Energy Labeling Showdown

What auditors, private owners and government property and facility managers need to know!

Funded By:

real estate foundation BRITISH COLUMBIA

Vancity

light house

Technical Case Study

Prepared by
Light House Sustainable Building Centre

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EXECUTIVE SUMMARY

British Columbia's existing buildings account for two-thirds of all energy consumed in the province and 41% of the province's total GHG emissions. On a small scale, building energy labeling systems are effective tools in helping owner / operators monitor and reduce their energy consumption and GHG emissions. On a larger scale, they are one of many tools that government can employ to tackle climate change and energy demand.

Recognizing those important roles, this study evaluates the two most common building energy labeling tools: Energy Star and ASHRAE bEQ.

In preparing this study, Light House worked in cooperation with Vancity, Canada's largest community credit union, and modelled Vancity's head office in Vancouver, BC using both systems. Through the study, Light House determined the differences in requirements for each program, the administrative concerns, and the energy labeling policy context, implications and opportunities.

KEY FINDINGS

General

- **Detailed sub-meter and energy use breakdown analysis is not required by Energy Star and it was only through the additional rigor required by bEQ that energy conservation issues and opportunities were discovered for Vancity head office.**
- **Issues with Data Centre energy usage measurement methodology for Portfolio Manager leading to challenges getting accurate Energy Star and bEQ scores.**
- **Variables for computers, occupants, hours of operation and parking lot size can lead to 40% error in ratings if these are not entered accurately.**
- **Energy Star ratings are more influenced than bEQ score by variables such as: computers, occupants, hours of operation and parking lot size.**
- **Insufficient supply of bEQ professionals; none within short distance. Nearest professional was located in Portland, OR. Energy Star only requires a P.Eng. or Licensed Architect to complete the audit.**
- **No Canadian policies for mandatory reporting or disclosure of energy usage at this time. The Yukon Territory and City of Vancouver aim to implement programs in the near future.**
- **bEQ energy requirements exceeded Energy Star: A Level One ASHRAE Energy Audit and Energy Use Breakdown are required for bEQ.**
- **Energy Star has certified more than 100,000 multifamily housing units, low-rise and high-rise, certified to date.**
- **Energy Star Portfolio Manager has more than 70,000 individual accounts with more than 325,000 commercial buildings in the database, nearly 40% of the USA's commercial building space.**

Vancity Head Office

- **The Vancity head office, excluding the data center, achieved a site EUI of 1.32 GJ/m2/yr, a bEQ rating of 98.7 or letter grade C and an Energy Star score of 58. This means the office portion of the Vancity Head Office is performing slightly better than a comparable national average office.**
- **Discovered that weekend electricity usage is 75% of weekday electricity usage, even though the building is not occupied.**
- **Discovered challenges with the buildings electricity sub-meter tracking.**
- **Identified data center as a large energy user, which resulted in low Energy Star and bEQ rating for the building.**
- **Identified lighting retrofit opportunities (photocells, LED, occupant concern).**

Energy Star and bEQ are comparable building labeling tools. Both systems can help building owners & operators achieve higher building performance. They can also be used by industry and government to advance the market towards greater energy efficiency and awareness of building energy performance.

Energy Star has been available to building owners and operators for years. Its brand is well-recognized, even amongst the general population, and because of its longevity, it has seen greater uptake than bEQ. It is also slightly less expensive to undergo Energy Star certification.

The bEQ system has a more comprehensive energy category and is therefore a more effective tool for analyzing energy consumption and planning energy reduction measures. But that work can only be performed by qualified professionals with BEAP certification, which, as we found, is lacking in Western Canada.

Both tools offer building owners and operators measurable ways to assess and communicate their buildings' energy efficiency and utility savings year over year. They also offer industry and government ways to make progress towards achieving various GHG reduction targets and carbon-neutral goals. But in order for wide-spread adoption of either system to be successful, government would need to provide sufficient legislative support and education, and industry would need to train and support energy professionals in delivering audits and providing certification services.

INTRODUCTION

The *Building Energy Labelling Showdown* provides a comparison of two key energy labelling systems now available in Canada - the U.S. Environmental Protection Agency's Energy Star for Buildings and Manufacturing Plants (Energy Star) and the American Society of Heating and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Building Energy Quotient (bEQ). Each of these labelling systems offers building owners and manager's greater options and information to sustainably manage their buildings, potential buyers information on building performance, similar to a vehicle fuel economy rating that may impact purchasing decisions, and government decision-makers information about building performance that can influence policy development.

Vancity Headquarters at 183 Terminal Avenue in Vancouver, BC was used as the technical case study for the project. The project involved auditing the building according to the ASHRAE bEQ and the Energy Star energy labeling programs. The study considered labeling procedures, available resources, tools to help building owners start labeling their buildings and a decision making matrix for owners, governments, buyers/renters and auditors. Finally the study considered the implementation costs, benefits and challenges of each system.

What is an Energy Label?

An energy label for a building is a numerical or alphabetical rating that indicates how energy efficient a building is compared to other buildings that are rated using the same system. Similar to vehicle fuel economy ratings, an energy label provides a simple and effective method for building owners to understand and communicate how well their buildings are performing. While these programs, particularly Energy Star, have been popular in the United States for years, the Energy Star building rating system became available in Canada for the first time in July 2013. ASHRAE bEQ was first established in March 2012, but has had a lower uptake in the U.S. and limited uptake in Canada.

Each of these labels relies on actual energy consumption data, and corrects / normalizes energy consumption for building type, building operating conditions and climate to allow for an 'apples-to-apples' comparison. Buildings are benchmarked based on operational data and *actual* energy-use data (gas, electricity, fuel oil, diesel fuel, propane, steam, etc.) covering at least a 12 months period. The use of quality, actual energy-use data ensures a more accurate benchmarking and more accurate assignation of the final label. The data is then normalized for building type, occupancy and weather region. Energy Star uses Energy Star Portfolio Manager™ software to normalize data, while bEQ relies on a built-in system. Each system encourages ongoing monitoring beyond the initial benchmarking to help building owners continuously manage and improve energy usage.

In addition to offering a building label disclosing a building's energy performance rating, each system offers:

- Unique recommendations for energy efficiency and improvements to prompt good asset and operational management.
- A professional assessment of the building and its equipment (which comprises a Level One ASHRAE energy audit for bEQ).

- Helpful online support and general recommendations for energy management strategies and 'low-lying fruit' energy retrofits.

Benchmarking is completed by comparison of the normalized data to reference datasets for each building type that account for weather variations as well as changes in key physical and operating characteristics of each building. The most comprehensive dataset available in North America is the Commercial Building Energy Consumption Survey (CBECS – 2003) from the US Department of Energy. The CBECS was first conducted in 1979; the tenth, and most recent survey, was fielded starting in April 2013 to provide data for calendar year 2012. CBECS is currently conducted on a quadrennial basis. Energy Star and bEQ reference the CBECS-2003 survey for building benchmarking. To note, the 2007 survey included water usage data.

Why Energy Labeling for Commercial Buildings?

Many consumers consider the fuel economy of a vehicle or the energy efficiency of household appliances prior to making purchasing decisions; the same due diligence should be applied prior to purchasing or leasing a building. Building energy benchmarking and the resulting labeling can provide potential purchasers or managers insight into future operating costs as well as the overall performance of the building compared to other similar buildings on a local and national scale.

Canada's commercial building sector accounts for 14% of end-use energy consumption and 10% of the country's carbon emissions[1]. In 2006, the National Round Table on the Environment and Economy (NRTEE)[2] set an emissions reduction target of 53Mt CO2 per year by 2050 or 66% below business-as-usual levels for all new and existing commercial buildings in Canada. In order to meet this necessary and ambitious goal, the NRTEE *Geared for Change* report found mandatory energy benchmarking and labeling to be one of the most effective policy instruments noting the cost-effectiveness of this approach and its high potential impact on emissions reduction as a result of reductions in energy consumption.

Globally, public labeling of building energy performance is becoming increasingly common as government and property managers look to reduce energy usage as part of carbon reduction strategies. In 2008, the EU enacted the *Energy Performance of Buildings Directive* (EPBD), which requires all EU Member States to tighten their building energy regulations and to introduce energy certification schemes for buildings. Australia has developed the national program Commercial Building Disclosure under the *Building Energy Efficiency Disclosure Act 2010* requiring building energy efficiency certificates. More recently, major U.S. cities such as Austin, TX, New York, NY, Washington, D.C., Seattle, WA, San Francisco, CA, Philadelphia, PA as well as the states of California and Washington have established requirements for commercial buildings to determine and disclose operational energy usage. Closer to home in British Columbia, the City of Vancouver is considering establishing building labeling as part of the renovation permit process. See Appendix D for a summary of the regulatory context for energy labeling.

[1] (NRTEE 2009) Geared for Change: Energy Efficiency in Canada's Commercial Building Sector.
[2] In March 2013, the Harper Government closed the NRTEE. As a parting shot, it offered Canadians the clearest report yet on where the country stands – namely, falling short the Conservative government's own goal of reducing emissions by 17% from 2005 levels by 2020.

British Columbia's existing buildings account for two-thirds of all energy consumed in the Province and 41% of the Province's total GHG emissions. Recognizing the significant role that buildings play in meeting the Province's efforts to address climate change, energy and water consumption and waste generation targets, this study sought to evaluate two energy labeling programs available in Canada and how they compared when completed on an office building in Vancouver, BC.

Energy Labels & Policy

Many jurisdictions in the United States now mandate that commercial buildings pursue an energy label, all relying on the Energy Star program (e.g., California; Austin, Portland, New York City, Seattle; Washington State; Chicago, Philadelphia and many others). Figure 1 displays a sample of US cities and states that are passing building energy labeling and benchmarking requirements.[3]

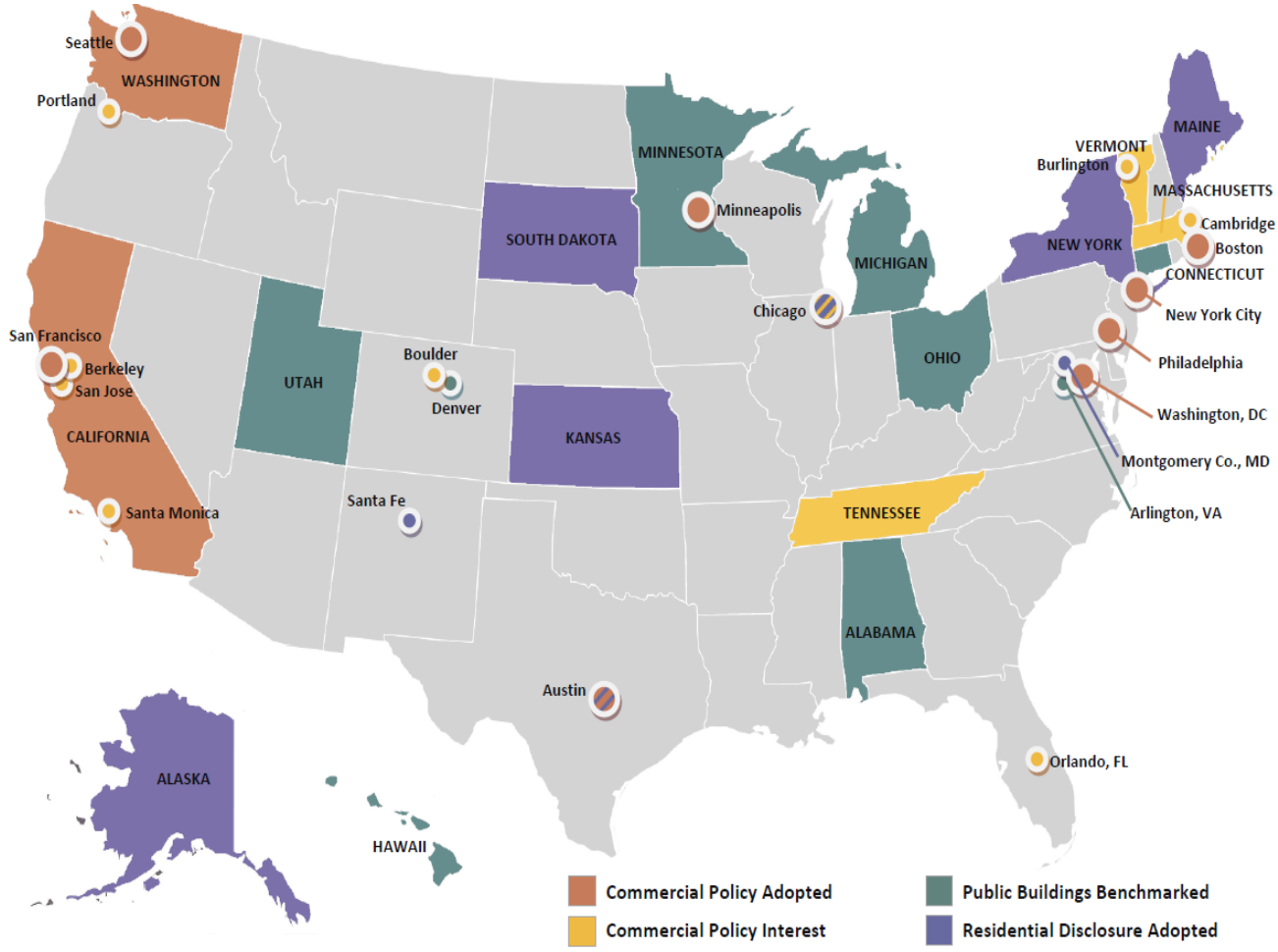


Figure 1: US Energy Benchmarking Policy

[3] City of Vancouver Benchmarking Presentation October 2014

Under the Energy Efficiency Act, the Government of Canada has the authority to make and enforce regulations that prescribe standards and labelling requirements for energy using products. Regulations have now been established for more than 40 products including major household appliances, water heaters, heating and air conditioning equipment, electric motors, commercial refrigeration and lighting products.[4] Are building benchmarking and labels next on the agenda? In any case Canadian cities are watching what is happening across Europe and the United States closely, while Vancouver is poised to be the first to implement building energy labeling requirements in the Vancouver Building Bylaw (VBBL 2014). In March 11, 2014, the City of Vancouver Council passed a resolution that takes a step to "empower local governments to require annual reporting of building energy use data to be submitted by building owners"[5]. Subsequent to this, the Lower Mainland Local Government Association passed a resolution at their May 2014 meeting to take the City of Vancouver motion to the Union of BC Municipalities in September 2014.

The City of Vancouver has passed an aggressive greenhouse gas reduction target for 2020 "to reduce community-based greenhouse gas emissions by 33% from 2007 levels"[6]. As part of this strategy the City of Vancouver has approved an "Energy Retrofit Strategy for Existing Buildings"[7] which includes action to move towards first voluntary and eventually mandatory Energy Benchmarking for Large Commercial (50,000 square feet) buildings.

OVERVIEW OF ENERGY STAR AND BEQ

Energy Star for Buildings and Manufacturing Plants (Energy Star)

Energy Star labels rely on the benchmarking software Energy Star Portfolio Manager™ to track, compare and rate building energy use, energy intensity and greenhouse gas emissions normalized for weather, building type, occupancy, location and hours of operation. Portfolio Manager now contains over 20,000 Energy Star-labeled buildings representing over three billion square feet of building space, making it the largest building benchmarking dataset available in North America[8].

Numerous comparisons, indicators and performance metrics are available through preloaded and customizable reports in the Portfolio Manager software. Energy managers, building owners and operators are able to benchmark a single facility or an entire portfolio of buildings for site energy, source energy, energy intensity, utility costs, comparisons to national medians, performance over multiple years, greenhouse gas emissions and many other indicators. A complete list is included in *Appendix B*.

Portfolio Manager assists owners and operators to understand how much site and source energy their building is consuming and whether the building qualifies for an Energy Star rating. Portfolio Manager offers owners the opportunity to conduct year over year comparisons with the national medians and with their own building fleet

[4] Source: NRCan extracted from http://oee.nrcan.gc.ca/publications/statistics/parliament09-10/chapter2.cfm?attr=0
[5] http://www.lmlga.ca/media/2014%20AGM/LMLGA%20Resolutions%20Disposition-2014.pdf
[6] http://vancouver.ca/green-vancouver/climate-leadership.aspx
[7] http://former.vancouver.ca/ctyclerk/cclerk/20140625/documents/ptec1.pdf
[8] US EPA Energy Star

and set performance targets for energy usage, greenhouse gas emissions and Energy Star scores. The Energy Star performance ratings are included in *Appendix C*.

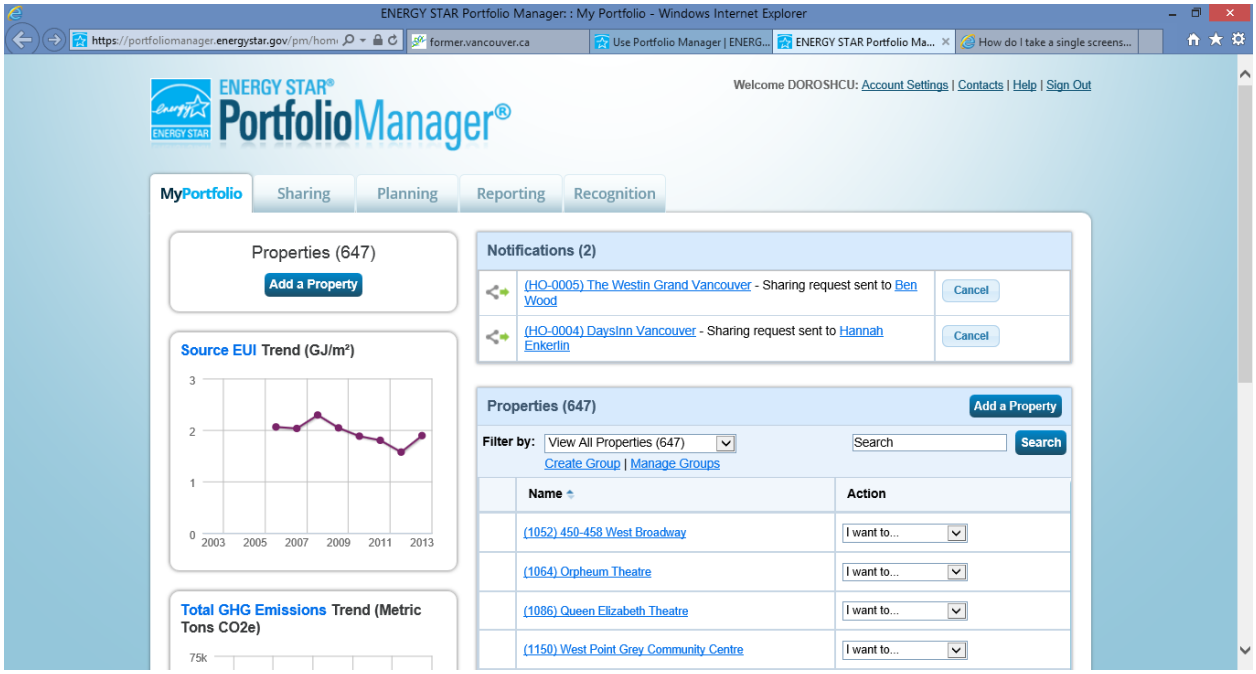


Figure 2: Screenshot of Energy Star Portfolio Manager

Portfolio Manager allows a building owner to rate the energy performance of his/her building on a scale of 1-100 relative to similar buildings nationwide. An Energy Star label is awarded to those buildings that perform better than 75% of all similar buildings.

It's important to note that Energy Star ratings are a relative measure (i.e. a sort of moving target). Buildings are compared to their peers rather than to technically achievable energy intensity figures, which are absolute (fixed) measures (EUI: calculated by energy use per area per year). As buildings across the country become collectively more efficient, Energy Star standards increase making it harder for newly rated buildings to achieve a given label. Conversely, if most buildings of a certain type are very inefficient or become less efficient as a group over time, a higher rating becomes easier to achieve.

Originally only available in the United States, Portfolio Manager is now available for Offices and K-12 Schools in Canada, with Hospitals coming online in 2014. The Canadian version of Portfolio Manager includes the following features to facilitate the Canadian-Portfolio Manager user experience:

- Canadian source energy
- Canadian greenhouse gas emissions factors
- Canadian 1-100 Energy Star energy performance scales for K-12 schools and commercial office space; other building types will be added over time
- Enhanced Canadian weather data with over 150 Canadian weather stations
- Metric units

- French language
- Automatic selection of the closest weather station, based on the postal code of the building

Figure 3: Energy Star label indicating the building is in the top 75% of its class.

ASHRAE Building Energy Quotient (bEQ)

ASHRAE administers bEQ, and developed the ASHRAE Level 1 building audit and In Operation Workbook upon which bEQ is based. bEQ assists commercial building owners to zero in on opportunities to lower building operating costs and make informed decisions to increase a building's value by improving the interior environment for occupants.

To ensure consistency and quality of data, only ASHRAE-certified Building Energy Assessment Professionals (BEAPs)[9] can register for bEQ, conduct the ASHRAE Level 1 energy audit and complete the *In Operation* workbook.

[9] ASHRAE has developed the Building Energy Assessment Professional (BEAP) certification program in collaboration with representatives from ASHRAE's Building Energy Quotient (bEQ) program, IESNA, NIBS, SMACNA, and TABB.

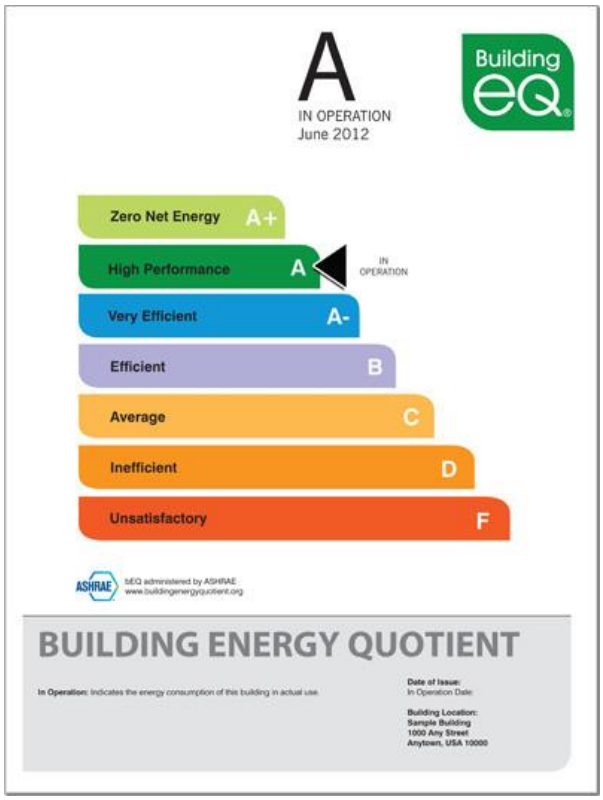


Figure 4: The bEQ program uses a label that is easily understood by the public[10].

The resulting energy performance rating applies an easily understood grading scale of A+ to F to compare a commercial building's energy use with similar buildings. The bEQ In Operation rating uses source EUIs obtained through Portfolio Manager™ that have been normalized for variables such as climate, occupancy and building function. Normalized Source EUIs are available for all Portfolio Manager building types[11] by entering basic building information such as total area and operating hours, along with 12 months of consecutive energy bills. For building types not listed in Portfolio Manager, ASHRAE has listed source Median EUIs by building type in the In Operation Workbook. To obtain an ASHRAE bEQ grade for the building, an energy modeller enters the normalised source EUI into the bEQ In Operation Workbook, where it will be compared to the Median Source EUI. The Median Source EUI is calculated from Portfolio Manager or from the ASHRAE bEQ In Operation Workbook and is based on an equivalent building type for the same climate zone.

$$\text{bEQ Rating} = \frac{\text{Source EUI}}{\text{Median EUI}} \times 100$$

[10] American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), 2013.

[11] http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager/identify-your-property-type

High performing buildings score a lower calculated EUI number, resulting in a higher grade. Table 1 and Table 2 list approximate bEQ ratings and a comparison between bEQ ratings and Site EUIs for a typical office building. Note that Table 2 was created by altering the building areas for one utility data set, resulting in slightly different Median Source EUIs for each simulation.

Table 1 Scale Range Rating Description

Scale Range	Rating	Description
=<0	A+	Zero Net Energy
1-25	A	High Performance
26-55	A-	Very Efficient
56-85	B	Efficient
86-115	C	Average
116-145	D	Inefficient
>145	F	Unsatisfactory

Table 2: bEQ vs Site EUI for an Office Building[12]

bEQ Score	bEQ Letter	Site EUI (GJ/m2)
178.1	F	3.24
163.0	F	3
136.3	D	1.81
124.1	D	1.66
103.0	C	1.43
101.3	C	1.41
100.0	C	1.4
98.7	C	1.32
92.9	C	1.27
84.8	B	1.01
81.3	B	0.94
74.2	B	0.87
67.0	B	0.7
55.4	B	0.54
50.6	A-	0.5

[12] *These results cannot be considered accurate for every office building.

What makes bEQ unique is that it uses a performance metric that results in a letter grade based on energy performance. This system lists net zero energy as the top A+ grade, which displays the ultimate goal of building performance; to reduce energy usage to a net zero energy level! This letter grade label is similar to the European Union's mandated energy performance certificate (EPC) for buildings[13].

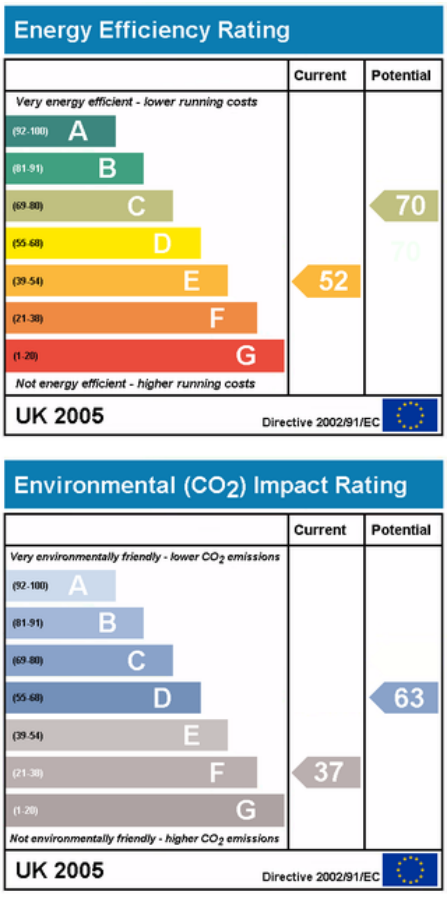


Figure 5: European Union EPC Rating for Homes

COMPARISON OF BEQ AND ENERGY STAR AT VANCITY HEAD OFFICE

Approach

Light House completed an ASHRAE bEQ assessment and an Energy Star Audit assessment on Vancity's head office located at 183 Terminal Avenue in Vancouver, BC. The 10,684 square meter (115,000 square foot) commercial office building includes a 4,127 m2 (44,427 ft2) parkade and 139 m2 (1,500 ft2) data center on the third floor. The building operates 50 hours per week with 592 staff and has 1,000 computers. The third floor

[13] http://en.wikipedia.org/wiki/Energy_Performance_Certificate

data center also includes a helpdesk IT center for Vancity offices. The lighting is mainly fluorescent T8 tubes. Vancity Centre is equipped with a computerized lighting system which allows control of lighting usage resulting in energy conservation. The lighting controller provides for full lighting during normal business hours (7:30am to 6:00pm Monday to Friday, statutory holidays excepted).

The building mechanical system includes:

- Vancity Center was designed to provide free cooling utilizing outside air whenever external temperature conditions allow.
- All 12 Occupied floors have their own AHU (air handling unit). Each air handling unit consists of a supply and return fan. The fan motors are controlled through speed drives and the BAS (Building Automation System).
- Each AHU is filtered with MERV 8 filters and airflow across the filter area is measured with a magnehelic guage
- Air is distributed on each floor through ductwork to individual VAV (Variable Air Volume) boxes. Each VAV is controlled with a dedicated BAS thermostat.
- When there is a demand for mechanized cooling the BAS brings on the 200 ton modular Multistack chiller. The chilled water is distributed through a cooling coil in each AHU. The SAT (Supply Air Temperature) is controlled at each AHU via use of the mixed air damper, outside air and the modulation of the cooling coil.
- If there is a demand for heat, the BAS brings on the gas fired low pressure/low temperature water tube boilers. The hot water is distributed via pumps and piping to the individual VAV's which then modulate air flow and hot water to control the space temperature. Two AHU's also have heating coils installed in them.
- CO2 is measured in every AHU's return ductwork and the BAS controls will modulate the outside air intake if it exceeds setpoint.
- There are heat pumps located on each floor that are dedicated to specific rooms to meet their individual needs for heating and cooling.
- The data center has 3 Liebert units. The Lieberts are water cooled and individually controlled to meet the demand for cooling in that space only. The data center utilizes hot and cold aisles to improve energy efficiencies
- The Heat pump and Liebert water loop is run through a heat exchanger and the heat is rejected through the two cooling towers located on top of the building. The cooling towers are controlled through speed drives and the BAS.
- The setpoints for space temperature are 22C -24C (72F-75F)

The project involved two site meetings at the Vancity head office to conduct an ASHRAE Level 1 energy audit and to assess the building for lighting, temperature, humidity and air quality. Our team reviewed records, interviewed the building operator and reviewed the building management and energy sub-metering systems.

The bEQ and Energy Star programs provide the BEAP Assessor and Licensed Professional or Certified Professional (*see Table 1 below for a full description of assessor and professional requirements for each system.) with templates and minimum requirements that need to be achieved in order to receive bEQ and Energy Star ratings. Energy data for the most recent 12 months is acquired and entered in Energy Star Portfolio Manager Software. bEQ and Energy Star ratings are available only for the calendar year that the assessment is completed.

The Vancity office, excluding the data center, achieved a site EUI of 1.32 GJ/m2/yr, a bEQ rating of 98.7 or letter grade C and an Energy Star score of 58. This means the office portion of the Vancity Head Office is performing slightly better than a comparable national average office.

The Comparison of Energy Labelling Tools and Technical Considerations Tables below provide detailed information on how to acquire each rating and what technical information is required by the licensed professional.

Table 1: Comparison of Energy Labelling Systems

	Steps to Earn a Label	Data Collection	Verification	Building Types?	Cost to certify?	Website Address
Energy Star	**Step 1**: Use Portfolio Manager to rate your buildings' performance. Buildings that rate 75 or greater on the 1-to-100 scale meet the Energy Star performance target. Offices and K-12 Schools currently available in Canada for a rating. **Step 2**: The building's indoor environment must be verified by a Licensed Professional (Professional Engineer or Registered Architect) as meeting industry standards for lighting levels, ventilation, thermal comfort, and control of indoor air pollutants. Additional requirements may apply depending on primary space type. Have the Licensed Professional sign and seal your Statement of Energy Performance, indicating that your building meets these standards. **Step 3**: Send the verified Statement of Energy Performance and a letter of agreement to EPA (NRCAN indicated this is not available in Canada and they do not have a timeline available for when ratings will be available). The letter must be received by EPA within 4 months of the year ending date on the Statement of Energy Performance. EPA will review your letter of agreement and, upon approval, designate your building as an Energy Star building. Award of the Energy Star is not final until approval is received from EPA.	Building utility data is entered into the Portfolio Manager software tool. The building must score in the top 75% in its category and a Professional Engineer or Registered Architect must verify the building data and performance. The verifier must also confirm the building meets ASHRAE requirements for thermal comfort (ANSI/ASHRAE Standard 55: Thermal Environmental Conditions for Human Occupancy), ventilation (ANSI/ASHRAE Standard 62.1, Ventilation for Acceptable Indoor Air Quality) and IESNA Lighting Handbook illumination levels. In others words you can't just not turn on the heat or lights and keep employees in cave-like conditions and achieve the Energy Star standard.	To validate the Statement of Energy Performance, a licensed professional (LP) must be a Professional Engineer or Registered Architect, possess a current license and be in good standing. The licensed professional should also have: • A license in a discipline related to commercial building systems (e.g. mechanical engineering or commercial architecture) • Working knowledge of building systems, ASHRAE Standard 55, ASHRAE Standard 62.1, and the IESNA Lighting Handbook.	As of May 2014 in Canada Offices and K-12 Schools are available with plans for Hospitals later in 2014.	Cost associated with hiring a verifier to verify the data and upload to the Portfolio Manager. There is no cost for Portfolio Manager.	http://www.energystar.gov/
ASHRAE bEQ	**Step 1**: The certified BEAP assessor will contact the building owner/manager and schedule time for an introductory meeting and building walk-through **Step 2**: The certified BEAP assessor will meet with the building owner, conduct the walk-through and gather (or obtain access to) building energy data; either utility bills or sub-meter readings. The downloadable ASHRAE In Operation Workbook includes all forms required for earning an ASHRAE bEQ rating as well as instructions for completion: Building Characteristics, Energy Data, Indoor Environment, Energy Saving Opportunities, Energy End Use Breakdown. **Step 3**: The certified BEAP assessor will complete the bEQ In Operation Workbook, pay the registration fee, and submit to ASHRAE for development of the label materials. The submittals to ASHRAE include the bEQ excel In Operation Workbook, signed Terms and Conditions and documentation of the metered/measured data used to calculate the rating on Form 2. This information may be recorded on the appropriate Metered Data Worksheet or provided as separate documents. **Step 4**: ASHRAE will produce the rating and transmit materials to the certified BEAP assessor.	General information compiled from the audit by the BEAP assessor: • Building characteristics • Billed energy use and cost by fuel type • Source EUI, generated from Portfolio Manager and/or the bEQ In Operation Workbook table • Indoor Environmental Quality screening • Water meter data The following information is provided from the bEQ worksheets: a. Normalized Source EUI (kBtu/ft2-yr) b. Building EQ rating/quotient – To be displayed on building Plaque and dashboard c. Energy cost index (ECI)($/ft2-yr) d. EPA Energy Star Portfolio Manager (scale of 1-100) The building must have at least 50% of its gross area (excluding parking) classified as: Bank/Financial Institution, Courthouse, Data Center, Hospital (General Medical and Surgical), Hotel, House of Worship, K–12 School, Medical Office, Municipal Wastewater Treatment Plant, Office, Residence Hall/Dormitory, Retail Store, Senior Care Facility, Supermarket, Warehouse (refrigerated and non-refrigerated) Library, restaurants cannot by >10% area.	To receive a bEQ rating, building owners must engage the services of professionals who have earned the ASHRAE-Certified Building Energy Assessment Professional (BEAP) designation to verify indoor environment quality conditions, utility bills and other documentation to calculate the building's energy usage and highlight potential energy conservation measures. The purpose of verifier certification is to ensure the quality control of the bEQ program particularly with respect to assessing indoor air quality, ventilation, illumination and thermal comfort standards.	K-12 Schools, College/University, Preschool/Daycare, Grocery Store/Food Market, Convenience Store, Convenience Store with Gas Station, Hospital/Inpatient Health Senior Care, Clinic/Other Outpatient Health, Medical Offices (Diagnostic) Laboratory, Hotel/Motel/Inn, Dormitory/Fraternity/Sorority, Enclosed Mall, General Office, Bank/Other Financial, Medical Office (Non-Diagnostic), Data Centre Mixed-Use Office, House of Worship Entertainment/Culture, Library Other Public Assembly, Recreation Social/Meeting, Courthouse, Fire Station/Police Station, Retail Store Enclosed Mall, Strop Shopping Mall Other Retail, Vehicle, Dealership/Showroom, Vehicle Service/Repair Shop, Vehicle Storage/Maintenance, Post Office/Postal Center, Repair Shop Other Service, Non-Refrigerated Warehouse, Refrigerated Warehouse, Distribution/Shopping Centre, Mid-Rise Apartment (5+ Units)	The registration fee for bEQ is $500. This fee, which typically will be included among the fees charged by the certified BEAP assessor, covers registration and program administration and will enable the assessor to provide the building owner with: 1. bEQ Workbook 2. bEQ Certificate 3. bEQ Dashboard 4. Graphic file for preparing a bEQ plaque for public display showing the designated rating. Cost of assessment is separate.	http://buildingenergyquotient.org/

Table 2: Technical Considerations for Energy Labeling Systems

	Indoor Air Quality	Ventilation	Thermal Comfort	Illumination	Energy Saving Opportunities	Energy Use Breakdown
Energy Star	No specific requirements for indoor air quality.	The Licensed Professional (LP) must verify that minimum ventilation rates and acceptable indoor air quality are provided according to the most recent version of the industry standard, ANSI/ASHRAE Standard 62.1, *Ventilation for Acceptable Indoor Air Quality*. There are two pathways to achieve ASHRAE 62.1: 1. Ventilation Rate Procedure: Measures outdoor air intake rates based on space type, occupancy, and floor area. 2. Indoor Air Quality Procedure: Analyzes contaminant sources, contaminant concentration limits, and level of perceived indoor air acceptability.	The Licensed Professional (LP) must verify that the building meets acceptable thermal environmental conditions as established by ANSI/ASHRAE Standard 55 "Thermal Environmental Conditions for Human Occupancy." The LP should measure the temperature, relative humidity, and air speed of a representative sample of the occupied interior spaces of the building during occupied hours. It is the responsibility of the LP to consider all measured data and observations at the time of the site visit and to determine, in his or her professional opinion, whether the building meets the letter and spirit of ASHRAE Standard 55. The LP should look for personal heaters, fans, etc. that could indicate thermal comfort issues.	The Licensed Professional (LP) must verify that the building meets acceptable illumination levels in accordance to the illuminance determination procedure of the Illuminating Engineering Society of North America (IESNA) Lighting Handbook. The LP should measure the illumination levels in a representative sample of the occupied interior spaces of the building as well as any associated parking facilities. He/She is expected to give a professional opinion about the capability of the building to provide minimum IESNA Lighting Handbook recommended illumination levels for both interior occupied spaces and generally unoccupied spaces (such as parking garages).	There is no formal energy audit conducted as part of the Energy Star Rating. The Energy Star website contains a wealth of information for building owners and operators to work on reducing building energy consumption.	Energy Star does not require a breakdown or an estimate of energy use by source in a building.
ASHRAE bEQ	1) The bEQ label requires at a minimum that indoor environmental quality (IEQ) meets minimum acceptable levels in order to assure that IEQ has not been compromised in the pursuit of increased energy efficiency. This box should be checked if, after completion of this form, the BEAP assessor judges that observations and spot measurements indicate that the building's IEQ is consistent with the intent of the label as explained above. 2) Review the buildings occupant issue and resolution logs with the building operator. Check the box when completed. 3) Provide a summary of the patterns, indications, or issues related to IEQ identified by reviewing the building's issue/resolution log. This section should characterize the predominant nature of recurring and unresolved issues for further investigation.	1) Attach a summary of ventilation information obtained from an occupant survey, if conducted. Check the box if these results are to be included as part of the submitted screening information. Note: The occupant survey is not required. 2) Indicate answers using pull down menus (Yes/No/NA) to questions regarding original design intent and ventilation flow rates. If the original design intent appears to meet ANSI/ASHRAE Standard 62.1, specify the version of the standard to which the building complies. 3) If the original design documents are not available, indicate with the pull down menu (Yes/No/NA) if there is a functional ventilation system installed to deliver approximately the ventilation flow rates in Standard 62.1. If yes, specify the version of the standard to which the building complies. 4) Conduct spot checks of ventilation flow rates at outdoor air (OA) intakes to determine that building interior controls have not been severely compromised below recommended levels in order to reduce energy consumption. If there are a large number of OA intakes, a representative sample should be used for the measurements. 5) Indicate the method used to determine flow rates above (e.g., measurements, calculations, estimates, etc.). A number of methods can be used for these spot checks. The intent is not to do a full test and balance but to verify that IAQ has not been compromised in the pursuit of energy savings. 6) If combustion sources are present in or near the building, carbon monoxide (CO) concentrations should be measured in occupied spaces and compared with the levels issued by the EPA for ambient air (US EPA. 2000. Code of Federal Regulations, Title 40, Part 50, National Ambient Air Quality Standards). If measured concentrations exceed 5 ppm, the source of these levels should be investigated by a qualified professional (engaged by the building owner/manager) and the need for corrective action considered.	1) Attach a summary of thermal comfort information obtained from an occupant survey, if conducted. Check the box if these results are to be included as part of the screening information submitted. Note: The occupant survey is not required. 2) Conduct an interview with the building operator to document the building's HVAC system general characteristics. Appropriate data includes floor area, HVAC system characteristics, occupancy, facade orientations, and fenestration characteristics. 3) Conduct an interview with the building operator to document the observed thermal comfort issue indicators. Appropriate data would include any conditions that would indicate the existence of thermal comfort problems such as occupant complaint logs, personal fans or space heaters, or blocked or altered supply air diffusers.	1) Attach a summary of lighting quality information obtained from an occupant survey, if conducted. Check the box if these results are to be included as part of the screening information submitted. Note: The occupant survey is not required. 2) Conduct an interview with the building operator to document the building's lighting system general characteristics. Appropriate data includes information on lamps, luminaries, and controls. 3) Conduct an interview with the building operator to document both operator and occupant reported lighting quality issues.	1) Document potential energy savings measures as observed during the site visit and assessment walk-through. These measures should be shown in the appropriate category: Envelope, Lighting/Daylighting, HVAC, Utility/Operations, Other. To retain the numbering of items, "edit" each cell rather than entering new data. The potential energy savings measures may be ordered by cost, payback, or other priority as deemed appropriate by the BEAP assessor. 2) Enter an opinion of probable cost or cost range for each suggested energy savings measure. Ranges will vary depending on the size and complexity of the suggested measures as well as the size and complexity of the candidate building. Low/no cost measures may have ranges such as $0-1000, $1000-$3000, etc. Medium cost measures may have ranges such as $10,000-20,000, $20,000-30,000, etc. High cost measures may have ranges such as $50,000-$100,000, $100,000-$200,000, etc. 3) Select an estimated payback range from the drop-down menu. Choices are: <1 year, 1-4 years, 5-10 years, >10 years.	Energy End Use: Enter the energy end use breakdown categories to be used. The categories currently on the worksheet are suggested categories only. Delete any unused categories, leaving unused rows blank. Annual Energy Use: Enter the annual energy use in kBtu/ft2-yr for each end use category specified. Data may be measured (i.e. submetered), calculated, or estimated. The units should be site energy and the total should match the site energy reported on Form 2 Energy Calculations Worksheet. Total Energy Entered The worksheet will automatically total the energy uses entered and build a pie chart from the entered data.

		This measurement is recommended, but optional. Enter the measured CO concentrations and locations of measurement. 7) Indicate with the pull down menu if the building has a CO monitoring system in place.				

Vancity Head Office Results: Energy Star and bEQ

The next section will compare the technical requirements of Energy Star and bEQ programs.

Indoor Air Quality

bEQ requirements exceed those from Energy Star in Indoor Air Quality. bEQ requires the BEAP assessor to review occupant issue logs concerning indoor air quality, take spot measurements in areas of concern and provide their own best judgment on the buildings indoor air quality and issue resolution. Energy Star only requires that minimum ventilation requirements are being met and does not require reviewers to look at occupant issue logs or surveys.

Vancity Head Office has an online issue/resolution system (FixIT) that seems to be working well. During the audit there were only a couple of complaints in the past 12 months relating to "stuffy offices, and broken air conditioning." It was difficult to determine if the issues were resolved from the log, however, follow up with the building operator indicated the tasks had been resolved. The FixIT system automatically sends users an e-mail notification that their request is completed. Users can also log-in online to check the status of their request.

In addition, Vancity Head Office conducts a FixIT user survey every three months, asking for comments and ratings on the level of building operator service. If the status of an item changes or a comment is added, updates can be viewed by all users.

Ventilation

The ventilation requirements for Energy Star and bEQ are quite similar. Both systems require the Licensed Professional or BEAP assessor to verify that the building occupants are receiving enough fresh air as prescribed by ASHRAE 62.1 using either the Ventilation Rate Procedure or the Indoor Air Quality Procedure. At Vancity Head Office there are continuous carbon dioxide (CO^2) monitors in the ventilation return ducts which are set to increase ventilation supply if CO^2 in the return ducts is greater than 1000 ppm. A building air balancing report was also available during the review which indicated most VAV boxes were supplying designed air flow rates to building occupants.

In addition, bEQ requires any indoor air quality surveys results and for carbon monoxide (CO) monitoring to be installed near any combustion sources (ie. parkades). Vancity Head Office had CO monitors in its parkade, however no records were available of an occupant air quality survey. Overall the bEQ system is slightly more prescriptive and rigorous than Energy Star with respect to ventilation requirements.

The Vancity Head Office achieved the requirements of both systems. RESULTS from bEQ and Energy Star calculations.

Thermal Comfort

Thermal comfort for Energy Star requires the opinion of the verifier to confirm the building spaces meet ASHRAE 55 Thermal Environmental Conditions for Human Occupancy. Light House conducted an interview with the building operator to obtain air handling unit (AHU) supply and return temperatures, CO^2 and relative humidity (RH) measurements. Temperature levels were deemed to be within ASHRAE 55 and to meet Energy Star requirements.

Thermal comfort requirements for bEQ include an occupant survey if available (not available for Vancity Head Office), and interviews with the building operator to determine building mechanical system design and any occupant issues in the past 12 months. In the case of occupant concerns the assessor is required to check temperature and relative humidity in each space of concern during the audit. Light House conducted an interview and collected logs that indicated the building was performing within an acceptable range for thermal comfort.

Both systems have similar requirements and submittal and documentation was the same for both. The bEQ system requires a more extensive interview with the building operator, whereas Energy Star ASHRAE 55 requirement can be met by onsite testing or logs from AHU or direct digital control (DDC) control boxes. Vancity Head Office met the thermal comfort requirements of both programs. This was demonstrated through the DDC logs and the building operator interview.

Illumination

Illumination requirements for Energy Star require the Licensed Professional to confirm all building spaces meet IESNA requirements for illumination. A space-by-space lighting survey was conducted at Vancity Head Office., the results are displayed in Table 3.

Table 3: Lumen Survey Vancity Head Office, Conducted April 4, 2014.

Floor	Space Type	Light Level	IESNA	Comments
1	Main Reception	500-600	100	
1	Corner Office	350	300-500	Blinds closed
1	Reception in Bank Area	**185**	300-500	Occupant had asked
2	Lunch Room	150-200	100	Blinds open
2	Lounge	210	100	Blinds open
2	Hallway	100	50	
3	Cubicle – interior	250-400	300-500	
3	Cubicle – window	480	300-500	
4	Cubicle – interior	**230**	300-500	

Floor	Space Type	Light Level	IESNA	Comments
4	Cubicle – window	700-1590	300-500	Blinds open
4	Cubicle – interior	320	300-500	
5	Cubicle – interior	300	300-500	
5	Elevator Hallway	150	100	
5	Cubicle – window	1470	300-500	Blinds open
5	Office – Interior	320	300-500	
Stairwell	Stairwell	20-100	50	
6	Boardroom – interior	830	300	
6	Cubicle –interior	420	300-500	
6	Cubicle – window	720	300-500	Blinds open
7	Cubicle – interior	310	300-500	
7	Cubicle – window	1100	300-500	
7	Office – window	550	300-500	Blinds open
8	Cubicle – interior	400	300-500	
8	Office	390-2000	300-500	Blinds closed
9	Cubicle – interior	**180**	300-500	
9	Cubicle – interior	**250**	300-500	
9	Office – window	975	300-500	Blinds open
9	Cubicle – interior	450	300-500	
10	Cubicle – interior	**230**	300-500	
10	Cubicle – window	1000	300-500	Blinds open
10	Cubicle – interior	**200**	300-500	
10	Cubicle – interior	310	300-500	
11	Cubicle – interior	**260**	300-500	
11	Cubicle – interior	300	300-500	
11	Office – window	1600	300-500	Blinds open
11	Cubicle – interior	440	300-500	

Floor	Space Type	Light Level	IESNA	Comments
12	Training room – interior	380	300-500	
12	Training room – window	1600	300-500	
12	Boardroom	990	300-500	Lights off, blinds open

With the exception of only a couple of interior cubicles, identified in bold in Table 3, the spaces all met IESNA requirements. There was one tenant concern which was also noted in Table 3. The results indicate that a future de-lamping program should be careful not to reduce lumen levels below IESNA and occupant requirements.

The bEQ program only required a lumen survey if the operator or occupants indicated concerns during the operator interview and building audit. Because the audit identified no operator concerns and only one occupant concern, the bEQ system ended up being a lot less rigorous and less time consuming than Energy Star. The Energy Star lighting audit required four hours for the Vancity Head Office while the bEQ requirements could be met after a brief discussion with the building operator.

Energy Saving Opportunities

Energy savings opportunities is a value added requirement of the bEQ program that Energy Star does not include in its labeling system. Essentially the bEQ requirement is to conduct a walk through Level 1 ASHRAE Energy Audit which includes identifying energy conservation measures and simple paybacks based on utility data and high level costing (costing is based on the assessors experience and probable costs). In this respect, the bEQ system significantly outperforms Energy Star in terms of moving building operators and owners from simply benchmarking their buildings, towards the next logical step which is to identify energy conservation measures.

During the Vancity Head Office audit, utility data assessment, operator interview and building walk through, Light House identified five energy conservation measures (shown in Table 4). As Vancity Head Office has been implementing continual performance improvement measures for many years, very few energy saving measures were identified.

Table 4: Suggested Energy Saving Measures Vancity Head Office

Suggested Energy Savings Measures by Category:		
Envelope Suggestions	**Cost Range**	**Payback**
No measures were identified.	N/A	N/A
Lighting/Daylighting Suggestions	**Cost Range**	**Payback**
1. Photo-sensors for Perimeter Lighting:	12 sensors / floor at $100 installed	2-5 yrs

Perimeter spaces are very well day-lit; installing photo-sensors would provide approximately a 40% reduction in current lighting costs. 0.40 * $15,000 annual lighting cost (lighting costs are from the building sub-metering system)[14].	each. $10,000 - $20,000	
2. Re-lamping and de lamping at Vancity Centre: Occurring in 2014: Vancity Head Office will be undergoing a re-lamping program aimed to optimize Lighting Power Density and still achieve IESNA lighting requirements.		1-4yrs
3. Ongoing - LED replacement of all MR16s.	$5-10/bulb	5-10yrs
HVAC Suggestions	**Cost Range**	**Payback**
4. Installation of Heat Recovery Chiller New Heat Recovery Chiller to capture waste heat from the Data Centre and use it for building heat. The heat recovery chiller is projected to reduce Vancity Centre greenhouse gas emissions by 62% (savings of 70,900kwh and 4,400GJ) and gas consumption by 95%.	A more detailed assessment is required.	
Utility/Operational Suggestions	**Cost Range**	**Payback**
5. Under Investigation A review of building automation system (BAS) reports and monthly utility bills identified significant energy use on weekend days, when the building is not occupied; weekend use is 75% of weekday energy usage. Light House has recommended further investigation by building operators to confirm the sources of energy use and whether BAS programming alone can reduce this figure.		
Other Suggestions	**Cost Range**	**Payback**
No other recommendations were identified.	N/A	N/A

Energy Use Breakdown

An energy use breakdown analysis is unique to ASHRAE bEQ and offers building owners and operators the additional value of identifying unusually high energy consumption by end-use, which assists target end-use energy conservation efforts. Typically, an energy use breakdown is one of the first steps when conducting an energy audit. If the building does not have energy end-use sub-meters, bEQ permits the

[14] "Effect of interior design on the daylight availability in open plan offices", by Reinhart, CF, National Research Council of Canada, Internal Report NRCC-45374, 2002. http://lightingcontrolsassociation.org/estimating-energy-savings-with-lighting-controls/

information to be calculated, or estimated. The Vancity Heat Office building has a number of energy end-use sub-meters; the energy use breakdown is shown in Figure 4 and all sub-meters are listed in Table 5.

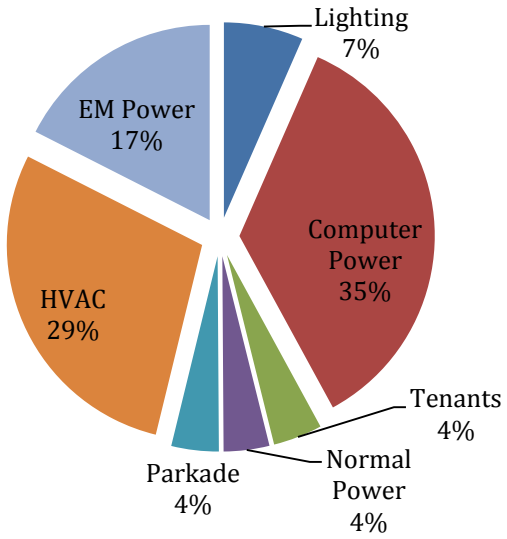


Figure 6: Electricity Use Breakdown at Vancity Head Office

Table 5: Description of Sub-Metered Systems

Sub-meter	Description
EM Power	Elevator and mechanical equipment.
HVAC	Ventilation, heating and cooling.
Parkade	Lighting, mechanical doors and ventilation in the parkade.
Normal Power	200A distribution panel that feeds kitchen power, photocopiers, printer etc. on all floors.
Tenants	Retail sub-tenants. There are two retail tenants occupying less than 1,000 square feet of space each on the main floor.
Computer Power	IT energy usage from the third floor data center, floor boxes and Liebert air conditioning (A/C) units.
Lighting	Whole building lighting electricity usage.
Mains	Sum of all the building sub-meters.

Figure 4 shows a breakdown of electricity usage at Vancity Head Office from March 23-30, 2014 and indicates that computer power is much higher than typical Canadian office buildings. This high computer usage is attributed to the large data center on the third floor and the 1,000 computers and monitors in the building. In the Data Center section we will look at the challenges the Data Center and relatively high computer loads cause when trying to normalize for energy usage in Portfolio Manager.

Based on the same week, March 23-30, 2014, the building used 75% of its weekday electricity usage on Saturday and Sunday. This indicates an opportunity to reduce electricity usage through the building automation system (BAS) using schedules and reducing heating, cooling and ventilation set points/rates during non-occupied hours. In 2013, Vancity completed a large system optimization program, but the results of sub-metering in Table 6 indicate that further weekend energy consumption reductions are possible.

Table 6: Electricity Sub-metered data Mar 23-30, 2014 Showing Weekday vs Weekend Split

Load Type:	Sat/Sun (kWh) Average	M-F (kWh) Average	Weekend % SS/MF	Total MWh	% Building Total
Mains	6,150	8,100	75.9%	**53.03**	
Lighting	60	740	8.1%	3.882	6.6%
Computer Power	2,750	3,100	88.7%	20.96	35.5%
Tenants	307	355	86.5%	2.4	4.1%
Normal Power	189	370	50.9%	2.233	3.8%
Parkade	244	365	66.8%	2.316	3.9%
HVAC	2,087	2,550	81.8%	16.93	28.7%
EM Power	1,123	1,625	69.1%	10.35	17.5%
Total	12,910	17,205	75.0%	**59.071**	100.0%

The investigation also revealed some double counting between the sum of the sub-meters and the building main meter (as indicated in bold in Table 2). The building engineer confirmed that some of the electricity load was in fact counted twice within the eight sub-meters.

This detailed sub-meter and energy use breakdown analysis is not required by Energy Star and it was only through the additional rigor required by bEQ that these issues and opportunities were discovered.

For the sake of comparison NRCAN provides an energy usage breakdown for a typical office building, shown in Figure 5[15]:

[15] http://oee.nrcan.gc.ca/commercial/eeeb/18909

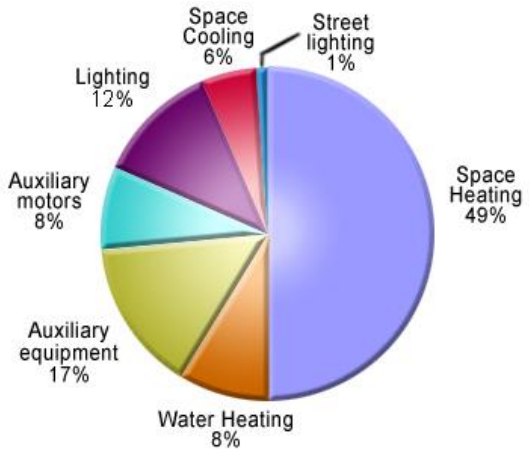


Figure 7: Energy Use Breakdown Typical Office Building

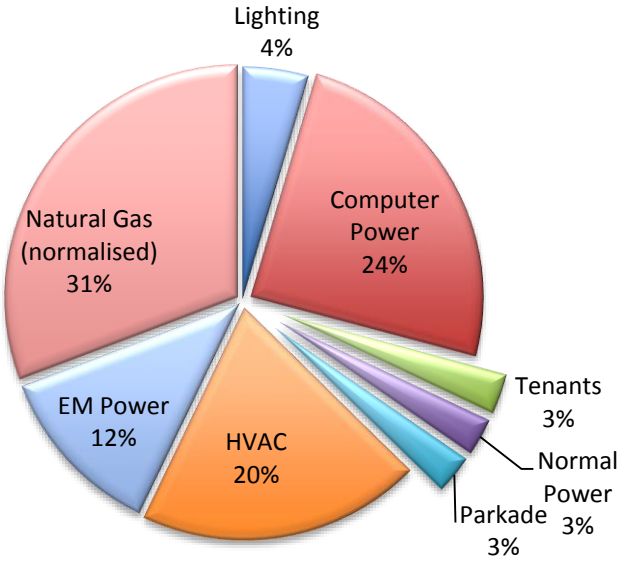


Figure 8: Whole Building Energy Use Breakdown Percent Based on March 23-30, 2014

From the typical energy use breakdown of a Canadian office building shown in Figure 5, we can see that Vancity Head Office, Figure 6, is using much less energy for lighting: 4% compared to 12% for a typical office. However, the computer usage which includes the data center at 24%, is much higher than the typical office which includes computer energy usage in auxiliary equipment at 17%.

bEQ and Energy Star Labeling Comparison

The bEQ and Energy Star scores were artificially compared by manipulating the number of computers, hours of operation, parking lot size, and number of occupants at Vancity Head Office in order to generate Table 7 below. The Table 7 indicates that only the very best performing buildings by the Energy Star standard (99) would be able to achieve an A- rating under the bEQ system. bEQ also

includes an A and A+ rating which are actually off the Energy Star Scale. Further analysis would be needed to determine if these scores are similar for different building types in different locations. A full bEQ rating score analysis can be found in Appendix B.

Table 7: Comparing Energy Star and bEQ Scores

Energy Star Score	bEQ Score	bEQ Letter
1	178.1	F
3	163.0	F
12	136.3	D
21	124.1	D
44	103.0	C
46	101.3	C
50	100.0	C
58	98.7	C
60	92.9	C
78	79.8	B
84	74.3	B
86	72.1	B
90	67.9	B
97	55.4	B
99	50.6	A-

Data Centers

During the Vancity Head Office audit, one of the most challenging aspects of both labeling systems was dealing with the data center. Energy Star Portfolio Manager requires all data center energy consumption to be sub-metered for the IT Equipment energy usage only. This is a challenge because very few buildings sub-meter their data center energy use, and even fewer specifically sub-meter the IT equipment. Fortunately, Vancity Head Office has sub-meters for their data center and with some difficulty was able to provide a calculation for annual energy usage. In order to get an Energy Star and bEQ rating the IT energy must be sub-metered and entered into Portfolio Manager. This is an often over-looked and relatively new requirement of Portfolio Manager, which came into effect in July 2013.

Vancity Head Office has a 1,500 ft^2 data center which accounted for 25% of the buildings total energy usage in 2013. Every workstation has a desktop or laptop and one or more monitors. Three methods were used to account for the data center energy usage in Portfolio Manager:

1. Method 1: The total energy consumption was entered and the data center was entered as its own meter but also included in the main energy meters. Using this method the site energy use intensity (EUI) for Vancity Head Office was 1.66 GJ / $m^2$with an Energy Star score of 21 and bEQ score of 222.8 – F, using this methodology.

Table 8: Method 1: Vancity Head Office -4052230			
Whole Electric Bill and Data Center Meter. (Methodology according to Portfolio Manager)			
Metric	**Baseline (Dec 2011)**	**Current (Mar 2014)**	**Median Property***
Energy Star score (1-100)	12	21	50
Source EUI (GJ/m²)	3.23	2.94	2.37
Site EUI (GJ/m²)	1.81	1.66	1.34
bEQ Score	136.3 – D	124.1 - D	
Source Energy Use (GJ)	34,537.40	31,403.00	25275.6
Site Energy Use (GJ)	19,317.30	17,782.10	14311.5
Total GHG Emissions (Metric Tons CO2e)	382.6	367.5	295.8

2. Method 2: Subtract the data center energy usage from the main electric meter and enter separately into Portfolio Manager. Using this methodology the site energy use intensity (EUI) was 1.04 GJ / $m^2$and the building received an Energy Star rating of 78 and a bEQ score of 79.8-B.

Table 9: Method 2: Vancity Head Office – 4047425			
Normalised for Data Center by subtracting the Data Center Electricity usage from the Main Electric Meter and included a Data Centre IT meter.			
Metric	**Baseline (Dec 2011)**	**Current (Mar 2014)**	**Median Property***
Energy Star score (1-100)	46	78	50
Source EUI (GJ/m²)	2.41	1.9	2.38
Site EUI (GJ/m²)	1.41	1.04	1.3
bEQ Score	101.3-C	79.8 - B	
Source Energy Use (GJ)	25,751.20	20,260.60	25396.9
Site Energy Use (GJ)	15,031.40	11,091.00	13899.1
Total GHG Emissions (Metric Tons CO2e)	342.1	202.6	253.9

3. Method 3: Model Vancity Head Office as an office building without a data center. The resulting site energy use intensity (EUI) was 1.32 GJ / m^2 with an Energy Star score of 58 and bEQ score of 98.7 – C.

Table 10: Method 3: Vancity Head Office – 3831487

Normalised for Office Building ONLY, no data center included.			
Metric	**Baseline**	**Current**	**Median**
	(Dec 2011)	**(Jun 2013)**	**Property***
Energy Star score (1-100)	44	58	50
Source EUI (GJ/m²)	2.44	2.23	2.37
Site EUI (GJ/m²)	1.43	1.32	1.4
bEQ Score	103.0-C	98.7 - C	
Source Energy Use (GJ)	25,751.20	23,545.80	25007.6
Site Energy Use (GJ)	15,031.40	13,949.30	14812.2
Total GHG Emissions (Metric Tons CO2e)	342.1	331.3	351.8

In order to determine the most appropriate methodology, Light House contacted the US EPA, who runs Portfolio Manager, however, they have not yet responded to our requests for clarification. Light House requested clarification on the source median EUI, which is used to calculate both the Energy Star and ASHRAE bEQ ratings, as it did not change significantly when the building was modelled with and without a data center. This seems inaccurate, as a building with a large data center should receive a performance credit based on that data center and the source median EUI should be different for a building with and without a data center. **This issue has not been resolved; therefore Method 3 was used to determine Vancity Head Offices Energy Star and bEQ ratings.**

Data Quality Control: Energy Star & bEQ Ratings

The information presented under sub-headings: Number of Computers, Number of Occupants, Hours of Operation and Parking Lots is particularly useful for assessors, fleet managers and municipalities who are looking at entering large sums of information into Portfolio Manager and are often using default values for occupancy, number of computers, number of employees, hours of operations and parking lot size**. By inputting different sets of values for Vancity's Head Office into Portfolio Manager, Light House determined that up to a 40% error may be introduced if inaccurate data is inadvertently entered.** Specific data impacts are correlated to changes in Energy Star and bEQ ratings below.

Number of Computers

The number of computers at Vancity Head Office proved to have a large impact on Energy Star and bEQ ratings. Figure 9 indicates that for every 20 to 30 computers added to a space the Energy Star rating increases by 1 point. The reverse is true for a bEQ score: an increase in the number of computers increased the median source EUI and therefore reduced the rating. The doubling of computers caused a

38% increase in the Energy Star score from 40 to 65. This same doubling of computers caused a 16% reduction in the bEQ score from 107 to 89. Based on these results the same change in computers results in nearly double the impact of Energy Star score compared to bEQ rating.

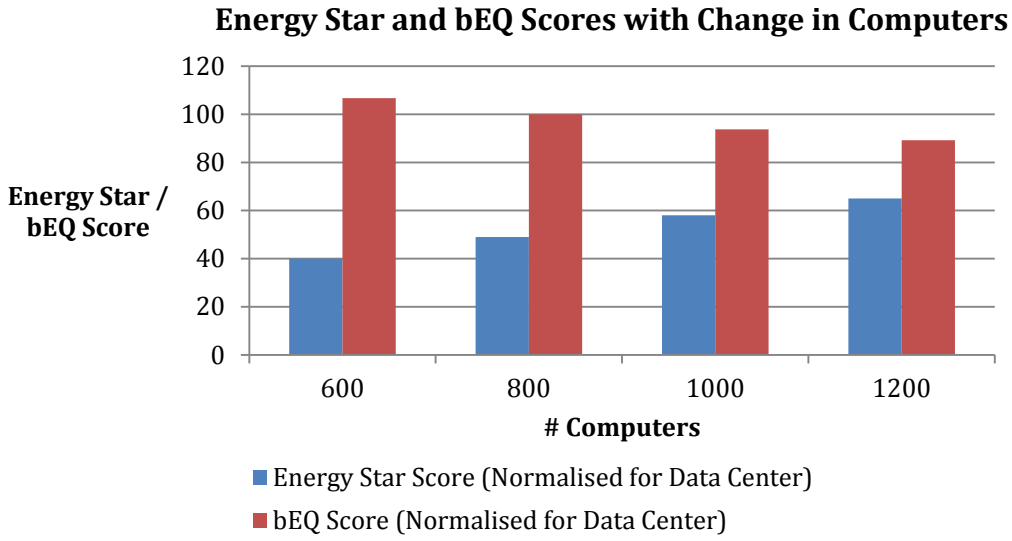


Figure 10: Energy Star Score vs Number of Computers (592 occupants & operated 50 hr/week)

Number of Occupants

The number of occupants at Vancity Head Office also proved to have a large impact on Energy Star and bEQ ratings. The results in Figure 11 indicated that for every 150 occupants added to a space the Energy Star rating increased by roughly 5 points. The impact was reversed on the bEQ score whereby an increase in the number of occupants increased the median source EUI and therefore reduced the bEQrating. The doubling of occupants caused a 22% increase in the Energy Star rating from 53 to 67. This same doubling of occupants caused an 11% reduction in the bEQ score from 98 to 88. **The results indicate that accurate occupant counts are essential to generating accurate bEQ and Energy Star ratings.**

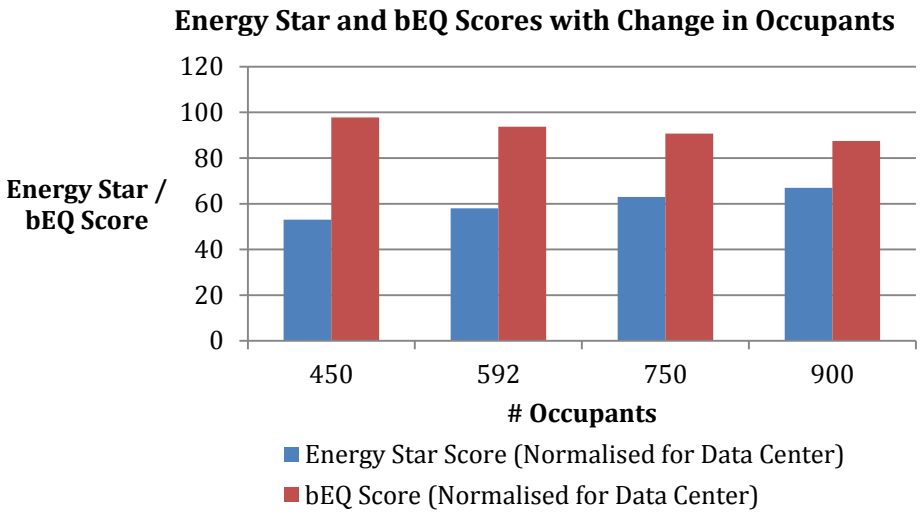


Figure 12: Energy Star Score vs Number of Occupants (1000 computers & operated 50 hr/week)

Hours of Operation

The hours of operation at Vancity Head Office also proved to have a large impact on Energy Star and bEQ ratings. The results in Figure 13 indicate that for every additional 10 hours of operation the Energy Star Score increases by 3 to 4 points. The impact was reversed on the bEQ score whereby an increase in the hours of operation increased the median source EUI and therefore reduced the bEQrating. The change in hours of operation from 40 to 70 caused a 15% increase in the Energy Star ratingfrom 54 to 64. This same change caused a 7% reduction in the bEQ score from 97 to 90. The relative impact of increasing the hours of operation caused almost double the change in Energy Star score compared to bEQ rating. Therefore the Energy Star score is more dependent on hours of operation.

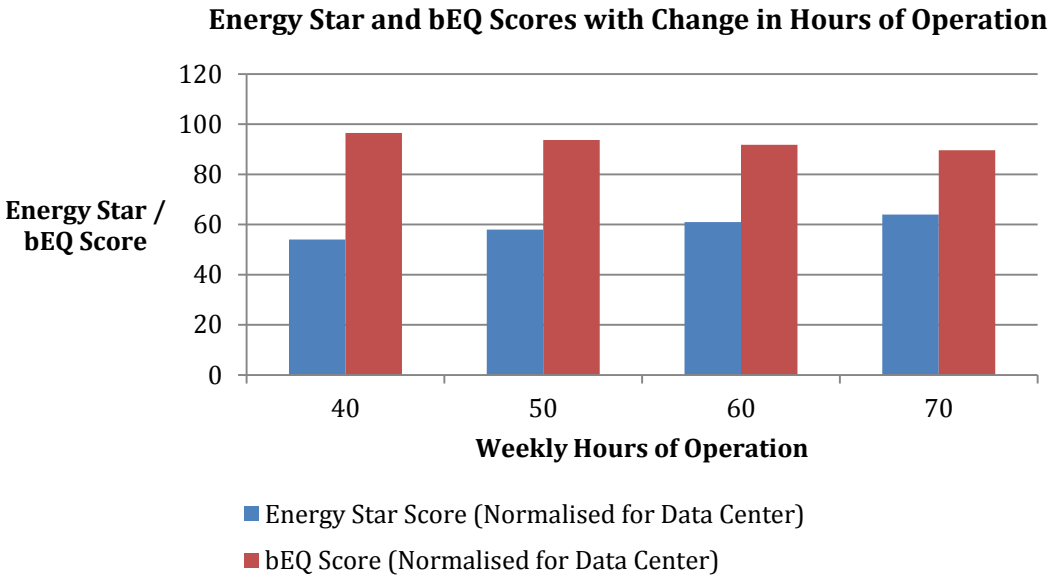


Figure 143: Energy Star Score vs Hours of Operation (1000 computers & 592 Occupants)

Parking Lots

The Vancity office was modeled with and without its parking lot, which is completely enclosed with a total area of 44,427 square feet). When the parking lot was removed from Portfolio Manager, the Energy Star rating dropped from 58 to 51 and the bEQ rating increased from 93.7 to 98.7. When the parking lot area was double, the Energy Star rating increased by 4 points, while the bEQ rating decreased by 3 points. Parking lots had a greater relative impact on the Energy Star score, both tools normalized for parking lot size.

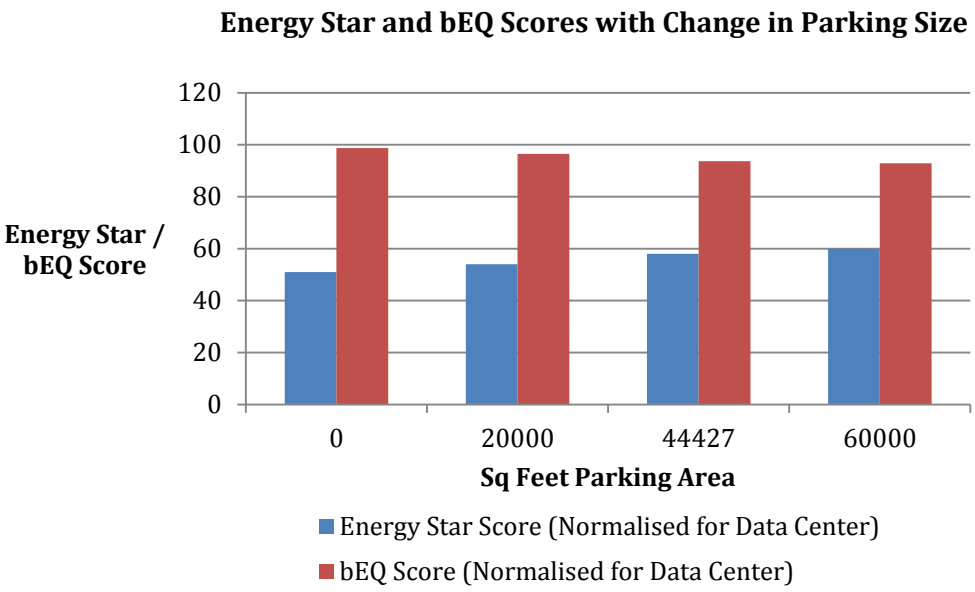


Figure 15: Energy Star Score vs Parking Lot Size (1000 computers & 592 Occupants)

Source and Site Energy

Energy Star and ASHRAE bEQ both use source energy to calculate their respective ratings as they have demonstrated this to be the most equitable unit of evaluation. **Source energy** represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, thereby enabling a complete assessment of how effectively a building gets energy to its site, as well as how effectively it uses energy. In comparison, **site energy** is simply the amount of energy used by a building as determined by each meter reading (gas, electricity, etc.). **Site energy is typically what most building owners, operators and managers are interested in obtaining in order to efficiently operate their building and determine energy conservation measures that may be appropriate. Source energy is useful for municipalities and provinces committed to reducing greenhouse gas emissions and/or energy in an entire region.**

For each fuel type, a source-site ratio is employed to calculate the final energy usage index as shown in Table 11 (US Environmental Protection Agency, 2011).

Table 11: Source-Site Ratios for Portfolio Manager Fuels

Source-Site Ratios for all Portfolio Manager Fuels	
Fuel Type	**Source-Site Ratio**
Electricity (Grid Purchase)	3.34
Electricity (on-Site Solar or Wind Installation)	1.0
Natural Gas	1.047
Fuel Oil (1,2,4,5,6, Diesel, Kerosene)	1.01
Propane & Liquid Propane	1.01
Steam	1.21
Hot Water	1.28
Chilled Water	1.05
Wood	1.0
Coal/Coke	1.0
Other	1.0

The use of national source-site ratios ensures that no specific building will be credited (or penalized) for the relative efficiency of its utility provider. At first, it will appear that a building is using three to four times the actual energy used, however this is due to the application of the ratio of source-site energy for the calculations. This ratio is applied consistently to all buildings; therefore, it does not affect the overall building rating. Users who are familiar with site energy are still able to compare a single building or a fleet of buildings using site energy; source energy is used to get the Energy Star and bEQ ratings.

Weather Normalization

Weather normalization is the process of correcting annual energy data to account for the impacts of cold and hot seasons, as energy use can vary drastically from year to year in order to properly measure the effectiveness of operational and capital energy improvements, the impact of heating and cooling degree-days must be normalized.

Degree-days are a measure of how much the temperature varies in a given year from a set point. The set point in a building would ideally be the outdoor air temperature (OAT) at which a building's mechanical system switches from heating to cooling, however for simplicity, degree-day data is collected and normalized by governments and organizations using 18 degrees Celsius (°C) as a baseline.

The number of degree-days for a region is calculated as the hours that the temperature varies from 18°C; above 18°C are considered cooling degree-days and below 18°C are heating degree-days. For Vancouver the average is 2,785 heating degree-days and 60 cooling degree-days[16]

Portfolio Manager simplifies this process by automatically accounting for degree-days when generating the energy usage and Energy Star ratings for a facility. bEQ then uses the source median EUI to calculate a bEQ rating so their system is also normalized for weather. Weather normalization allows building owners and operators to compare how much energy or cost a building would have used compared to how much energy it actually used in a given year.

For additional information on weather normalization check out Abraxas Energy:
http://www.abraxasenergy.com/articles/intro-weather-correction/

GETTING YOUR ENERGY LABEL

Labeling Procedures

The general steps required to get an energy label on a building are as follows:

Step 1: Compile actual energy and water performance based on 12 months of utility bills.

Step 2: Enter utility data in a building benchmarking tool that will normalize the data for weather such as Energy Star Portfolio Manager or ASHRAE's building Energy Quotient.

Step 3: Generate your building's energy usage index (GJ/m^2/yr), source median EUI, and Energy Star or bEQ rating analysis.

Step 4: Conduct analysis of building operations relating to illumination, ventilation and thermal comfort for compliance with ASHRAE, IESNA, bEQ and Energy Star guidelines.

Step 5: Provide a building energy efficiency recommendations report and plan for the implementation of the recommendations (bEQ only). Continued energy data analysis and benchmarking will provide actual energy savings from the energy efficiency upgrades completed for the building.

It is important to note that measuring complex and mixed-use buildings with various occupancy types is complicated and sub-meters or space exemptions may be required.

[16] (Environment Canada, 1989-2013).

BENEFITS OF ENERGY LABELING

Vancity Head Office

Even in a building as high functioning as Vancity's Head Office, which has sub-meters for electricity usage, a building engineer, building operator and a team that works on continuous optimization, there were still tangible, actionable benefits to completing the Energy Star and bEQ audit programs:

- Discovered that weekend electricity usage is 75% of weekday electricity usage, even though the building is not occupied.
- Discovered challenges with the buildings electricity submeters.
- Identified data center as a large energy use, which resulted in low Energy Star and bEQ rating for the building.
- Identified lighting retrofit opportunities (photocells, LED, occupant concern).

Building Performance

Results from over 35,000 buildings from 2008 – 2011 from the US EPA's Portfolio Manager Database indicated buildings using the database were able to reduce energy by 2.4% annually.[17] Results indicated that over 70% of buildings reduced their energy consumption.

Improve Your Building's Bottom Line

Operational costs may not be the largest expense but they are likely the most controllable expense. With an audit and a set of recommendations in hand, managers can begin to make informed decisions about short-term, easy improvements and long-term, capital-intensive investments, including energy conservation measures, related simple payback analyses, and a host of other measures.

Support Third Party Certification

Buildings that are undergoing certification or which are already certified to LEED BD+C, LEED EBOM, or BOMA BESt rating systems, can use credits and prerequisites from each of the programs that support using Portfolio Manager to track and benchmark building performance. Obtaining an energy label assures you are meeting these requirements.

Competitive Advantage

Sophisticated tenants and potential building owners are seeking better performing buildings in order to cut operational costs and provide a better indoor environment for employees and tenants. Providing an energy label for a building clearly demonstrates its performance and increases potential tenant satisfaction and engagement that can lead to longer-term retention.

[17] Source: http://www.energystar.gov/buildings/sites/default/uploads/tools/DataTrends_Savings_20121002.pdf

Reduced Risk

Higher performance buildings are less likely to have unforeseen costs due to retrospective government regulations. In the UK, where energy labeling is mandatory, buildings with low ratings have "earlier than expected obsolescence", have sold for significantly reduced prices, and have been required to upgrade before a sale was completed. Energy performance certificates have also been reported to affect access to capital, with poor ratings being included in debt negotiations.[18]

Better for the Environment

Measuring building performance equips companies with data and methods to reduce their carbon footprint and decrease their energy and water usage.

POLICY DISCUSSION

Figure 11 compares provincial and municipal policy objectives on energy and carbon dioxide reduction in relation to ASHRAE bEQ and Energy Star. The results indicate that each program can contribute to different aspects of carbon and energy reduction targets.

Indicator	Policy Objectives	US Environmental Protection Agency Energy Star	ASHRAE building Energy Quotient
Energy & Carbon Dioxide	Make government buildings carbon neutral by 2010 Reduce GHG emissions by 33% by 2020 from 2007 levels. Reduce GHG emissions by 80% by 2050 from 2007 levels.	Utilises free software (Portfolio Manager) to track energy and greenhouse gas emissions. US EPA study indicated from 2008 - 2011 buildings using Portfolio Manager reduced emissions by 2.4% annually.	Utilises Portfolio Manager as well as internal benchmarking to track and compare energy but not greenhouse gas emissions.
	Reduce the energy demand at work by 9% per sq. metre by 2020	US EPA study: 2.4% reduction annually.	Energy Conservation Measures and Paybacks as part of ASHRAE Level 1 Audit.
	Reduce average energy demand per home by 20% by 2020.	N/A	N/A

[18] IIGCC. Protecting Value in Real Estate 2013.

Costs		Free Software. Evaluation needs to be completed by a registered architect or Professional Engineer. Consultant fees are between $2,500 - $4,000	$500 Registration Cost. Evaluation must be completed by an ASHRAE Certified BEAP Professional. Consultant fees are between $4,000 - $8,000.
Challenges		Only Offices and K-12 Schools available in Canada (Hospitals in 2014). No energy star labels currently available through NRCAN.	Additional administration and data tracking requirements in addition to Portfolio Manager software. Very challenging to find a BEAP accredited professional in Canada.
Benefits		Licensed Professional Review. US and NRCAN free support and online tools for energy management.	BEAP Accredited Professional Review. Energy Star Level One Audit. bEQ labels are available from ASHRAE.

Figure 14: Energy Star and bEQ Contributions to Energy and Climate Goals

Energy Star Contribution

Energy Star utilizes free software for portfolio holders to track their energy and greenhouse gas emissions (GHGs), compare to national medians and set targets and reduction goals. Between 2008 and 2011, Energy Star demonstrated annual reductions of 2.4% for all buildings (sample population: 35,000) when using Portfolio Manager. The Energy Star program offers a common language, which can be used by policy makers to track energy and greenhouse gas emission (GHGs) savings in buildings in a specific or general region over time.

bEQ Contribution

ASHRAE bEQ uses Portfolio Manager to track and measure the same energy and GHG emmissions, targets and goals. If a specific building type is not covered by Portfolio Manager, ASHRAE offers an internal energy usage intensity database to estimate them. ASHRAE bEQ also requires an ASHRAE Level 1 energy audit to be conducted which encourages and educates operators and owners on simple energy conservation measures that are recommended for their building. This requirement helps building owners and operators implement cost effective energy conservation measures and takes benchmarking to the next logical step ("manage what you are measuring"). The bEQ program has additional administration and data tracking requirements that make it more complicated than the Energy Star program. For instance, a more intensive indoor environmental and energy assessment is required, and a certified BEAP assessor must verify the building's performance.

Challenges and Opportunities

The Energy Star Portfolio Manager and ASHRAE bEQ rating systems both have their challenges.

- Throughout this study Portfolio Manager has evolved almost daily with new and improved features and functions. Current challenges include:
- Limited number of building types can earn an Energy Star rating in Canada: offices, K-12 schools, hospitals in 2014.
- Energy Star physical labels are not yet available in Canada through NRCan. In the USA the United States Environmental Protection Agency EPA distributes the labels.
- Energy Star ratings must be verified by a Licensed Professional, which can be either a Professional Engineer or a Registered Architect.
- bEQ ratings must be conducted by a BEAP assessor and project submissions to ASHRAE must be verified by BEAP reviewers. At the moment, there are no BEAP reviewers in Western Canada.
- Energy Star Portfolio Manager offers conflicting requirements for accurately entering data center information. Additionally, data centers which are >75kVA are required to sub-meter IT equipment.
- Energy Star Portfolio Manager's reporting features are not as intuitive as operators and energy managers would like, whereas many operators are already familiar with Microsoft Excel or other energy management tools. Portfolio Manager might be viewed as another tool that takes operators away from keeping the building running smoothly. Both the importing and reporting templates take some time to become proficient at.
- Energy managers wishing to become competent with Portfolio Manager benefit from targeted training, as the software has numerous restrictions and requirements. For example bulk import tools require three sets of data imports into Portfolio Manager from Microsoft Excel and one needs to pay careful attention to the unique ID assigned to the building during data import. Many other energy management software tools would allow for data import in one step.
- Issues with data upload bulk and single building utility templates (ie. data is sometimes lost and sometimes duplicated).
- Date formatting issues with Portfolio Manager utility upload templates. The lesson learned here was that although PM utility template asked for the data in DDMMYY format it would actually only accept the data in MMDDYY format. The US EPA has been notified of this issue.
- A user cannot simply cut, copy, and paste utility data from existing excel spreadsheets directly into Portfolio Manager online interface.
- Data transfer and access issues. While it was relatively easy to access utility bills from Vancity as they continually monitor their utility usage, this has not been the case with many buildings that only keep hard copies or no copies at all of their utility data.

Widespread Adoption

Portfolio Manager is now being used to manage utility data for over 300,000 buildings in the United States. In order for widespread adoption to occur in Canada, a range of activities and drivers will need to materialize; Table 12 identifies drivers and their stakeholders.

Table 13 Getting to Widespread Energy Labelling Adoption

Stakeholder Group	Energy Star and ASHRAE bEQ	
Verifiers	Energy Star ready professionals are already available in the lower mainland; however, market demand is currently small.	BEAP Assessors who are available in the lower mainland will be needed.
Renters, Buyers	Market demand: Both systems have easy to understand scorecards and could be picked up and understand relatively quickly by the public. In a study published by Johnson Controls, Energy Star labeled buildings have: • Increased resale value (2-17%) • Increased rental rates (5.8-35%) • Higher occupancy rates (0.9-18%) • Lower operating expenses (30%) • Higher net operating income (5.9%) • Lower capitalization rates (50-55 basis points) and • Productivity gains (4.8%)[19]	
Users – Operators and Energy Managers	Portfolio Manager training and familiarity through usage is one barrier. Another barrier is that similar to Vancity Head Office Operators and Energy Managers are already using many other energy management tools that have been on the market for many years and are adverse to adding work for the sake of work to their busy days.	
Utilities	Utilities need to provide access or even better direct download to Portfolio Manager for all buildings. Utilities in the Lower Mainland both have their own online utility billing system available for customers; the next step would be a direct downloadable file for Portfolio Manager. This would allow work to be transferred from data entry towards more analysis during the audits for both programs.	
Municipalities	Municipalities could help speed up the transition to Portfolio Manager by starting with incentives and then moving towards mandated labelling similar to so many jurisdictions in the United States. In order for labelling to really take off it will need to be a	

[19] http://www.institutebe.com/InstituteBE/media/Library/Resources/Green%20Buildings/Green-Building-Valuation-Fact-Sheet.pdf

Stakeholder Group	Energy Star and ASHRAE bEQ
	requirement at point of sale or lease. This could add a small cost to the sale of a building in order to verify its energy performance, however, much of this could be eliminated with automated utility data imports to Portfolio Manager.

FINDINGS

Energy Star Score 58 and bEQ rating of C (98.7)

Vancity Head Office received an Energy Star score of 58 and a bEQ letter score of C – 98.7. This rating means that the Vancity Head Office is performing above the median for other similar office buildings however below the Energy Star 75 threshold required to achieve an Energy Star Score. The building met and exceeded all Indoor Environmental Quality and Building Management requirements of both programs.

The audit process revealed that while Vancity Head Office is performing above the national median for a comparable building, there is still room for improvement in order to achieve an Energy Star 75 or equivalent bEQ score (B or higher). Some of these potential improvements were identified in the Energy Audit described above in Table 4: Suggested Energy Saving Measures. The bEQ auditing process revealed energy conservation opportunities and both rating tools acted as a performance check for Vancity Head Office, a building that is very well operated. One could expect to reveal more energy conservation opportunities and potentially more surprises in a less rigorously operated building.

Portfolio Manager

Portfolio Manager is not the only energy normalization tool on the market, but it is the only one being used by over 300,000 buildings and it's free. It still has many challenges and the output (Energy Star Score) is only as good as the inputs. As demonstrated during this project, the user or verifier must account for data centers, hours of operation, computers and occupants as accurately as possible. The impact of computers, occupants, hours of operation, location and parking lot size is summarized in Table 13.

Table 13: Normalisation Factors for Energy Star and bEQ Ratings

Normalisation Factor	Number	Impact on Energy Star	Impact on ASHRAE bEQ
Computers (number)	600	40	107
	800	49	100
	1,000	58	94

	1,200	65	89
Occupants (number)	450	53	98
	592	58	94
	750	63	91
	900	67	88
Hours of Operation (hours)	40	54	97
	50	58	94
	60	61	92
	70	64	90
Parking (sq. ft.)	0	51	99
	20,000	54	97
	44,427	58	94
	60,000	60	93
Weather	Zone A (Vancouver)	58	
	Zone B (Kelowna)	70	
	Zone C (Prince George)	77	

The main finding from this exercise was that Energy Star scores are more dependent than bEQ score on the variables: computers, occupants, hours of operation and parking lot size.

Policy Implications

While this was not the primary focus of the Energy Labelling Showdown, the authors have identified the following barriers to mainstream adoption of energy labelling in North America:

- A shortage of education and market understanding:
  - Lack of trained BEAP assessors
  - Very few professionals who have conducted Energy Star audits in Canada
  - No Energy Star labels currently in Canada
  - Many professionals and operators are still learning how to effectively use Portfolio Manager
  - No Canadian policies for mandatory reporting or disclosure of energy usage at this time. The Yukon Territory and City of Vancouver aim to implement programs in the near future.

- An absence of BEAP assessors: only two in British Columbia (June 2014) and neither of them are actively conducting bEQ audits.[20]

Table 4: bEQ Assessors in Canada

Name	Company/Organization	Designation	Certification Valid until	Province	Country
Dharam Ahuja	Millenium Engineering Ltd	BEAP	12/2014	ON	CANADA
Edward Cai	Pretium Anderson Building Engineers	BEAP	12/2017	ON	CANADA
Frank Fu		BEAP	12/2015	ON	CANADA
Edwin Lim	Shared Services, B C	BEAP	12/2014	BC	CANADA
Harri Makivirta	Virta Energy Consultants	BEAP	12/2014	ON	CANADA
Douglas McClary	Vancouver School Board	BEAP	12/2014	BC	CANADA
Lalith Perera		BEAP	12/2014	ON	CANADA
Gavin Platt		BEAP	12/2015	ON	CANADA
David Robb	WTS INC	BEAP	12/2016		CANADA
Morley Ross		BEAP	12/2015	ON	CANADA

- A lack of market demand for the Energy Star and bEQ programs in Canada.
    - No formally NRCAN certified Energy Star buildings or plants currently in Canada.
- There is no current policy or legislation mandating energy labels at time of building lease or sale in Canadian jurisdictions. As discussed earlier there are many energy disclosure policies in the USA, all using Portfolio Manager as the reporting tool. Also as discussed there are energy labelling requirements in many parts of Europe.

Overall Comparison

The Energy Star and ASHRAE bEQ energy labeling programs are both well developed and provide valuable feedback to the building owner and operator. See Table 14 below for a high-level side-by-side comparison of the two programs; criteria were developed from key owner and operator concerns communicated during the case study.

Criteria	Energy Star	ASHRAE bEQ

[20] http://report.ashrae.org/Certification/list?type=BEAP

Criteria	Energy Star	ASHRAE bEQ
Duration	The average ASHRAE Level I Energy Audit and report takes between one to five days; this can vary based on availability of data.	The ASHRAE Level I Energy Audit and Energy Use Breakdown take between one to five days based on availability of data. Completing the bEQ workbook and Portfolio Manager utility data increases the time requirement substantially. Total time for completion of all tasks took 20% longer than Energy Star to complete at Vancity Head Office.
Cost	Energy Star cost estimate based on past Energy Star Audits (2) $3,500.	bEQ quotation (we could only get one quote) $6,000 (not including travel from Portland, OR).
Required Professionals	Energy Star requires a P.Eng. or Licensed Architect	bEQ requires a BEAP accredited assessor
Availability of Required Professionals	Acceptable range of professionals within a short distance.	Insufficient range of professionals; none within short distance. Nearest professional was located in Portland, OR.
Quality of Program Tools	The Energy Star data checklist provides good guidance for building physical, IEQ and utility data entry. The data checklist lacks a place to include the IEQ data analysis.	The bEQ workbook provides a high level of clarity regarding required data and where results should be included.
Normalisation	A more dramatic impact on Energy Star score from changes in variables: computers, hours of operation, occupants, and parking lots.	Less impact on bEQ rating from changes in variables: computers, hours of operation, occupants, and parking lots.
Energy Requirements	12 months of utility data required, no energy audit completed.	bEQ requirements exceed Energy Star: A Level One ASHRAE Energy Audit and Energy Use Breakdown are required.
Indoor	Energy Star has a more detailed	bEQ requires a more detailed interview with

Criteria	Energy Star	ASHRAE bEQ
Environmental Quality Requirements	lighting audit.	building operator to determine if there are IEQ issues currently and historically. Optional surveys of air distribution systems, flow rate calculations and samples. More detailed description of HVAC systems is required.
Label Physical Recognition	The Energy Star label has the slight advantage as their label has been available for many years on appliances and vehicles and is easily recognized by the public.	Uses a number and a letter grade, does not correspond to Energy Star score directly. bEQ labels are easy to understand if they were to become mainstream.
Uptake / Momentum	Energy Star significant recognition: • Used by more than 70,000 individual accounts. More than 325,000 commercial buildings in the database, nearly 40% of the USA's commercial building space. More than 100,000 multifamily housing units, both low-rise and high-rise, certified to date.	ASHRAE has not published data on uptake in the bEQ program.
Renewal	The Energy Star label is valid for the calendar year it is produced.	
Marketing Tools and Communication	Energy Star offers owners a wealth of information on energy management best practices and how to get the most value out of your Energy Star label though their Communications Toolkit[21].	Offers owners limited support for communication through additional Resources on their website including a case study, presentation and a program brochure[22]. The program also boasts a custom ASHRAE plaque for owners to display on their building.

[21] http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/communicate-your-success
[22] http://buildingenergyquotient.org/whats-the-benefit.html

Energy Star and bEQ are comparable building labeling tools which could help the market advance in terms of energy efficiency and awareness of building energy performance. bEQ has a more comprehensive energy category, while Energy Star is the leader in terms of momentum, brand recognition, duration and cost. Another significant finding was the lack of qualified professionals with the BEAP certification in the Lower Mainland, British Columbia and throughout Western Canada.

In conclusion, both tools offer building owners and operator's measurable ways to communicate their buildings' energy efficiency and utility savings year over year. With additional legislative support at the municipal and provincial level, and with sufficient industry training, the adoption of energy labeling would assist owners and operators to meet GHG reduction and carbon neutral goals. In order to move forward with either rating tool, building energy labelling will require support from policy makers, market and user education, and trained professionals to deliver the audits and provide the labels.

APPENDIX A: METRICS IN ENERGY STAR PORTFOLIO MANAGER

The following is a full list of available metrics that you can include in a custom report template.

Building Information
Facility Name (Required)
Address 1
Address 2
Year Built
Administrator
Building ID (Required)
Facility Owner
Building Profile Status
Facility Type
City
Country Name
County
State
Zip Code
eGrid Region
Power Plant
Last Modified Date
Service and Product Provider
Shared By
Unique Building Identifier
Notes
Metering Configuration
Total Floor Space (Sq. Ft.)
Agency
Department/Region
Federal Campus
Federal Real Property ID
Federal Sustainability Checklist Completion Percentage
Electric Distribution Utility
Emissions Factor (kg CO2e/MBtu)

Data Center Metrics
Baseline Data Center Source PUE
Baseline PUE-PDU Input
Baseline PUE-UPS Output
Baseline Site IT Equipment Input Energy (kWh)
Baseline Site PDU Input Energy (kWh)
Baseline Site PDU Output Energy (kWh)
Baseline Site UPS Output Energy (kWh)
Baseline Source IT Energy (kBtu)
Current Data Center Source PUE
Current PUE-PDU Input
Current PUE-UPS Output

Current Site IT Equipment Input Energy (kWh)
Current Site PDU Input Energy (kWh)
Current Site PDU Output Energy (kWh)
Current Site UPS Output Energy (kWh)
Current Source IT Energy (kBtu)
National Average PUE

Comparisons to Energy and Water Baselines
Change from Baseline: Adjusted Energy Use (%)
Change from Baseline: Adjusted Energy Use (kBtu)
Change from Baseline: Adjusted Energy Use Intensity (kBtu/Sq. Ft.)
Change from Baseline: Energy Use Intensity (kBtu/Sq. Ft.)
Change from Baseline: Energy Use (kBtu)
Change from Baseline: Indoor Water Use (%)
Change from Baseline: Indoor Water Use (kGal)
Change from Baseline: Indoor Water Use Intensity (kGal/sqft)
Change from Baseline: Other Water Use (%)
Change from Baseline: Other Water Use (kGal)
Change from Baseline: Outdoor Water Use (%)
Change from Baseline: Outdoor Water Use (kGal)
Change from Baseline: Total Water Use (%)
Change from Baseline: Total Water Use (kGal)

Energy Star Application Information
Eligibility for Energy Star
Energy Star Application Status
Energy Use Alerts
Full Year
Space Use Alerts
Year(s) Labeled
Approval Date - Last Energy Star

Financial Indicators
Annual Energy Cost (US Dollars ($))
Cumulative Investment in Facility Upgrades (US Dollars ($))
Cumulative Investment per Sq. Ft. (US Dollars ($))
Total Energy Cost per Sq. Ft. (US Dollars ($))
Financial Indicators - Annual Fuel Costs
Annual Energy Cost - Electricity (Grid Purchase) (US Dollars ($))
Annual Energy Cost - Electricity (On-Site Solar) (US Dollars ($))
Annual Energy Cost - Electricity (On-Site Wind) (US Dollars ($))
Annual Energy Cost - Natural Gas (US Dollars ($))
Annual Energy Cost - Fuel Oil (No. 2) (US Dollars ($))
Annual Energy Cost - District Steam (US Dollars ($))
Annual Energy Cost - Wood (US Dollars ($))
Annual Energy Cost - Propane (US Dollars ($))
Annual Energy Cost - Liquid Propane (US Dollars ($))
Annual Energy Cost - Other (US Dollars ($))
Annual Energy Cost - Kerosene (US Dollars ($))
Annual Energy Cost - Fuel Oil (No. 1) (US Dollars ($))

Annual Energy Cost - Fuel Oil (No. 5 and No. 6) (US Dollars ($))
Annual Energy Cost - Diesel (US Dollars ($))
Annual Energy Cost - Coal (anthracite) (US Dollars)
Annual Energy Cost - Coal (bituminous) (US Dollars)
Annual Energy Cost - Coke (US Dollars ($))
Annual Energy Cost - Fuel Oil (No. 4) (US Dollars ($))
Annual Energy Cost - District Hot Water (US Dollars)
Annual Energy Cost - District Chilled Water (US $)

GHG Emissions
Baseline Direct GHG Emissions (MtCO2e)
Baseline Indirect GHG Emissions (MtCO2e)
Baseline Total GHG Emissions (MtCO2e)
Change from Baseline: GHG Emissions (MtCO2e)
Current Direct GHG Emissions (MtCO2e)
Current Indirect GHG Emissions (MtCO2e)
Current Total GHG Emissions (MtCO2e)

Period Ending Dates
Baseline Energy Period Ending Date
Current Energy Period Ending Date
Baseline Water Period Ending Date
Current Water Period Ending Date

Rating
Baseline Rating (1-100)
Current Rating (1-100)
Target Rating (1-100)

Renewable Energy
Baseline Total On-Site Renewable Electric Use (kWh)
Current Total On-Site Renewable Electric Use (kWh)
Percent of Electricity from On-Site Renewable (%)
Total Avoided GHG Emissions from Green Power (MtCO2e)
Total On-Site Electric Generation (kWh)
Total Green Power Purchased (MWh)
Total Renewable Energy Sold to Grid (kWh)
Total Revenue From Energy Sold to the Grid (US Dollars ($))

Site Energy
Baseline Site Energy Intensity (kBtu/Sq. Ft.)
Baseline Total Site Energy Use (kBtu)
Current Site Energy Intensity (kBtu/Sq. Ft.)
Current Total Site Energy Use (kBtu)
National Median Site EUI (kBtu/Sq. Ft.)
Target Site Energy Intensity (kBtu/Sq. Ft.)
Weather Normalized Site EUI (kBtu/Sq. Ft.)
% Difference from National Median Site Energy per Square Foot (%)

Site Energy - Temporary Data Flags
Temporary Data Flag - Electricity (Grid Purchase)

Temporary Data Flag - Electricity (On-Site Solar)
Temporary Data Flag - Electricity (On-Site Wind)
Temporary Data Flag - Natural Gas
Temporary Data Flag - Fuel Oil (No. 2)
Temporary Data Flag - District Steam
Temporary Data Flag - Wood
Temporary Data Flag - Propane
Temporary Data Flag - Liquid Propane
Temporary Data Flag - Other
Temporary Data Flag - Kerosene
Temporary Data Flag - Fuel Oil (No. 1)
Temporary Data Flag - Fuel Oil (No. 5 and No. 6)
Temporary Data Flag - Diesel
Temporary Data Flag - Coal (anthracite)
Temporary Data Flag - Coal (bituminous)
Temporary Data Flag - Coke
Temporary Data Flag - Fuel Oil (No. 4)
Temporary Data Flag - District Hot Water
Temporary Data Flag - District Chilled Water

Site Energy - Fuel Totals
Baseline Site Electric Use (kWh)
Baseline Site Natural Gas Use (therms)
Electricity Use (kWh)
Natural Gas Use (therms)
Electricity Use (kBtu)
Natural Gas Use (kBtu)
District Steam Use (kBtu)
Fuel Oil #1 Use (kBtu)
Fuel Oil #2 Use (kBtu)
Fuel Oil #56 Use (kBtu)
Fuel Oil #4 Use (kBtu)
Wood Use (kBtu)
Propane Use (kBtu)
Liquid Propane Use (kBtu)
Other Use (kBtu)
Kerosene Use (kBtu)
Diesel #2 Use (kBtu)
Coal - Anthracite Use (kBtu)
Coal - Bituminous Use (kBtu)
Coke Use (kBtu)
Chilled Water - Electric Driven Use (kBtu)
Chilled Water - Absorption Use (kBtu)
Chilled Water - Engine Driven Use (kBtu)
Chilled Water - Other (kBtu)
District Hot Water (kBtu)

Source Energy
% Difference from National Median Source Energy per Square Foot (%)
Baseline Source Energy Intensity (kBtu/Sq. Ft.)
Baseline Weather Normalized Source Energy Intensity (kBtu/Sq. Ft.)

Current Source Energy Intensity (kBtu/Sq. Ft.)
Current Weather Normalized Source Energy Intensity (kBtu/Sq. Ft.)
National Median Source EUI (kBtu/Sq. Ft.)
Baseline Total Source Energy Use (kBtu)
Current Total Source Energy Use (kBtu)

Space Attributes (Time Weighted) - Bank/Financial Institution
Bank/Financial Institution- Gross Floor Area (Sq. Ft.)
Bank/Financial Institution- Number of PCs
Bank/Financial Institution- Office Air-Conditioned
Bank/Financial Institution- Office Heated
Bank/Financial Institution- PC Density
Bank/Financial Institution- Weekly Operating Hours
Bank/Financial Institution- Workers Density
Bank/Financial Institution- Workers on Main Shift

Space Attributes (Time Weighted) - Courthouse
Courthouse- Gross Floor Area (Sq. Ft.)
Courthouse- Number of PCs
Courthouse- Office Air-Conditioned
Courthouse- Office Heated
Courthouse- PC Density
Courthouse- Weekly Operating Hours
Courthouse- Workers Density
Courthouse- Workers on Main Shift

Space Attributes (Time Weighted) - Data Center
Data Center- Annual IT Energy
Data Center- Cooling Equipment Redundancy
Data Center- Gross Floor Area (Sq. Ft.)
Data Center- IT Energy Configuration
Data Center- UPS System Redundancy
Data Center- PDU Input Energy (kWh)
Data Center- UPS Output Energy (kWh)

Space Attributes (Time Weighted) - Hospital (General Medical and Surgical)
Hospital- Gross Floor Area (Sq. Ft.)
Hospital- Laboratory? (Y=1, N=0)
Hospital- Laundry Facility? (Y=1, N=0)
Hospital- Maximum Number of Floors
Hospital- Number of Buildings
Hospital- Ownership Status
Hospital- Tertiary Care? (Y=1, N=0)
Full-time Equivalent (FTE) Workers
Number of Staffed Beds
Number of MRI Machines

Space Attributes (Time Weighted) - Hotel
Hotel- Average Occupancy (%)

Hotel- Comm Refrig Density
Hotel- Floor Area of Full-service Spas
Hotel- Floor Area of Gym/Fitness Center
Hotel- Gross Floor Area (Sq. Ft.)
Hotel- Hours per Day Guests On-site
Hotel- Number of Commercial Refrigeration/Freezer Units
Hotel- Number of Rooms
Hotel- Number of Guest Meals Served per Year
Hotel- Onsite Laundry (short tons/year)
Hotel- Percent Cooled
Hotel- Percent Heated
Hotel- Presence of Cooking Facilities? (Y=1, N=0)
Hotel- Quantity of Laundry Processed On-site Annually
Hotel- Room Density
Hotel- Workers Density
Hotel- Workers on Main Shift

Space Attributes (Time Weighted) - House of Worship
House of Worship- CommRefrig Density
House of Worship- Gross Floor Area (Sq. Ft.)
House of Worship- Number of Commercial Refrigeration/Freezer Units
House of Worship- Number of PCs
House of Worship- PC Density
House of Worship- Presence of Cooking Facilities? (Y=1, N=0)
House of Worship- Weekly Operating Hours

Space Attributes (Time Weighted) - K-12 School
K-12 School- Gross Floor Area (Sq. Ft.)
K-12 School- High School? (Y=1, N=0)
K-12 School- Number of PCs
K-12 School- Number of Walk-in Refrigeration/Freezer Units
K-12 School- Open Weekends? (Y=1, N=0)
K-12 School- PC Density
K-12 School- Percent Cooled
K-12 School- Percent Heated
K-12 School- Presence of Cooking Facilities? (Y=1, N=0)
K-12 School- School District
K-12 School- Walk-in Refrig Density

Space Attributes (Time Weighted) - Medical Office
Medical Office- Gross Floor Area (Sq. Ft.)
Medical Office- Number of Workers
Medical Office- Percent Cooled
Medical Office- Percent Heated
Medical Office- Weekly Operating Hours

Space Attributes (Time Weighted) - Multifamily Housing
Multifamily Home- Dishwasher Hookups in all Buildings
Multifamily Home- Gross Floor Area (Sq. Ft.)
Multifamily Home- Laundry in Common Area
Multifamily Home- Laundry in Each Unit

Multifamily Home- Number of Floors
Multifamily Home- Number of Units
Multifamily Home- Percent Cooled
Multifamily Home- Percent Heated
Multifamily Home- Percent of Gross Floor Area that is Common Space Only
Multifamily Home- Total Number of Bedrooms
Multifamily Home- Primary Hot Water Fuel Type (for units)
Multifamily Home- Resident Population Type
Multifamily Home- Government Subsidized Housing? (Y=1, N=0)

Space Attributes (Time Weighted) - Municipal Wastewater Treatment Plant
Wastewater- Average Effluent BOD5 Concentration (mg/l)
Wastewater- Average Influent BOD5 Concentration (mg/l)
Wastewater- Average Influent Flow (MGD)
Wastewater- Trickle Filtration Process? (Y=1, N=0)
Wastewater- Nutrient Removal? (Y=1, N=0)
Wastewater- Plant Design Flow Rate (MGD)

Space Attributes (Time Weighted) - Office
Office- Gross Floor Area (Sq. Ft.)
Office- Number of PCs
Office- Office- Air-Conditioned
Office- Office- Heated
Office- PC Density
Office- Weekly Operating Hours
Office- Workers Density
Office- Workers on Main Shift

Space Attributes (Time Weighted) - Other
Other- Gross Floor Area (Sq. Ft.)
Other- Number of PCs
Other- Weekly Operating Hours
Other- Workers on Main Shift
Other Space Type Name

Space Attributes (Time Weighted) - Parking
Parking- Enclosed Floor Area (Sq. Ft.)
Parking- Gross Floor Area (Sq. Ft.)
Parking- Non-Enclosed Floor Area (w/roof) (Sq. Ft.)
Parking- Open Floor Area (w/o roof) (Sq. Ft.)
Parking- Weekly Hours of Access

Space Attributes (Time Weighted) - Residence Hall/Dormitory
Residence Halls/Dormitories- Percent Cooled
Residence Halls/Dormitories- Percent Heated
Residence Halls/Dormitories- Dorm Computer Lab? (Y=1, N=0)
Residence Halls/Dormitories- Dorm Dining Hall? (Y=1, N=0)
Residence Halls/Dormitories- Gross Floor Area (Sq. Ft.)
Residence Halls/Dormitories- Number of Rooms

Space Attributes (Time Weighted) - Retail

Retail- Cash Register Density
Retail- Exterior Entrance to the Public? (Y=1, N=0)
Retail- Gross Floor Area (Sq. Ft.)
Retail- Number of Cash Registers
Retail- Number of PCs
Retail- Number of Open or Closed Refrigeration/Freezer Cases
Retail- Number of Walk-in Refrigeration/Freezer Units
Retail- Open/Closed Refrig Density
Retail- PC Density
Retail- Percent Cooled
Retail- Percent Heated
Retail- Walk-in Refrig Density
Retail- Weekly Operating Hours
Retail- Workers Density
Retail- Workers on Main Shift

Space Attributes (Time Weighted) - Supermarket/Grocery
Supermarkets/Grocery- Gross Floor Area (Sq. Ft.)
Supermarkets/Grocery- Number of Open or Closed Refrigeration/Freezer Cases
Supermarkets/Grocery- Number of Registers and/or Personal Computers
Supermarkets/Grocery- Number of Walk-in Refrigeration/Freezer Units
Supermarkets/Grocery- Percent Cooled
Supermarkets/Grocery- Percent Heated
Supermarkets/Grocery- Presence of Cooking Facilities? (Y=1, N=0)
Supermarkets/Grocery- Walk-in Refrig Density
Supermarkets/Grocery- Weekly Operating Hours
Supermarkets/Grocery- Workers Density
Supermarkets/Grocery- Workers on Main Shift

Space Attributes (Time Weighted) - Swimming Pool
Swimming Pool- Indoor Outdoor
Swimming Pool- Months in Use
Swimming Pool- Size

Space Attributes (Time Weighted) - Warehouse (Refrigerated)
Warehouse (Refrigerated)- Gross Floor Area (Sq. Ft.)
Warehouse (Refrigerated)- Weekly Operating Hours
Warehouse (Refrigerated)- Workers Density
Warehouse (Refrigerated)- Workers on Main Shift

Space Attributes (Time Weighted) - Warehouse (Unrefrigerated)
Warehouse (Unrefrigerated)- Distribution Center? (Y=1, N=0)
Warehouse (Unrefrigerated)- Gross Floor Area (Sq. Ft.)
Warehouse (Unrefrigerated)- Number of Walk-in Refrigeration/Freezer Units
Warehouse (Unrefrigerated)- Percent Cooled
Warehouse (Unrefrigerated)- Percent Heated
Warehouse (Unrefrigerated)- Walk-in Refrig Density
Warehouse (Unrefrigerated)- Weekly Operating Hours
Warehouse (Unrefrigerated)- Workers Density
Warehouse (Unrefrigerated)- Workers on Main Shift

Space Attributes (Time Weighted) - Water Treatment and Distribution Utility
Water Treatment- Total Average Flow (MGD)

Space Attributes (Time Weighted) - Senior Care Facility
Senior Care Facility Gross Floor Area
Senior Care Facility Total Number of Units
Senior Care Facility Average Number of Residents
Senior Care Facility Total Resident Capacity
Senior Care Facility Workers on Main Shift
Senior Care Facility Number of PCs
Senior Care Facility Number of Commercial Refrigeration/Freezer Units
Senior Care Facility Number of Commercial Washing Machines
Senior Care Facility Number of Residential Washing Machines
Senior Care Facility Number of Residential Electronic Lift Systems
Senior Care Facility Percent Cooled
Senior Care Facility Percent Heated

Water
Indoor Water Cost (US Dollars ($))
Indoor Water Use (kGal)
Indoor Water Use per Sq. Ft. (Gal/Sq. Ft.)
Other Water Cost (US Dollars ($))
Other Water Use (kGal)
Outdoor Water Cost (US Dollars ($))
Outdoor Water Use (kGal)
Total Indoor and Outdoor Water Cost (US Dollars ($))
Total Indoor and Outdoor Water Use (kGal)
Wastewater/Sewer Cost (US Dollars ($))
Wastewater/Sewer Use (kGal)
Water Use Alerts

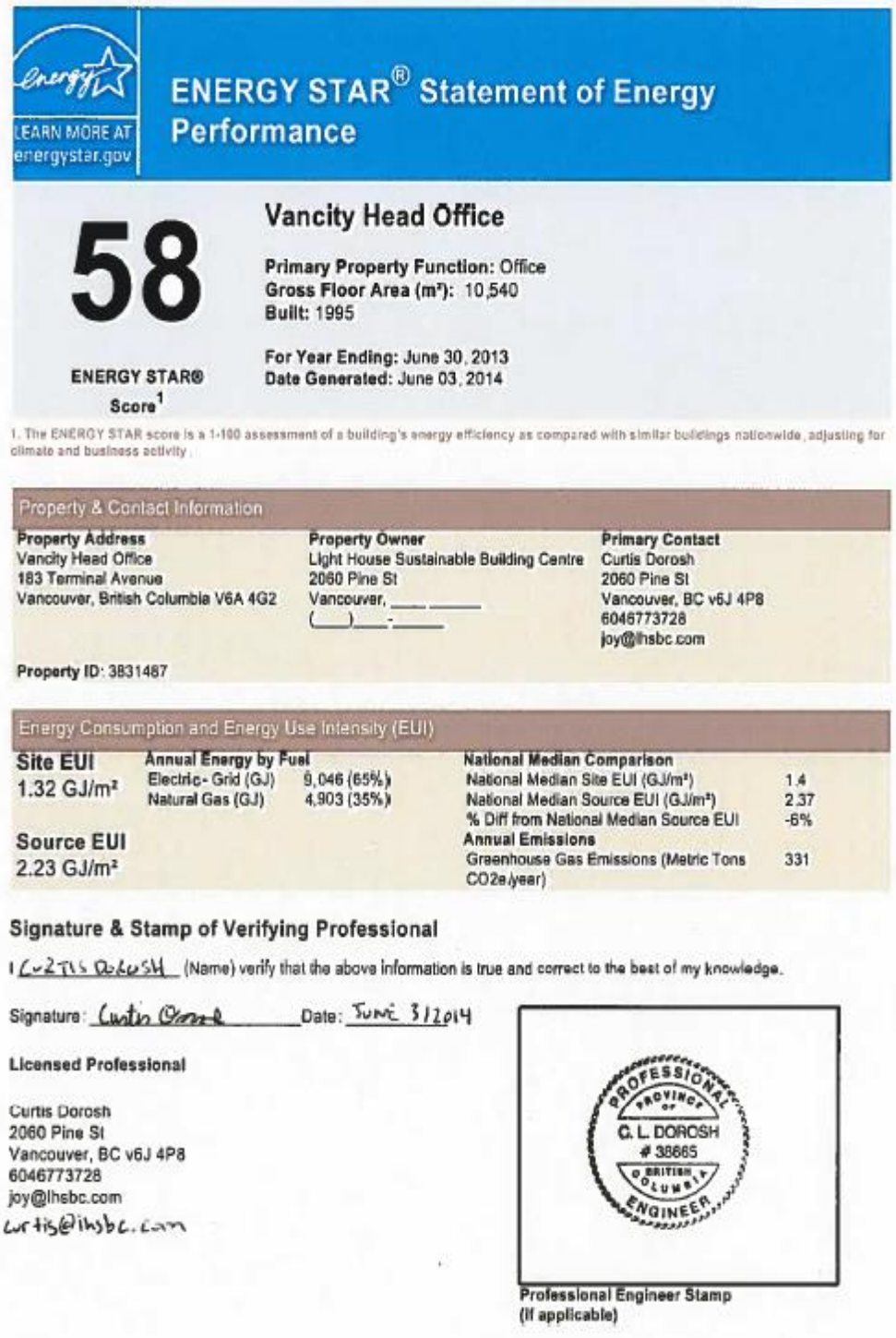
Water Utilities and Wastewater Treatment Facilities
% Difference from National Median Source Energy per Flow (%)
Average Flow (MGD)
Baseline Site Energy per Flow (kBtu/gpd)
Baseline Source Energy per Flow (kBtu/gpd)
Baseline Weather Normalized Source Energy per Flow (kBtu/gpd)
Current Site Energy per Flow (kBtu/gpd)
Current Source Energy per Flow (kBtu/gpd)
Current Weather Normalized Site Energy per Flow (kBtu/gpd)
Current Weather Normalized Source Energy per Flow (kBtu/gpd)
Effluent BOD5 (mg/l)
Influent BOD5 (mg/l)
National Median Site EUI (kBtu/gpd)
National Median Source EUI (kBtu/gpd)
% Difference from National Median Site Energy per Flow (%)

APPENDIX B: RESULTS FROM PORTFOLIO MANAGER

The following table illustrates the capabilities of Portfolio Manager to compare year over year energy data. Portfolio Manager allows users to set a target or a baseline year and then compare year over year to this baseline. This allows energy managers and operators to tracks improvements from energy conservation measures or increases through changes in building occupancy or operation with time.

Metric	Baseline (Dec 2011)	Current (Jun 2013)	Target*	Median Property*
Energy Star score (1-100)	44	58	Not Set	50
Source EUI (GJ/m²)	2.44	2.23	Not Set	2.37
Site EUI (GJ/m²)	1.43	1.32	Not Set	1.40
Source Energy Use (GJ)	25,751.2	23,545.8	Not Set	24,957.7
Site Energy Use (GJ)	15,031.4	13,949.3	Not Set	14,783.1
Energy Cost ($)	48,308.70	43,510.11	Not Set	46,110.97
Total GHG Emissions (Metric Tons CO2e)	342.1	331.3	Not Set	351.1

The Statement of Performance is used to achieve an Energy Star Rating; it is generated by Portfolio Manager and signed by the Licensed Professional.



LEARN MORE AT energystar.gov

ENERGY STAR® Statement of Energy Performance

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ENERGY STAR® Score[1]

Vancity Head Office

Primary Property Function: Office
Gross Floor Area (m²): 10,540
Built: 1995

For Year Ending: June 30, 2013
Date Generated: June 03, 2014

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Vancity Head Office 183 Terminal Avenue Vancouver, British Columbia V6A 4G2	Light House Sustainable Building Centre 2060 Pine St Vancouver, ___ _____ (___)___-_____	Curtis Dorosh 2060 Pine St Vancouver, BC v6J 4P8 6046773728 joy@lhsbc.com

Property ID: 3831487

Energy Consumption and Energy Use Intensity (EUI)

Site EUI	Annual Energy by Fuel		National Median Comparison	
1.32 GJ/m²	Electric - Grid (GJ)	9,046 (65%)	National Median Site EUI (GJ/m²)	1.4
	Natural Gas (GJ)	4,903 (35%)	National Median Source EUI (GJ/m²)	2.37
Source EUI			% Diff from National Median Source EUI	-6%
2.23 GJ/m²			**Annual Emissions**	
			Greenhouse Gas Emissions (Metric Tons CO2e/year)	331

Signature & Stamp of Verifying Professional

I Curtis Dorosh (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: Curtis Dorosh Date: June 3/2014

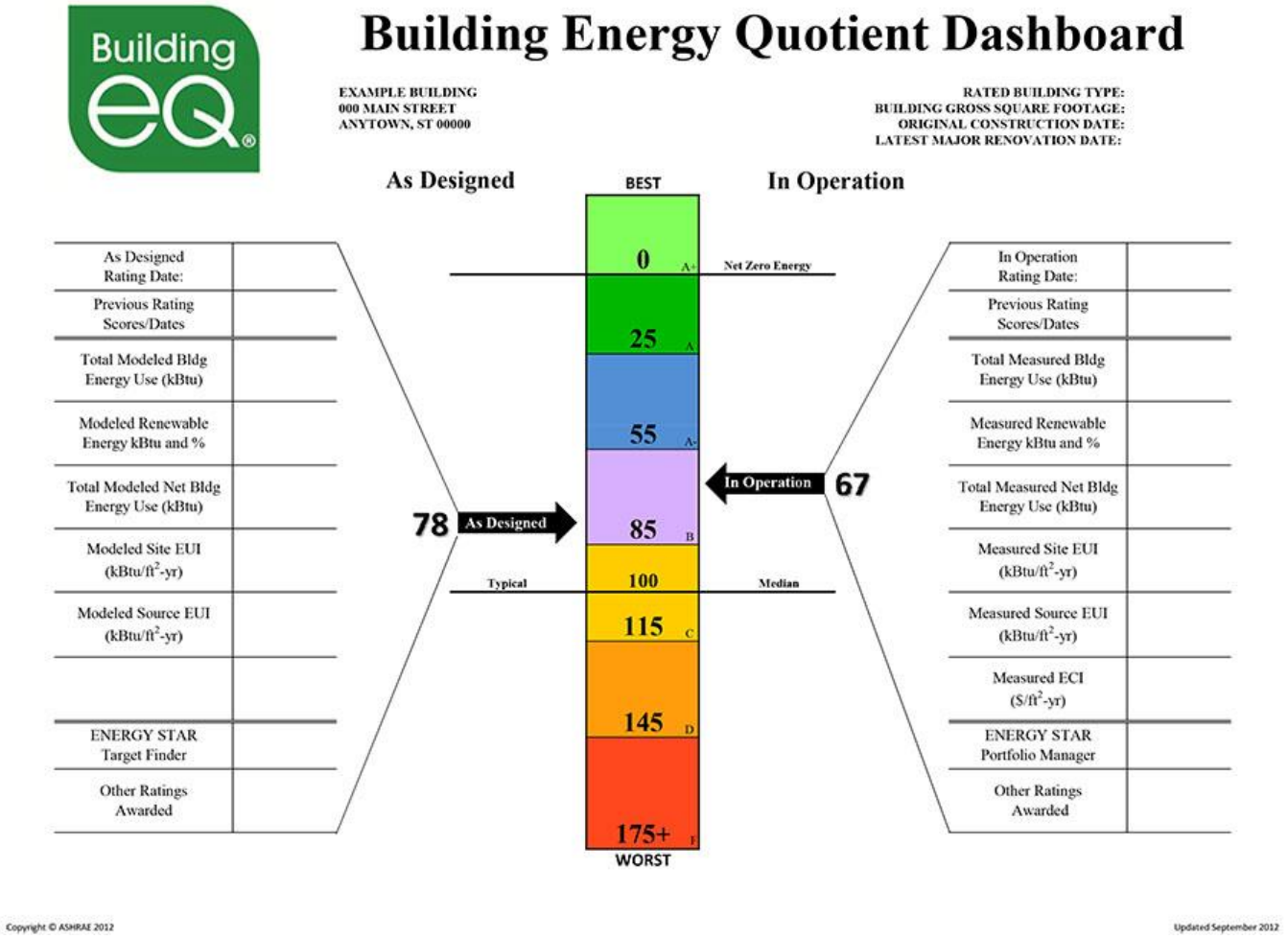
Licensed Professional

Curtis Dorosh
2060 Pine St
Vancouver, BC v6J 4P8
6046773728
joy@lhsbc.com
curtis@lhsbc.com

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — C. L. DOROSH # 38665

Professional Engineer Stamp
(If applicable)

The bEQ rating system awards an A rating for buildings achieving a 0 – 25 score. The calculation to determine a buildings bEQ rating: Source EUI / National Median EUI (from Portfolio Manager) * 100.



APPENDIX C: REGULATORY CONTEXT

Europe

The EU's Energy Performance of Buildings Directive (EPBD 2008) requires all EU Member States to tighten their building energy regulations and to introduce energy certification schemes for buildings. The EPBD mandates that an energy performance certificate (EPC) is to be made available to the owner or by the owner whenever a building is constructed, sold or rented; as well, for buildings with a useful floor area greater than 1,000 sq.m., an EPC is to be publicly displayed.

Australia

Australia's Commercial Building Disclosure (CBD) is a national program managed by the Australian Government and designed to improve the energy efficiency of Australia's large office buildings. Under the *Building Energy Efficiency Disclosure Act 2010*, most sellers or lessors of office space of 20,000 sq. ft. or more are required to obtain and disclose a current Building Energy Efficiency Certificate (BEEC). A BEEC is comprised of:

- A NABERS[23] Energy Star rating for the building.
- An assessment of tenancy lighting in the area of the building that is being sold or leased.
- General energy efficiency guidance.

The Act, implemented through the Commercial Building Disclosure (CBD) program, forms part of a package of measures to encourage building energy efficiency developed by the Australian, state and territory governments.

USA

California passed Assembly Bill 1103 in October 2007. The law requires benchmarking and disclosure for nonresidential buildings involved in a financial transaction, and includes requirements on utilities to help owners by uploading energy consumption data using Energy Star Portfolio Manager.[24]

Washington DC Pursuant to the Clean and Affordable Energy Act enacted in October 2007, Washington DC requires all buildings more than 100,000 sq.ft. to submit their energy use date through Energy Star Portfolio Manager.[25]

Austin, Texas approved the Energy Conservation Audit and Disclosure Ordinance to help meet the goals of the Austin Climate Protection Plan. The Ordinance requires that any commercial facility with a gross floor area greater than 10,000 sq.m. calculate an energy benchmark rating for the facility by June 2014.[26]

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[23] The National Australian Built Environment Rating System (NABERS). (n.d.). *NABERS.* Retrieved August 1, 2010, from www.nabers.com.au/

[24] Building Rating.org. Policy Brief: State of California http://www.buildingrating.org/content/policy-brief-state-california

[25] Building Rating.org. Policy Brief: Washington, D.C. http://www.buildingrating.org/content/policy-brief-washington-dc

Washington State introduced the Efficiency First bill which requires commercial building energy rating and disclosure using Energy Star Portfolio Manager.[27]

New York City approved the Greener, Greater Buildings Plan in December 2009 requiring Energy Star benchmarking and public disclosure using Energy Star Portfolio Manager for public buildings greater than 10,000 sq. ft. and commercial and multifamily buildings greater than 50,000 sq. ft.[28]

Seattle passed an ordinance in January 2010 that requires benchmarking, energy rating and disclosure for nonresidential and multifamily buildings using Energy Star Portfolio Manager; an expansion of the Green Building Capital Initiative to reduce the climate impact from Seattle's building stock.[29]

San Francisco passed the Existing Commercial Buildings Energy Performance Ordinance in February 2011 which requires annual benchmarking using Energy Star Portfolio Manager, periodic energy audits and public disclosure of benchmarking information for nonresidential buildings.[30]

Philadelphia passed the Bill No. 120428 under the Greenworks Philadelphia Plan mandating that all large commercial buildings use Energy Star Portfolio Manager to benchmark and disclose their energy and water use using.[31]

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[26] Government of Austin, Texas, Austin Energy: Energy Conservation Audit and Disclosure Ordinance http://www.austinenergy.com/about%20us/environmental%20initiatives/ordinance/index.htm

[27] Building Rating.org. Policy Brief: Washington State. http://www.buildingrating.org/content/policy-brief-washington-state

[28] Building Rating.org. Policy Brief: New York City. http://www.buildingrating.org/content/policy-brief-new-york-city

[29] Building Rating.org. Policy Brief: Seattle, WA http://www.buildingrating.org/content/policy-brief-seattle-wa

[30] Building Rating.org. Policy Brief: San Francisco. http://www.buildingrating.org/content/policy-brief-san-francisco

[31] Building Rating.org. Policy Brief: Philadelphia. http://www.buildingrating.org/content/policy-brief-philadelphia