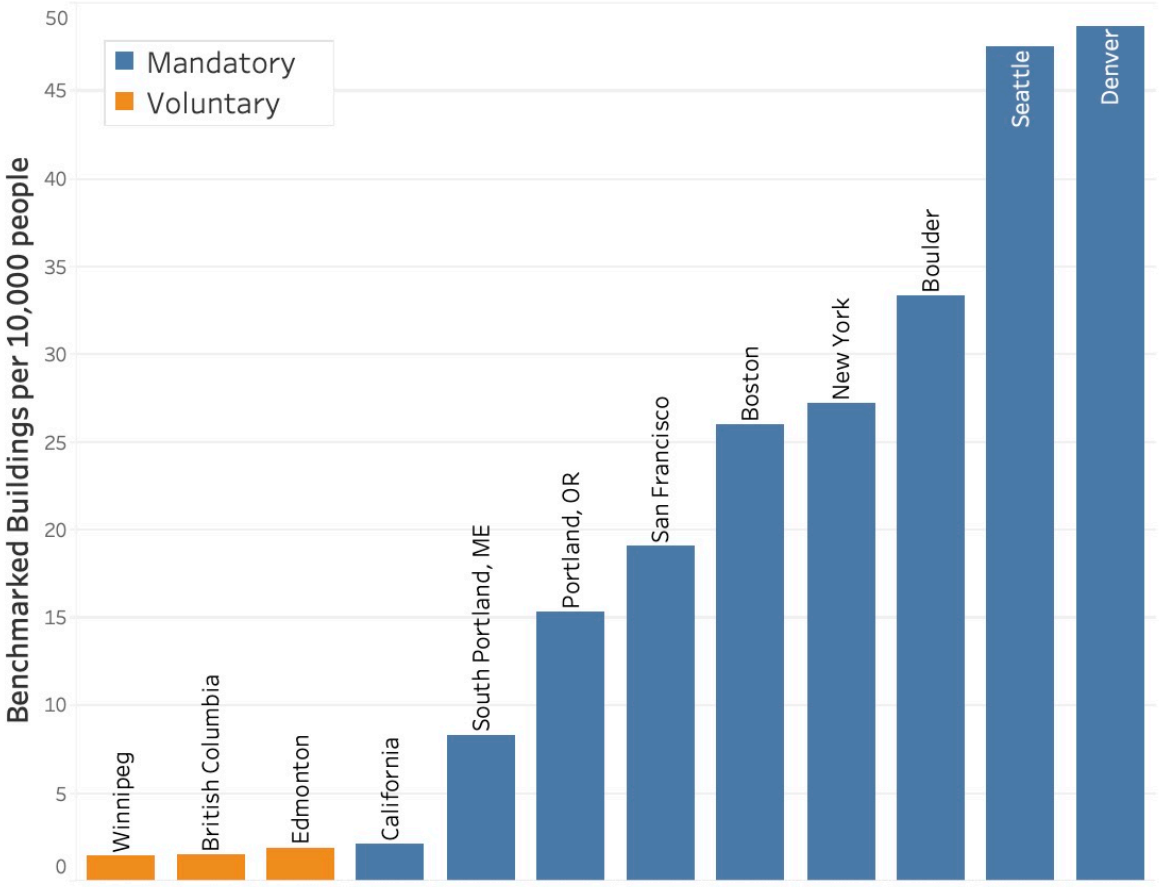


Figure 5: Per capita comparison of mandatory vs. voluntary benchmarking program participation

The value of a benchmarking program for research and regional policy decisions depends on the amount of data generated. While voluntary programs may be a good steppingstone to benchmarking adoption, voluntary programs are not shown to achieve similar participation rates to mandatory programs.

Regional governments like the CRD may not have authority to institute mandatory policies. However, regional governments have a role to play in the implementation of any potential regional benchmarking program, such as coordinating mandatory municipal policies or being granted new authority by the Province, similar to Metro Vancouver's Air Quality Regulatory Program.

Expand program over time with a phased approach

Making a program mandatory can result in a surprise to building owners who suddenly need to benchmark all of their buildings. To give building owners time, a program should expand with a phased approach. For example, a program can begin as voluntary but shift to mandatory after a stated amount of time to give building owners time to prepare. The number of buildings required to be benchmarked can increase with time as well. Boston followed a phased program where larger buildings (>50,000 sq. ft) were benchmarked in the first year and medium buildings (>35,000 sq. ft) were included in the third year of the program (see Table 3). This allows building owners and program administrations to adapt and solve problems on a smaller scale at first.

Table 3: Summary of Boston's Phased Benchmarking Approach

Phase 1	Year 1	Buildings > 50,000 sq. ft
Phase 2	Year 3	Buildings > 35,000 sq. ft
Result	99% compliance	

Figure 6 shows a breakdown of the number of complex buildings in the capital region within 4 different categories of total floor area. This breakdown could be used to define the building sizes for a phased approached in the capital region. For example, benchmarking buildings over 4500 sq. meters (approx. 50 000 sq. ft.) in the first phase would cover 15% of the complex buildings in the capital region.

If a program in the capital region begins with a voluntary program, this could be a partnership with the existing voluntary Building Benchmark BC[3] program with Open Technologies, with whom the municipalities of Victoria and Saanich have already partnered.

[3] https://buildingbenchmarkbc.ca/

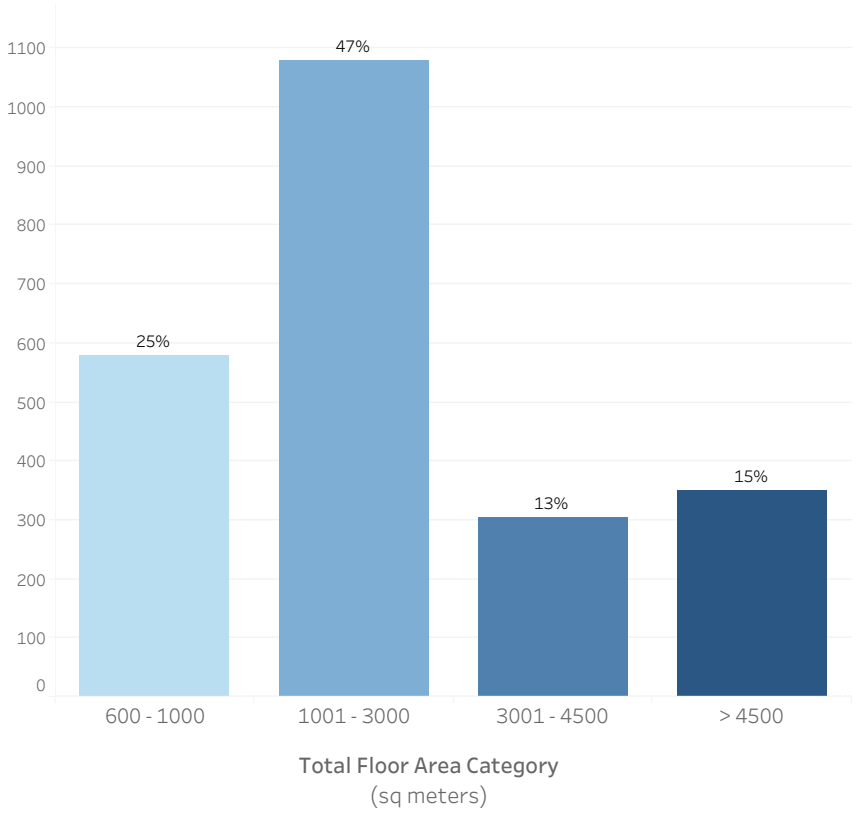


Figure 6: Number of Complex Buildings in the Capital Region per Category of Total Floor Area

The timeline and different phases should be well-advertised so building owners understand early when their buildings will be covered by the program. The approach would be similar to the BC Step Code phased approach, where builders are aware of the forthcoming requirements of each step.

Determine clear benchmarking criteria

"A building can be compared against itself from year to year or compared against a peer group of buildings – either internally or externally. A building can also be compared against a static sample of buildings and given a score" (*Energy Benchmarking Primer*, Natural Resources Canada, 2014). To avoid confusion, it is important that a policy defines specific criteria for benchmarking and ensures it is used consistently.

U.S. Office of Energy Efficiency & Renewable Energy ("Designing a benchmarking plan", 2013) outlines a number of potential criteria that can be measured:

- Gross Consumption—measuring the total energy use allows for tracking energy use reduction, typically converted to a common unit such as British Thermal Units (Btu)[4].
- Demand—for some organizations, demand charges constitute a considerable portion of energy costs. A common unit for electricity demand is kilowatt (kW).
- Energy Use Intensity (EUI)—a measure of energy consumption per production or footprint (common energy intensity metrics are shown below)
    - Btu per square foot: Any building
    - Btu per employee: Office building
    - Btu per unit of product: Assembly plant
    - Btu per number of beds occupied: Hotel or hospital
- Greenhouse gas emissions—typically a calculated value based on the energy consumption of facilities measured in carbon dioxide equivalents
- Energy cost savings—the measurement of purchase cost for energy and energy fuel sources.

Include data input quality control measures

As with any data set, errors risk the integrity of the end results and proceeding actions. Therefore, to achieve the best results from a benchmarking program, ensuring high input data quality is an essential component.

A program should include actions that help ensure data is correct at the time of input. These measures should assist building owners who are unsure of how to enter data and send quick feedback to building owners if their input data may contain a simple mistake.

The Canada Green Building Council (Energy Benchmarking, Reporting & Disclosure in Canada: A Guide to a Common Framework, 2016, p.45) recommends that benchmarking programs should include the following steps to increase data quality:

- Ensure staff is sufficiently trained to support building owners and operators in achieving compliance
- Provide rapid feedback to building owner queries or improper data entries

[4] In Canada, kilowatt hours (kWh) or gigajoules (GJ) are used more commonly than BTU

- Engage directly with service providers to ensure their understanding of program requirements
- Provide automatic software alarms that flag missing or improper data entries

The U.S. Office of Energy Efficiency and Renewable Energy ("Designing a Benchmarking Plan", 2013) gives the following specific recommendations for achieving high levels of data quality:

- Ensure staff members are trained
- Filter for unusually high or low energy use intensity (EUI) values compared with the national median EUI values for buildings of specific types
- Compare the reported footprint with building inventory lists or real property data.
- Confirm the appropriate facility type is selected for facilities.

Make data available for use

Data must be made available for public use. In the simplest form, program administrators can release data in its raw anonymized form and leave it to others to analyze, such as provincial programs or academic researchers.

Commonly, however, programs provide some level of analysis such as the following listed by CaGBC (*Energy Benchmarking, Reporting & Disclosure in Canada: A Guide to a Common Framework*, 2016):

- A public, searchable, and downloadable energy data registry
- Annual reports of aggregated regional data
- Data mapping and visualization (see Figure 7)

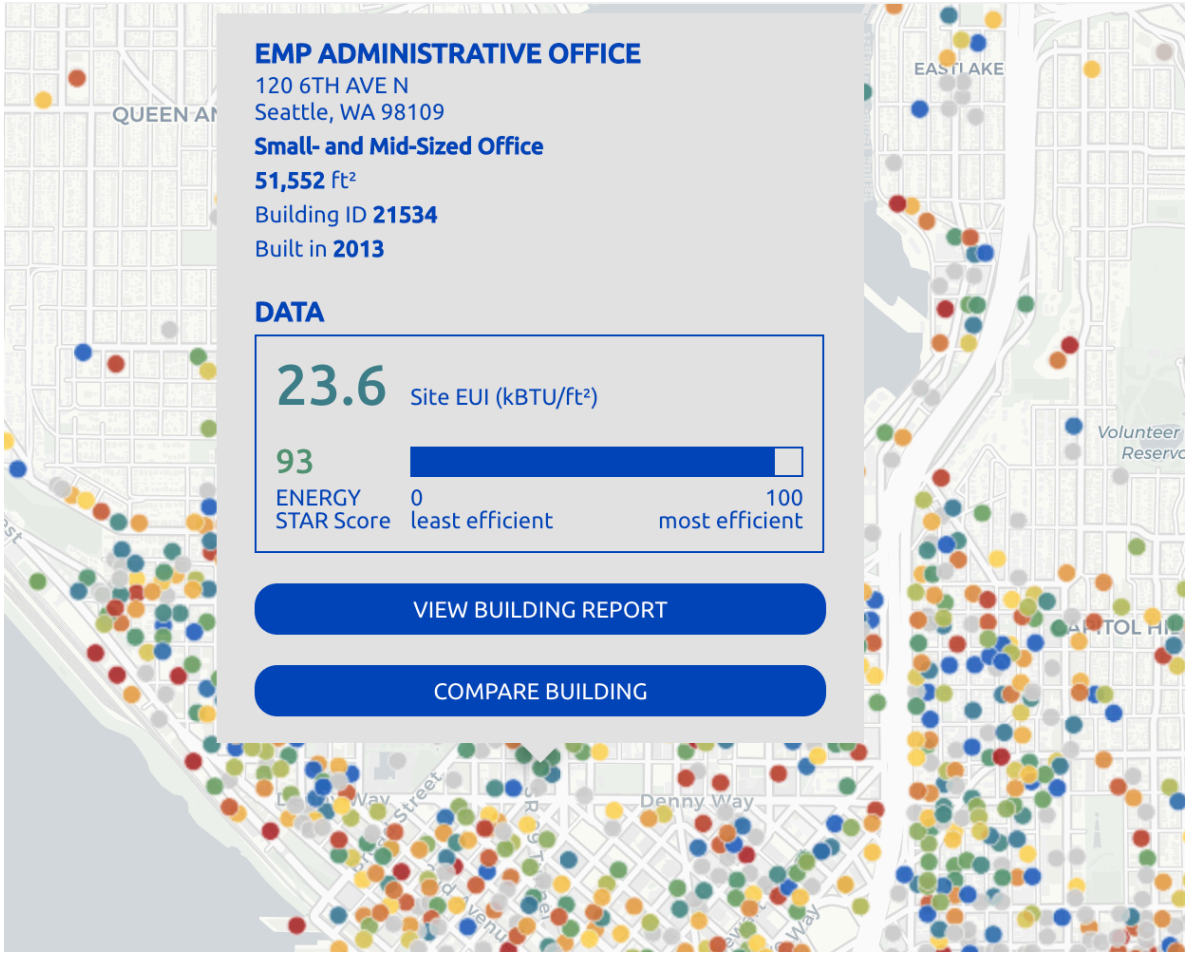


Figure 7: Seattle's Online Benchmarking Visualization Tool[5]

The U.S. Office of Energy Efficiency and Renewable Energy website (Building Energy Benchmarking, n.d) makes the important note that data should be presented in different ways for different audiences, as building owners, researchers, and policy makers all have different needs and priorities.

[5] http://www.seattle.gov/energybenchmarkingmap/

Important Considerations

This section of recommendations includes aspects that are important to consider for a benchmarking program but are not fundamental to a minimum level of success. They can, however, add considerable value to the results and success of a program by providing more and better data for future use and helping building owners to easily benchmark and then take steps to improve their buildings. A new program should discuss the feasibility of the aspects in this section and strive to include as many as possible.

Consider Public Disclosure

Public disclosure of energy data is described as "the point of greatest possible contention when establishing benchmarking regulations" according to the Canada Green Building Council (Energy Benchmarking, Reporting & Disclosure in Canada: A Guide to a Common Framework, 2016, p.49). Disclosure must balance between industry concerns and government goals as well as the intended purpose of a benchmarking program. That said, all U.S. cities with benchmarking programs have eventually made disclosure mandatory (Energy Benchmarking, Reporting & Disclosure in Canada: A Guide to a Common Framework, Canada Green Building Council, 2016).

The Canada Green Building Council lists many benefits of public disclosure of energy data (Energy Benchmarking, Reporting & Disclosure in Canada: A Guide to a Common Framework, 2016, p.49):

- Add energy efficiency considerations into the real estate market
- Let researchers identify of trends to improve efficiency and conservation
- Highlight gaps between predicted and actual performance building performance to improve future design efforts

Concerns from industry are described by the Canada Green Building Council (Energy Benchmarking, Reporting & Disclosure in Canada: A Guide to a Common Framework, 2016, p.49) to generally concern the negative business impacts of poor energy ratings, particularly in buildings that cannot improve easily (heritage buildings, factories, etc.).

BOMA BC does not support public disclosure, stating "concern is that, along with the threat of unreliable data, an unfair business environment may be created through this practice, for example, buildings that have great difficulty improving energy performance could be further disadvantaged" (*Best Practice: Building Energy Benchmarking & Reporting*, 2017).

To address these concerns, disclosure methods can contextualize building data with additional information to let viewers understand why a negative score may be occurring. Additionally, data

disclosure can begin a year or two after the start of a benchmarking program to give building owners a chance to improve their performance before data becomes public.

The benefits of public disclosure are a primary reason for a benchmarking program; therefore, policy makers should consider public disclosure of energy data.

When considering mandatory disclosure, the legal restrictions and privacy requirements within Canada and British Columbia should be identified and considered.

Align policy format and requirements with municipal and/or provincial programs

The more alignment between overlapping and adjacent benchmarking programs, the possibility for cooperation. Alignment also keeps things simple for building owners who only have to learn one workflow, and coordinates information at a larger scale for research and analysis. Regional governments should reach out to higher levels, and vice versa, to ensure they are all acting in a similar direction. Supportive local programs will add to the success of broader programs.

CAGBC (*Energy Benchmarking, Reporting & Disclosure in Canada: A Guide to a Common Framework*, 2016) outlines some key points that should be coordinated:

- Deadlines for building data submission (e.g. annual filing date)
- Energy use metrics (e.g. energy use intensity)
- Building scoring and ranking (e.g. Energy Star score)
- Benchmarking Criteria (e.g. compare against the Regional, Provincial, or Federal average)
- Software used (e.g. Portfolio Manager)

Perform audits to ensure reliability

This report recommended taking steps to ensure high input data quality as a mandatory measure. The next step in quality assurance is auditing data after it has been submitted.

Many publications regarding benchmarking recommend performing audits to ensure quality, identify issues, and increase accountability with benchmarking data, after it has been received from building owners. Because auditing involves deeper investigation, hiring experts, and following up with building owners, it is more expensive and time-consuming than initial data quality assurance steps. Therefore, despite their importance, audits are recommended in this report as important but not mandatory.

The Canada Green Building Council (Energy Benchmarking, Reporting & Disclosure in Canada: A Guide to a Common Framework, 2016, p.45) outlines the following options for auditing procedures:

- Automatic software alarms that flag missing or improper data entries
- Random audits by program administrators
- Established audits of high/low performers (e.g. 10th percentile)
- Required review by in-house or third-party professional with recognized credentials
- On-site audits and utility meter audits
- Offer pro-bono verification for smaller buildings with lower capacity
- Subject reports to random audits, for example by sampling within each building size and type grouping, or based on high/low EUI values

The U.S. Office of Energy Efficiency and Renewable Energy ("Designing a Benchmarking Plan", 2013) gives the following specific recommendations for auditing data:

- Filter for unusually high or low energy use intensity (EUI) values compared with the national median EUI values for buildings of specific types
- Compare the reported footprint with building inventory lists or real property data.
- Confirm the appropriate facility type is selected for facilities.
- Scan for gross rounding of footprint values.
- Ensure facility names appear appropriate and real (e.g., not "sample facility").
- Perform onsite verification (sometimes through a third party).
- Consider random sampling of utility meter data to allow for more in-depth spot checks.
- Establish a protocol for filling in gaps in data as needed (because not all data will be perfect).

Work with utilities to make data easily available

Both Natural Resources Canada (*Energy Benchmarking: The Basics,* Natural Resources Canada, 2019) and BOMA BC (*BOMA BC Case Studies: Energy & Environment Series*, 2014) list accessibility of utility data as one of the primary barriers to benchmarking, particularly in buildings with multiple tenants.

In British Columbia, the primary utility companies, BC Hydro[6] and Fortis BC[7], both provide a service to automatically submit energy data to a Portfolio Manager account. However, both require the

[6] https://www.bchydro.com/powersmart/business/resources/energy-efficiency-benchmarking.html

[7] https://www.fortisbc.com/services/commercial-industrial-services/energy-efficiency-tools-for-natural-gas-business-customers

building owner to take the first steps to create a Portfolio Manager account and request the upload service from each utility.

To address the challenges of obtaining data from multiple tenants, BC Hydro provides aggregate utility data for multi-unit residential buildings with 10 or more units. Fortis BC does not advertise the option of aggregate utility data.

Regional governments should work to inform and connect building owners with information and guides to use these automatic services. Further discussion with FortisBC regarding aggregate building data should be pursued.

Assist building owners with analyses and conclusions

One approach that program administrators can use to assist building owners understand their data is providing individualized score cards for buildings with individual building performance (e.g. EUI, ENERGY STAR score) as well as the comparative performance for the building characteristics, sector, and location (*Energy Benchmarking, Reporting & Disclosure In Canada: A Guide to a Common Framework*, Canada Green Building Council, 2016).

Provide information to building owners regarding the next steps

The CaGBC highlights that "a key challenge facing program administrators is the ability to return analyzed benchmarking data back into the hands of building and property owners" (*Energy Benchmarking, Reporting & Disclosure in Canada: A Guide to a Common Framework*, 2016). Therefore, the most successful benchmarking programs must work to help people use the data in actionable ways.

Once building owners have their building performance data, the next steps are making improvements. Regional organizations can help inform building owners of possibilities to improve energy performance and the potential benefits and make connections to facilitate these improvements. The Canada Green Building Council recommends that program administrators provide building owners with the following information, specific to their building and based on their benchmarking results (*Energy Benchmarking, Reporting & Disclosure in Canada: A Guide to a Common Framework*, 2016):

- Key areas of potential improvement and next steps
- Potential cost savings from improvements
- Contact information for service providers
- Links to relevant incentives programs

Optional Additions

This final section provides recommended options for a benchmarking program to go above and beyond the fundamental functions of energy benchmarking but can provide valuable added benefits. These aspects can encourage and support benchmarking efforts in the region.

Recognize and applaud high-performing buildings

To keep building momentum and awareness for energy benchmarking, another opportunity at the regional level is to recognize success stories and high performers. A benchmarking guide developed for the San Diego Unified Port District (Center for Sustainable Energy, 2015) recommends districts develop case studies, awards, and recognition opportunities to encourage others and reward early adopters. This is especially effective at a local and regional level as it highlights smaller business and building communities.

Consider benchmarking more than just energy

As benchmarking gets building owners in the habit of tracking their building's metrics, this is an opportunity to expand the scope of what is measured and managed. Portfolio manager can track water use. Water is included by some jurisdictions in their benchmarking policies (New York, Boston, Cambridge, Ontario). BOMA BC (Best Practice: Building Energy Benchmarking & Reporting, 2017) recommends a holistic benchmarking approach that includes not only energy and water, but waste generation as well.

Accredit or advertise external benchmarking professionals

If a building owner does not have the time or staff to benchmark their building, there is an option to hire an external energy professional. Regional bodies can support this by advertising available professionals as part of their benchmarking program communication strategy. Furthermore, a jurisdiction could act to accredit individuals as benchmarking professionals to ensure availability and qualification of those assisting to benchmark buildings. BOMA BC (*Best Practice: Building Energy Benchmarking & Reporting*, 2017) suggests regions support the availability of external professionals.

Existing programs use this strategy as well. For example, the Building Benchmark BC program[8] has partnered with OPEN Technologies who offer software and staff to assist in the process. Berkeley, California has city-registered energy assessors to help buildings complete benchmarking activities.[9]

[8] https://buildingbenchmarkbc.ca/

[9] https://www.cityofberkeley.info/besoassessor/

Portland, Oregon, offers an online directory of qualified professionals on the city benchmarking webpage.

As another strategy, Natural Resources Canada suggests building owners use students to input benchmarking data through the National Youth Employment Strategy (Natural Resources Canada, 2019).

Consider financial incentives

Natural Resources Canada indicates that addressing cost barriers by creating or connecting financial incentive programs with building owners. Often, utilities have energy incentive programs related to benchmarking or hiring energy managers within an organization. Additionally, some jurisdictions have offered financial incentives to benchmark buildings. For example, the City of South Portland, Maine, offers benchmarked properties $5,000 off any City permit or application fees associated with making improvements to their properties. The City of Edmonton offers $10,000 for an energy audit, which involves the essentials first steps to benchmarking.

Hold launch events, workshops, and benchmark-a-thons

At a regional level, jurisdictions can host events to educate, connect, and help the benchmarking community. According to the U.S. Office of Energy Efficiency and Renewable Energy website ("Building Energy Use Benchmarking", n.d) launch events can help "get the project off to a strong start".

Often the first year a building is benchmarked is the most challenging and time consuming for building owners. Launch events can bring staff together, provide guidance, and offer peer-to-peer support, as well as the opportunity to have industry professionals assist a large group at once. They can build confidence and break through initial barriers to getting buildings initially benchmarked.

Benchmark-a-thons are a similar concept, but on an ongoing basis. These events offer building staff an opportunity to get together with other building staff and industry professionals to work in the same space or at the same time to input or analyze their benchmarking data. This provides an opportunity for peer support and encouragement, building a sense of community, and having professionals on-hand to quickly assist with issues. Additionally, having a scheduled event can be beneficial for staff to carve out time in busy schedules to get their benchmarking work done in a collaborative and helpful scenario.

Summary

Energy benchmarking in buildings is an important step towards energy efficiency, because it leads to measuring energy, understanding building performance, and highlighting possibilities for improvement. Implementing a regional benchmarking program, however, requires consideration of many factors. This report has presented a series of recommendations to develop and implement a successful regional benchmarking program. These recommendations have been based on publications regarding energy benchmarking, an analysis of North American benchmarking programs, as well as interviews with benchmarking professionals. The recommendations are presented in three categories: essential components that are key to the success of any program; important considerations that are very valuable but not fundamental; and finally, optional additions that can contribute positively to a program but are not necessary for success. These recommendations are summarized in Table 4.

The purpose of these recommendations is to give policy makers and future program administrators at the CRD an overview of the key factors for consideration.

Overall, perhaps the most important point of consideration is the end goal of a benchmarking program, and that the specific actions based on the recommendations should work towards this end goal.

Benchmarking programs are not one-size-fits-all and individual regions must make decisions based on their own priorities and goals as well as those of broader Provincial and Federal initiatives. These recommendations act to frame and facilitate this future decision making.

Table 4: Summary of Recommendations

Recommendations for a Regional Benchmarking Program
Essential Components
Provide useful and localized information to building owners & operators
Use Portfolio Manager
Make Participation Mandatory
Expand program over time with a phased approach
Determine clear benchmarking criteria
Include data input quality control measures
Make data available for use
Important Considerations
Consider Public Disclosure
Align policy format and requirements with municipal and/or provincial program
Perform audits to ensure reliability
Work with utilities to make data easily available
Assist building owners with analyses and conclusions
Provide information to building owners regarding the next steps
Optional Additions
Recognize and applaud high-performing buildings
Consider benchmarking more than just energy
Accredit or advertise external benchmarking professionals
Consider financial incentives
Hold launch events, workshops, and benchmark-a-thons

Next Steps

With the insights from this report as a steppingstone and framework of discussion, the author recommends the CRD consider the following next steps in the process to develop a benchmarking program:

1. Take steps to clarify the legal authority of municipal actors to create a mandatory benchmarking programs
2. Coordinate with municipalities in the capital region and other levels of government to better understand the political framework of a benchmarking program
3. Determine the internal business case associated with supporting benchmarking in the region
4. Begin discussions regarding the overall goals of a benchmarking program in the capital region
5. Get further feedback from local building owners to understand the general level of awareness and help regionalize the future program
6. Outline program phasing and timeline
7. Establish clear benchmarking criteria and data quality assurance procedures
8. Identify a means to make the data publicly available

References

Best Practice: Building Energy Benchmarking & Reporting. (2017, February). Building Owners and Managers Association of British Columbia. https://www.boma.bc.ca/media/58037/best-practice-building-energy-benchmarking-and-reporting-part-1-building-owners.pdf

Case Studies: Energy & Environment Series. (no date). Building Owners and Managers Association of British Columbia. https://www.boma.bc.ca/media/60514/from-energy-benchmarking-to-conservation-project.pdf

Center for Sustainable Energy. (2015, November). Energy Benchmarking and Transparency: A review of national best practices, California policies and energy efficiency opportunities for the San Diego Unified Port District. San Diego Unified Port District. https://energycenter.org/sites/default/files/docs/ext/building-performance/energy_benchmarking_transparency_nov2015.pdf

Energy Benchmarking Primer. (2014). Natural Resources Canada. https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/BenchmarkPrimer_en.pdf

Energy Benchmarking, Reporting & Disclosure in Canada: A Guide to a Common Framework. (2016). Canada Green Building Council. https://www.cagbc.org/cagbcdocs/CaGBC_National_Energy_Benchmarking%20_Framework_April_2016.pdf

ENERGY STAR. (n.d.). Retrieved July 13, 2020, from https://www.energystar.gov/buildings/tools-and-resources/datatrends-benchmarking-and-energy-savings

Energy Star, U.S. Department of Energy. (n.d.). Engage upper management. ENERGY STAR Buildings and Plants | ENERGY STAR. Retrieved July 13, 2020, from https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants/make-business-case/engage-upper-management

Government of British Columbia. (2015). BUILDING ACT GUIDE SERIES: SECTION A1: Understanding B.C.'s Building Regulatory System. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/guides/buildingactguide_sectiona1_june2015_web.pdf

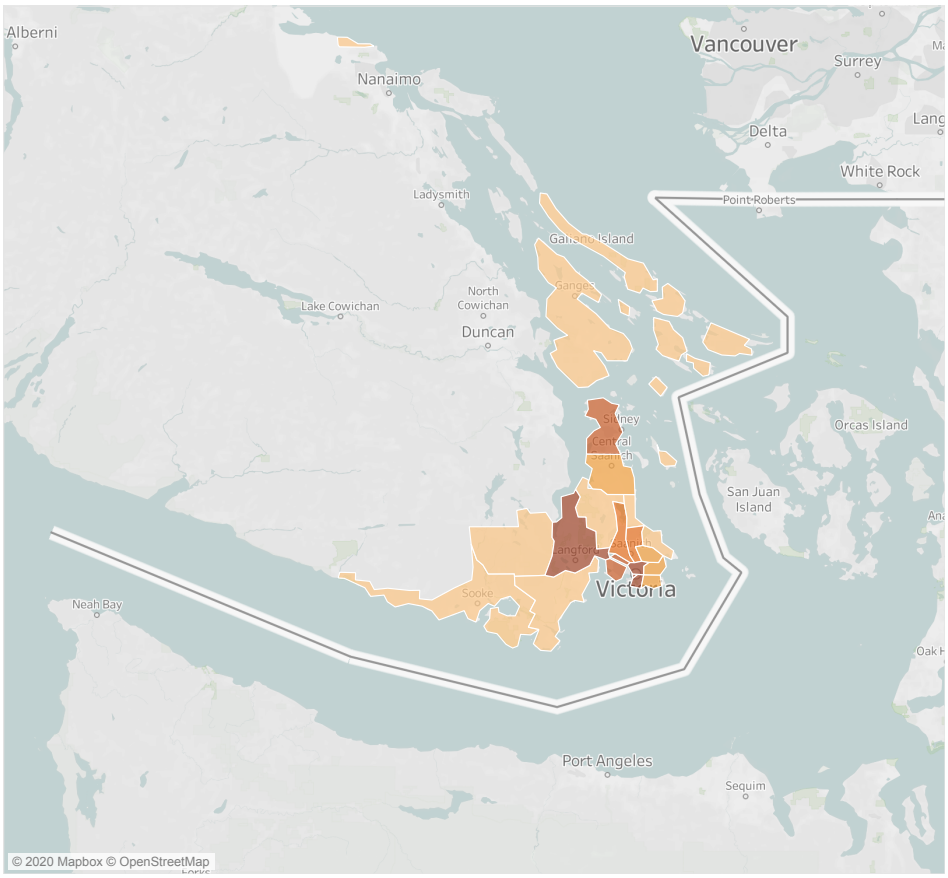
Natural Resources Canada. (2019, January 31). Energy benchmarking: the basics. Government of Canada. https://www.nrcan.gc.ca/energy/efficiency/buildings/energy-benchmarking/building/18260

U.S. Office of Energy Efficiency and Renewable Energy. (n.d.). Building Energy Use Benchmarking. U.S. Department of Energy. https://www.energy.gov/eere/slsc/building-energy-use-benchmarking

U.S. Office of Energy Efficiency & Renewable Energy. (2013, February). Designing a Benchmarking Plan. https://www.energy.gov/sites/prod/files/2017/09/f36/tap_designing_a_benchmarking_plan.pdf

Appendix A Statistical Analysis of Complex Buildings in the Capital Region

Regional Distribution of Class 3 Complex Buildings in the CRD



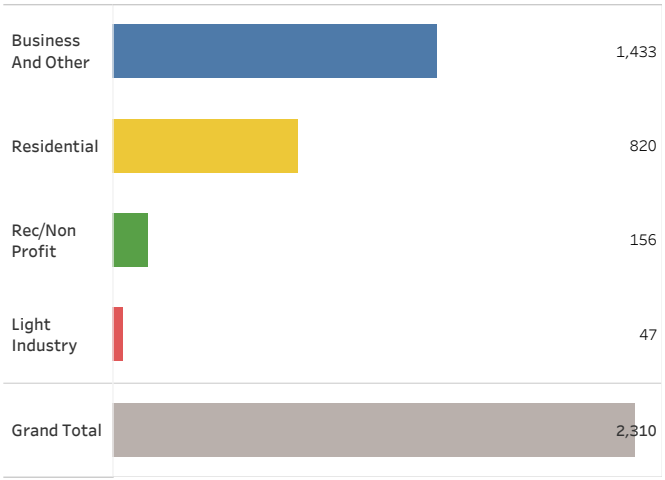
Jurisdiction, Short	Distinct count of Ad..	Total Floor Area (m2)
Victoria	998	3,034,744
Saanich	416	1,976,293
Langford	206	697,364
Sidney	160	329,115
Central Saanich	122	258,499
Esquimalt	94	419,344
Colwood	66	205,760
Gulf Islands Rural	55	68,750
North Saanich	54	249,073
Oak Bay	52	653,519
Sooke	46	76,520
View Royal	42	139,693
Metchosin	9	60,011
Victoria Rural	4	50,666
Highlands	1	8,310

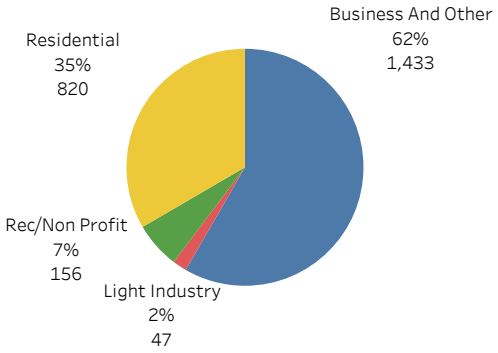
No complex buildings were identified in the Juan de Fuca Electoral Area

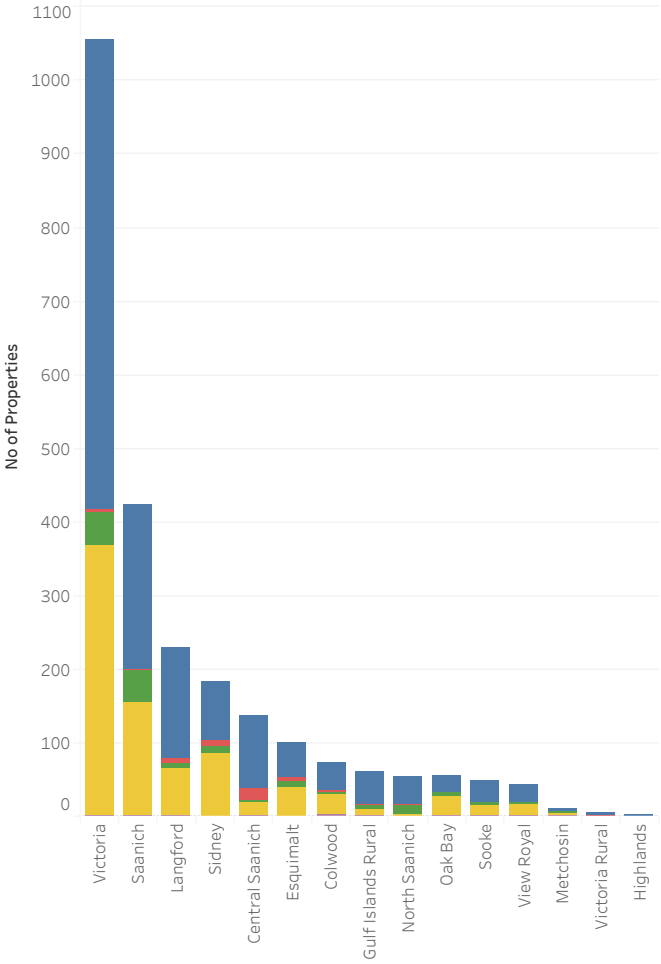
No. of Complex Buildings

1 250

Part 3 Complex Buildings in the CRD by Class

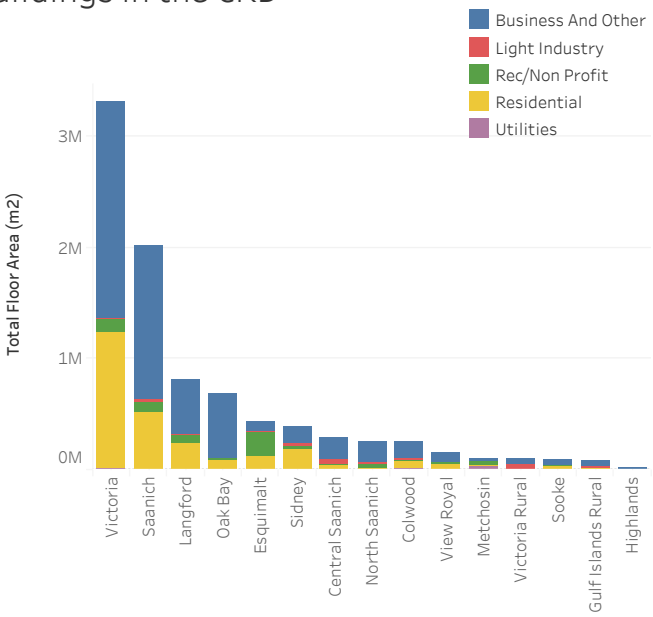




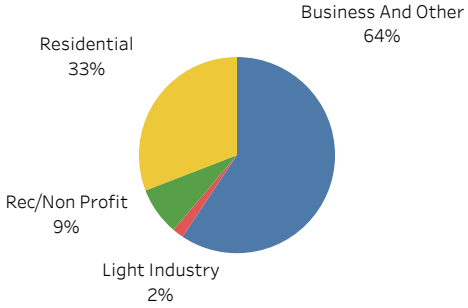


Total Floor Area Breakdown of Complex Part 3 Buildings in the CRD

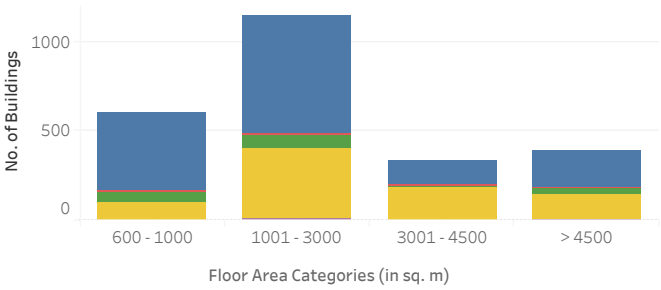
Jurisdiction, Short	Distinct cou..	Total Floor Area (m2)
Victoria	998	3,034,744
Saanich	416	1,976,293
Langford	206	697,364
Sidney	160	329,115
Central Saanich	122	258,499
Esquimalt	94	419,344
Colwood	66	205,760
Gulf Islands Rural	55	68,750
North Saanich	54	249,073
Oak Bay	52	653,519
Sooke	46	76,520
View Royal	42	139,693
Metchosin	9	60,011
Victoria Rural	4	50,666
Highlands	1	8,310



Breakdown of Total Floor Areas in the CRD

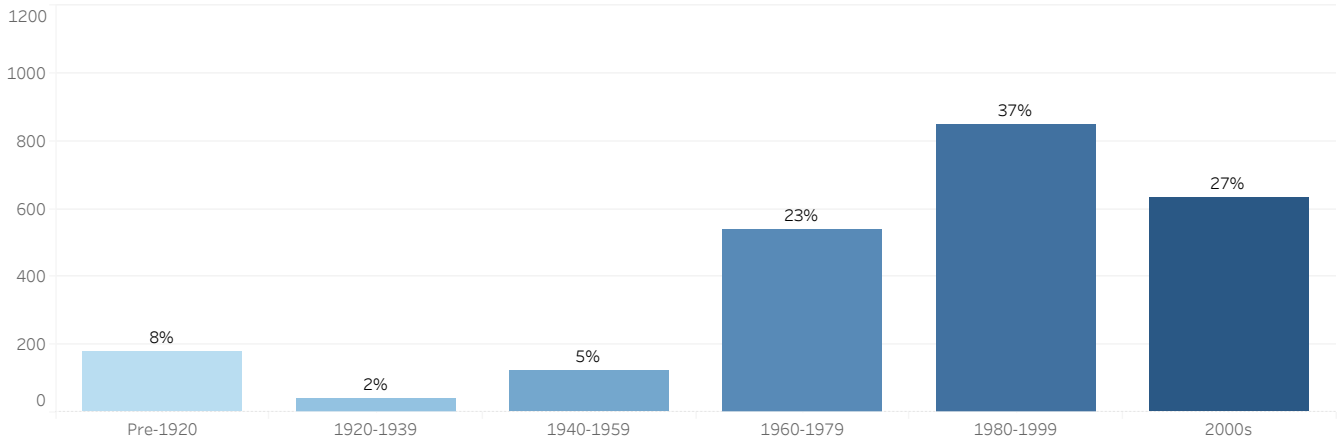


Building Size Categories Based on Floor Area (m2)

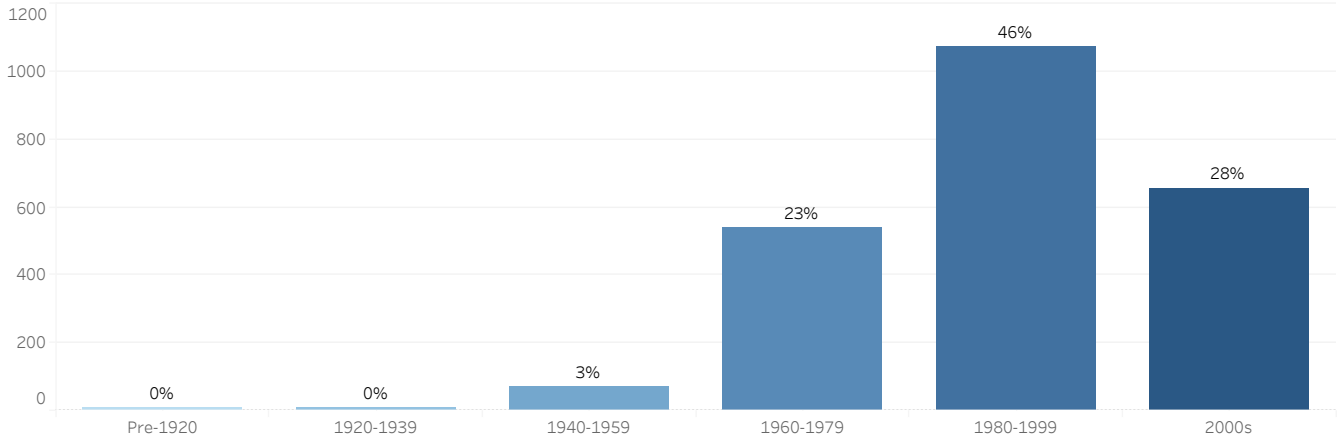


Original and Effective Eras of Construction for Part 3 Complex Buildings in the CRD

Original Construction Era



Effective Era (after renovations)



Types of Complex Part 3 Buildings in the CRD

Commercial

Primary Use	
Storage & Warehousing (Closed)	248
Commercial Strata-Lot	219
Office Building (Primary Use)	197
Store(S) And Service Commercial	189
Store(S) And Offices	131
Government Buildings (Includes Court..	44
Shopping Centre (Neighbourhood)	37
Automobile Paint Shop, Garages, Etc.	31
Self Storage	26
Recreational & Cultural Buildings (Inclu..	24
Automobile Dealership	23
Stores And/Or Offices With Apartments	23
Airports, Heliports, Etc.	20
Hotel	20
Schools & Universities, College Or Tech..	18
Store(S) And Living Quarters	17
Big Box	16
Multi-Family (Minimal Commercial)	16
Neighbourhood Pub	14
Hospitals (Nursing Homes Refer To Co..	13
Individual Strata Lot (Hotel/Motel)	13
Restaurant Only	9
Food Market	8
Lumber Yard Or Building Supplies	8
Multi-Family (Apartment Block)	8
Strata Lot (Parking Residential)	8
Motel & Auto Court	7
Shopping Centre (Community)	7
Stratified Operational Facility Areas	7
Retail Strip	6
Shopping Centre (Regional)	6
Storage & Warehousing (Cold)	6
Theatre Buildings	6
Bank	5
Fast Food Restaurants	4
Hall (Community, Lodge, Club, Etc.)	3
Marine & Navigational Facilities (Inclu..	3
Marine Facilities (Marina)	3
Sand & Gravel (Vacant and Improved)	3
Strata-Lot Residence (Condominium)	3
Water Distribution Systems	3
Bus Company, Including Street Railway	2
Convenience Store/Service Station	2
Electrical Power Systems (Including No..	2
Government Research Centres (Include..	2
Greenhouses And Nurseries (Not Farm ..	2
Seasonal Resort	2
Telephone	2
Asphalt Plants	1
Bakery & Biscuit Manufacturing	1
Car Wash	1
Churches & Bible Schools	1
Dairy Products	1
Metal Fabricating Industries	1
Miscellaneous (Transportation & Com..	1
Miscellaneous & (Industrial Other)	1
Multi-Family (High-Rise)	1
Neighbourhood Store	1
Railway	1
Recreational Clubs, Ski Hills	1
Sash & Door	1
Shipyards	1
Storage & Warehousing (Open)	1
Telecommunications (Other Than Telep..	1
Winery	1

Residential

Primary Use	
Strata-Lot Residence (Condominium)	765
Stratified Operational Facility Areas	45
Stratified Rental Apartment (Frame Co..	15
Multi-Family (Apartment Block)	13
Strata Lot (Parking Residential)	10
Individual Strata Lot (Hotel/Motel)	7
Commercial Strata-Lot	6
Seniors Strata - Care, Independent or A..	6
Strata-Lot Self Storage-Res Use	3
Multi-Family (Conversion)	2
Seniors Licensed Care	2
Campground (Commercial)	1
Government Buildings (Includes Court..	1
Hospitals (Nursing Homes Refer To Co..	1
Mixed	1
Multi-Family (High-Rise)	1
Recreational & Cultural Buildings (Inclu..	1
Seasonal Resort	1
Seniors Independent & Assisted Living	1
Store(S) And Offices	1

Rec, Non-profit & Light Industry

Primary Use	
Churches & Bible Schools	79
Storage & Warehousing (Closed)	30
Marine Facilities (Marina)	17
Hall (Community, Lodge, Club, Etc.)	15
Recreational & Cultural Buildings (Inclu..	14
Commercial Strata-Lot	13
Government Buildings (Includes Court..	11
Office Building (Primary Use)	5
Schools & Universities, College Or Tech..	3
Store(S) And Offices	3
Airports, Heliports, Etc.	2
Recreational Clubs, Ski Hills	2
Government Research Centres (Include..	1
Lumber Yard Or Building Supplies	1
Marine & Navigational Facilities (Inclu..	1
Miscellaneous (Forest And Allied Indus..	1
Petroleum Bulk Plants	1
Restaurant Only	1
Sand & Gravel (Vacant and Improved)	1
Shipyards	1
Shopping Centre (Neighbourhood)	1
Store(S) And Service Commercial	1
Stratified Operational Facility Areas	1

Notes on Data Analysis Process

Data Manipulation

- Data analysis software used was Tableau Desktop (2020).
- “Address (No Unit Numbers)” removes the unit numbers from the ADDRESS
- “Year Built” Column takes the max of YR_BUILT_SFD and YR_BUILT_COMM to create a single column
- “Effective Year” does the same thing for EFFECTIVE_YEAR_SFD and _COMM
- “Built Era” and “Effective Era” categorize buildings into a 20 year period based on “Year Built” or “Effective Year”
- “Building Area (sq ft)” takes the maximum from STRATA UNIT_AREA, COMM BUILDING_AREA, SFD TOTAL AREA
- “Building Area (m2)” converts “Building Area (sq ft)” to square meters
- “Primary Property Class” takes the first property use listed in PROPERTY_CLASS_CODE which general had duplicated values in the column

Filtering to Part 3 Buildings Only

Building Size:

- The BC Assessment data lists each suite in a multi-suite building as an individual listing. To determine total building floor areas, a tableau function {FIXED[Address (No Unit Numbers)]:SUM([Building Area (m2)])} was used to sum the total areas given for a single address, once the unit numbers were removed using the field “Address (No Unit Numbers”).
- Any address with less than 600 square meters of total floor area was excluded from the analysis.

Building Type:

- “Primary Property Class” of Farm and Managed Forest Land were excluded.
- Buildings of the following PRIMARY_ACTUAL_USE were excluded:

000:Single Family Dwelling	
001:Vacant Residential Less Than 2 Acres	181:Mixed (Vacant)
002:Property Subject To Section 19(8)	191:Other (Vacant)
020:Residential Outbuilding Only	201:Vacant IC&I
032:Residential Dwelling with Suite	217:Air Space Title
033:Duplex, Non-Strata Side by Side or Front / Back	219:Strata Lot (Parking Commercial)
034:Duplex, Non-Strata Up / Down	227:Automobile Sales (Lot)
035:Duplex, Strata Side by Side	260:Parking (Lot Only, Paved Or Gravel-Com)
036:Duplex, Strata Front / Back	262:Parking Garage
037:Manufactured Home (Within Manufactured Home Park)	288:Sign Or Billboard Only
038:Manufactured Home (Not In Manufactured Home Park)	401:Industrial (Vacant)
039:Row Housing (Single Unit Ownership)	421:Managed Forest (Vacant)
040:Seasonal Dwelling	422:IC&I Water Lot (Vacant)
041:Duplex, Strata Up / Down	423:IC&I Water Lot (Improved)
043:Parking (Lot Only, Paved Or Gravel-Res)	426:Logging Operations, Incl Log Storage
047:Triplex	427:Logging Roads & Bridges
049:Fourplex	428:Managed Forest (Improved)
051:Multi-Family (Vacant)	478:Docks & Wharves
052:Multi-Family (Garden Apartment & Row Housing)	490:Parking Lot Only (Paved Or Gravel)
057:Stratified Rental Townhouse	601:Civic, Institutional & Recreational (Vacant)
060:2 Acres Or More (Single Family Dwelling, Duplex)	610:Parks & Playing Fields
061:2 Acres Or More (Vacant)	612:Golf Courses (Includes Public & Private)
062:2 Acres Or More (Seasonal Dwelling)	614:Campgrounds (Includes Government Campgrounds,
063:2 Acres Or More (Manufactured Home)	Ymca &
070:2 Acres Or More (Outbuilding)	615:Government Reserves (Includes Greenbelts (Not In Farm
111:Grain & Forage (Vacant)	625:Garbage Dumps, Sanitary Fills, Sewer Lagoons, Etc.

121:Vegetable & Truck (Vacant) 131:Tree Fruits (Vacant) 141:Small fruits (Vacant) 151:Beef (Vacant) 161:Dairy (Vacant) 171:Poultry (Vacant)	630:Works Yards 632:Ranger Station 642:Cemeteries (Includes Public Or Private). 660:Land Classified Recreational Used For

Map View Creation

- Used first three digits of postal codes for map view (software limit)
- Some postal codes were outside of the capital region. These were assumed to be errors in the postal code information only so they were excluded from the map view but included in the remainder of the analysis

Appendix B Summary of North American Benchmarking Program Details

	Program Description				Program Format					Program Implementation						Additional Info	
Location	**Program Name**	**Region Population**	**Start Date**	**Participation Rate**	**Building Category**	**Mandatory/ Voluntary**	**Disclosure**	**Water Included**	**Software**	**Incentives**	**Enforcement**	**Accuracy Verification**	**Support Offered by Organizational Body**	**Benchmarking service providers**	**How is data gathered/provided for building owners?**	**Interesting notes**	**Link**
New York	NYC Benchmarking Law	8,000,000	2009	21,708 buildings, 90% of private buildings	private buildings over 50,000 ft2 and public sector buildings over 10,000 ft2	Mandatory	Public	Yes	Portfolio Manager		$500 per quarter	Yes	Help center, training and presentations,	no	Utilities		https://www1.nyc.gov/site/buildings/business/benchmarking.page
Boulder	BOULDER BUILDING PERFORMANCE RATING & REPORTING	97,385	2016	324 buildings, 99% compliance	CITY-OWNED BUILDINGS ≥ 5,000; NEW CONSTRUCTION BUILDINGS ≥ 10,000 EXISTING BUILDINGS ≥ 20,000 SF	Mandatory	Public (two year grace period)	No	Portfolio Manager		can result in fines of $0.0025 per square foot up to $1,000 per day of non-compliance.		Help desk, online support documents	No	Utilities, but owners must compile data	Rating and reporting requirements are phased in based on building size.	https://bouldercolorado.gov/sustainability/boulder-building-performance-rating-reporting
BC	Building Benchmark BC	5,000,000	2020	730 buildings	public sector buildings and private buildings over 50,000 square feet.	Voluntary	Optional, encouraged	no	Portfolio Manager/Open Technologies Software	none	n/a		Partnership with Open Technologies. Benchmark BC facilitates getting utility data	External	Utilities	Still gathering participants before launch	https://buildingbenchmarkbc.ca/
Montgomery County, MD	Building Energy Benchmarking	1,000,000	2015	50 - 80% participation depending on building type	Public buildings and privately owned buildings 50,000 square feet or greater	Mandatory	Public	No	Portfolio Manager		Class A violation	data verified by a Recognized Data Verifier the first year of reporting and every three years thereafter	Mailing list and online community group. Email help desk.		Utilities		https://www.montgomerycountymd.gov/green/energy/benchmarking.html#:~:text=Building%20owners%20are%20required%20to,and%20key%20data%20metrics%20here%20.
Edmonton, AB	Building Energy Benchmarking Program	981,280	2017	184 buildings	Office, Retail, Multi-Unit Residential, Education, Recreation, and Other (over 10,000 square feet)	Voluntary	optional	no	Portfolio Manager	None specific to benchmarking but up to $10,000 for initial energy audit	n/a		technical support (help desk), customized building benchmarking reports, tenant education workshops and access to financial incentives ($10,000 /building) to help offset the cost of an energy audit.		Energy data from Utilities. Tenants to provide usage data		https://www.edmonton.ca/programs_services/environmental/building-energy-benchmarking-program.aspx

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Boston	Building Energy Reporting and Disclosure Ordinance (BERDO)	694,583	2013	1799 buildings, first year compliance rate of 84%	Nonresidential buildings that are 35,000 square feet or larger. Residential buildings that are 35,000 square feet or larger, or have 35 or more units. Any parcel with multiple buildings that sum to 100,000	Mandatory	Public	Yes	Portfolio Manager		Daily Fees, $35 - $200	Yes. Feedback provided to owners in first year how to correct data	Help desk. Online how-to guide, list of required buildings, reporting template partners at EPA and business organizations supported the outreach and training	No	Utilities provide data	Phased approach to building size: >50, 000 sq ft for the first two years, >35 000 sq ft on year 3	https://www.boston.gov/departments/environment/building-energy-reporting-and-disclosure-ordinance
Berkeley, CA	Building Energy Saving Ordinance (BESO)	121,643	2017	info not found	Bldgs >25,000 ft2	Mandatory	Public	no	Portfolio Manager		Fees	Yes	Online How-to guide, webinars and training. Connection with registered energy assessors	Registered Energy Assessors	From Utilities. Utility has a system to collate tenant data	Overlaps with State policy, so by participating in regional program the requirements for state program are automatically met	https://www.cityofberkeley.info/BESO/
Cambridge, MA	Building Energy Use Disclosure Ordinance (BEUDO)	118,977	2014	95%	Parcels with non-residential buildings singly or together contain 25,000 square feet or greater Parcels with residential buildings singly or together contain 50 or more units Municipal buildings	Mandatory	Public	Yes	Portfolio Manager		(a) For the first violation, a written warning may be issued; and (b) For any subsequent violation, the Department may issue a fine of up to $300.00 per day pursuant to the provisions of		help desk covering Portfolio Manager, Accessing energy data and building attribute information, General questions. Online tool to indicate if building is required to provide benchmarking or not.		From Utilities. Online data request portal	More than half of Cambridge's total energy use was consumed by 5% of the City 's buildings. The largest category of property type required to report was college/university, followed by multifamily housing,	BEUDO - Cambridge
Denver, CO	Energize Denver	619,968	2017	93% of required buildings (3016)	all buildings in Denver at or over 25,000 square feet	Mandatory	Public	No	Portfolio Manager		thirty (30) calendar days upon receipt of notification to correct errors. Afterwhich, subject to a civil penalty of not more than two thousand dollars ($2,000.00) per violation per day.		How-to videos, help center, training and help sessions	External, city certified			https://www.denvergov.org/content/denvergov/en/climate-sustainability/goals-policy/benchmarking-ordinance.html
Ontario	Energy and Water Reporting and Benchmarking (EWRB)	14,500,000	2019	not yet released	100,000 square feet and larger, 2023 for buildings 50,000 square feet and larger	Mandatory	Voluntary	Yes	Portfolio Manager		Not clear	Yes	Online guide, support phone number		Owners must obtain from utilities		https://www.ontario.ca/page/report-energy-water-use-large-buildings

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Seattle, WA	Energy Benchmarking Program	744,955	2015	3,538 BUILDINGS	non-residential and multifamily buildings (20,000 sf or larger)	Mandatory	Public	No	Portfolio Manager		Fines: 50,000 SF or greater non-residential and multifamily buildings = $1,000 per quarter Total annual penalty of $4,000 per reporting year. 20,000 to 49,999 SF non-residential	City flags reports with possible errors, flagged reports require additional verification	How-to guide and video tutorials.	External		City provides interactive visualization on city webpage	https://www.seattle.gov/environment/climate-change/buildings-and-energy/energy-benchmarking
BOMA BC	uTrack		2017	Not released		Voluntary	None	Yes	Portfolio Manager		n/a						https://www.boma.bc.ca/green-buildings/boma-utrack/
California	Building Energy Benchmarking Program	39,500,000	2018	8000 properties	more than 50,000 square feet of gross floor area and either no residential units or 17+ residential units.	Mandatory	Public after year 1	No	Portfolio Manager		fines for noncompliance, after allowing a 30-day period	Not indicated	Hotline phone number, detailed FAQ, video tutorials	None provided by organization. Consultants could be hired.	Utilities. Utilities can directly upload info into portfolio manager. If not uploaded, owners must request data.	buildings reported under a local benchmarking program to be exempted from reporting to the state Extensive FAQ online	https://www.energy.ca.gov/programs-and-topics/programs/building-energy-benchmarking-program#:~:text=The%20Building%20Energy%20Benchmarking%20Program.on%
Portland, ME	Energy Benchmarking	66,417	2016	not yet released	Municipal Buildings Non-Residential single or grouped buildings over 20,000 sq. ft. Residential Buildings that singly or together contain 50+ dwelling units	Mandatory	Public	Yes	Portfolio Manager		For the first violation, a written warning may be issued; and Any subsequent or ongoing violation will be subject to a fine of up to $20.00 per day					Power utility could not make aggregated whole building energy data available to their customers in a convenient, electronic format, and this has delayed the results of the program	https://www.portlandmaine.gov/2389/Energy-Benchmarking
Portland, OR	Commercial Building Energy Reporting	654,741	2016	93% (2018) Approx 1000 buildings	commercial buildings 20,000 square feet and larger	mandatory	Public	no	Portfolio Manager		Letter of warning, civil penalty of up to $500 per covered building for every 90- day period	No. Certification and verification are voluntary	Help desk, how-to guide	Regional energy group has a directory of businesses that can help support compliance. Portfolio manager has a searchable directory of licensed professionals.	Utility providers can provide whole-building aggregated data	Can designate an commercial property agent to act on building's behalf for reporting	https://www.portland.gov/bps/energy-reporting

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San Francisco	Benchmarking	881,549	2011	1675 buildings	non-residential building larger than 10,000 square feet and each residential building larger than 50,000 square feet	Mandatory	Public	No	Portfolio Manager		Written Warning, Public Notice after 30 days, fines 45 days after warning. $100/day or $50/day up to $2500 or $1500 respectively depending on building size (more or less than 25000 sq ft)	Energy Audits	Training and technical assisatnce online, in person workshops,				https://sfenvironment.org/energy/energy-efficiency/commercial-and-multifamily-properties/existing-commercial-buildings-energy-performance-ordinance/benchmarking
Washington State	Senate Bill 5854	7,600,000	2009	Not released	Public/Government Greater Than 10,000 Sq. Feet 2010-07-01 Non-Residential Greater Than or Equal To 10,000 Sq. Feet2012-01-01	Mandatory	Purchase, sale, or lease	no	Portfolio Manager		Efficiency First	Audits, no other verification			Utilities required to automatically upload building info to portfolio manager	state agencies may not sign a new lease or a lease renewal in a privately owned building with a Portfolio Manager rating of less than 75	https://www.des.wa.gov/services/facilities-leasing/energy-program/energy-star-portfolio-manager
City of South Portland, ME	Energy & Water Benchmarking Ordinance	25,532	2017	75% (21/28 buildings)	Non-residential building with 5,000 square feet or more of gross floor area Residential building with 10 or more dwelling units Municipal or school building with 5,000 square feet or more of gross floor area	Mandatory	Public	Yes	Portfolio Manager	Owners who have reported their benchmarking data and are in compliance with the program are eligible to be forgiven the first $5,000 of any City permit or application fees associated with making	Any delay in report submission greater than thirty (30) calendar days shall be deemed a violation.		The City's Sustainability Coordinator will make time, as needed, to assist building owners get their Portfolio Manager accounts up and running. However, there is a wealth of tips and tutorials on the				https://www.southportland.org/departments/sustainability-office/energy-climate/energy-water-benchmarking-ordinance/
Winnipeg	Building Energy Disclosure Project	749,534	2018	100 buildings	commercial and institutional buildings over 20,000 ft2 in size	Voluntary	Public	No	Portfolio Manager	free educational workshops on disclosure and benchmarking			The Canada Green Building Council (CaGBC), a non-profit industry association, will be acting as the City's consultant and support administrator, responsible for facilitating participation and			The Canada Green Building Council (CaGBC), a non-profit industry association, will be acting as the City's consultant and support administrator, responsible for facilitating participation and	https://winnipeg.ca/Sustainability/building-energy-disclosure.stm#1