Energy Profiles Limited

6880 Financial Drive
GHG Emissions Inventory Report

Prepared for Bentall Kennedy (Canada) LP

November 2013

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EXECUTIVE SUMMARY

6880 Financial Drive, located in Mississauga, Ontario, is applying for LEED Canada Existing Buildings: Operations and Maintenance (LEED EB) certification with the Canada Green Building Council (CaGBC).

This report was prepared by Energy Profiles Limited (EPL) on behalf of Bentall Kennedy (Canada) LP. The purpose of this report is to summarize the GHG emissions generated by 6880 Financial Drive and the measures taken to reduce those emissions.

This report fulfils the requirements for LEED Canada EB: Operations and Maintenance - Credit 6, Energy and Atmosphere: Emissions Reduction Reporting (LEED EAc6), and has been prepared in accordance with ISO 14064-1.

During the LEED Reporting Period (October 1, 2012 – September 30, 2013), 6880 Financial Drive produced a total of 3,472.2 tCO2e of emissions: 1,631.5 tCO2e of Direct (Scope 1) emissions and 1,840.7 tCO2e tons of Energy Indirect (Scope 2) emissions. Non-energy Indirect (Scope 3) emissions were not assessed.

The following table shows a comparison of emissions in the LEED Performance Period vs. the October 1, 2011 – September 30, 2012 Base Year:

Emissions by Scope: Base Year vs. Performance Period

Scope	Base Year (tCO2e)	Performance Period (tCO2e)	Increase vs. Base Year
Direct	1,376.0	1,631.5	255.6
Energy Indirect	1,877.6	1,840.7	-36.9
Total	3,253.6	**3,472.2**	218.6

As per the LEED Canada reporting requirements, Bentall Kennedy (Canada) LP has enrolled in the CSA GHG CleanStart Registry, and the results have been verified by an independent third-party evaluator.

1.0 ORGANIZATIONAL PROFILE

6880 Financial Drive is a "Class A" commercial building located in Mississauga, Ontario, built in 2000. 6880 Financial Drive consists of two identical nine storey office buildings, Tower 1 and Tower 2, with a two storey link between them. The property is leased by a single tenant, Royal Bank of Canada (RBC), and is managed by Bentall Kennedy (Canada) LP.

The gross floor area of the building is 816,858 square feet and is occupied by 6,015 workers. The property also houses enclosed parking totalling 104,795 square feet, and an additional 681,467 square feet of partially enclosed parking.[1]

1.1 Major Energy Consuming Systems

Major energy consuming systems at 6880 Financial Drive are as follows, as described by an Energy Audit[2] completed by Energy Profiles Limited in February 3013 of as part of the LEED EAc6 process:

HVAC General

- *Conditioned fresh air is provided by two supply fans per tower, and a single fresh air fan for the 2nd floor link.*
- *Conditioned fresh air and return air is mixed in mechanical rooms located on each floor, then provided to the office space via compartment units.*
- *Heating is provided by boilers.*
- *Cooling is provided by chillers/cooling towers.*
- *Waterside free cooling is implemented during non-summer months with two heat exchangers per tower.*

Controls

- *The building uses a Siemens Apogee Building Automation System (BAS) with DDC controls*
- *The BAS controls compressor stations, boilers, chillers/cooling towers, supply fans, compartment units, fan power boxes, exhaust fans and lights.*
- *It also stores trend data, and monitors alarms.*

1 Energy Star Statement of Energy Performance for Year Ending September 2013 (Halsall Associates, 2013)
2 ASHRAE Level II Energy Management Review (Energy Profiles Limited, 2013)

Heating

Tower 1 & 2:

- *Five 6,000 MBH modulating Cleaver-Brooks atmospheric boilers; per tower*
- *The primary loop serves the two fresh air fans; per tower.*
- *The constant temperature secondary loop serves basement unit heaters, entrance heaters, cafeteria fan coil units, unit heaters, and miscellaneous air handling units.*
- *The variable temperature secondary loop serves perimeter fan powered boxes and ground floor radiation system.*

Cooling

Tower 1 & 2:

- *Three York centrifugal chillers operating in parallel at each building; 600 tons each in Tower 1, 500 tons each in Tower 2.*
- *Four BAC single cell cooling towers with VFD controls; per Tower.*
- *The chilled water loop serves fresh air fans, compartment units, and miscellaneous supply fans within their respective Tower.*

Domestic Hot Water

- *Tower 1: two natural gas HWTs.*
- *Tower 2: two natural gas HWTs.*
- *Two-storey link washrooms: two natural gas HWTs.*
- *Cafeteria: two natural gas HWTs.*
- *Supplementary: four natural gas HWTs (2 per Tower).*

Lighting

- *Majority of the interior lighting is provided by 2 x 4ft 32W T8 fluorescent lamps.*
- *Lobby lighting provided by compact fluorescent and LED lamps.*
- *Underground garage/parkade lighting provided by 80W induction lamps.*
- *Above ground exterior lighting provided by 100W/120W induction lamps.*
- *Majority of interior lighting is controlled by zones and time-of-day schedules through BAS.*
- *Majority of exterior lighting is controlled by photo-sensors.*

2.0 INVENTORY DESIGN AND DEVELOPMENT

2.1 Organizational Boundaries

The organizational boundaries for this project were set using the control approach, using the operational control criteria as defined by the GHG Protocol:

> *Operational Control. A company has operational control over an operation if the former or one of its subsidiaries (see Table 1 for definitions of financial accounting categories) has the full authority to introduce and implement its operating policies at the operation. This criterion is consistent with the current accounting and reporting practice of many companies that report on emissions from facilities, which they operate (i.e., for which they hold the operating license). It is expected that except in very rare circumstances, if the company or one of its subsidiaries is the operator of a facility, it will have the full authority to introduce and implement its operating policies and thus has operational control.*

In the case of 6880 Financial Drive, Bentall Kennedy (Canada) LP is considered to have operational control over building systems, though it is noted that building tenants may also influence how the building is operated.

2.2 Operational Boundaries

This report includes Direct (Scope 1), Energy Indirect (Scope 2) emissions at 6880 Financial Drive, as follows:

Emission Sources by Scope

Direct/Indirect	Scope	Emission Source	End Use
Direct	1	Refrigerants	Space cooling
Direct	1	Diesel	Emergency backup generation
Direct	1	Natural Gas	Space heating, domestic water heating
Energy Indirect	2	Electricity	Lighting, HVAC, space cooling, plug load, etc.

No Non-energy Indirect (Scope 3) emissions are included in the scope of this project as these are not required to be included for LEED EAc6.

No combustion of biomass or GHG removals occur at 6880 Financial Drive. GHG sinks are not applicable to this inventory.

3.0 QUANTIFICATION OF GHG EMISSIONS

Measuring GHG emissions directly is cost prohibitive for a project of this size. Therefore, in keeping with industry best practices, GHG emissions have been quantified using the following formula for each GHG source identified in Section 3.2.1:

GHG Emissions = Activity Data (consumption) X Emission Factor

3.1 Activity Data

The following subsections describe the sources of the activity data used.

3.1.1 Electricity

Electricity is purchased for 6880 Financial Drive from Enersource Hydro Mississauga via a single metered electricity service. Building level electricity consumption was obtained directly from the utility bills. Billed electricity consumption is detailed in Appendix A.

3.1.2 Natural Gas

Natural gas is purchased for 6880 Financial Drive from Enbridge via a two metered gas services. Natural gas consumption was obtained directly from the utility bills. Billed natural gas consumption is detailed in Appendix A.

Note that Enbridge's meter reading dates do not always coincide exactly with the reported base period and performance period, nor are the reading dates identical for both accounts. Consumption for the first and last month of the base period and performance period may therefore be adjusted to ensure that the total number of days billed matches the number of days in the reported periods.

3.1.3 Diesel Fuel

Diesel fuel is consumed by four emergency generators at 6880 Financial Drive. Fuel consumption was estimated based on payments made for diesel fuel during the base year and performance period, and corresponding commodity costs. The following table details the attributes of the diesel generators on site:

Generator Attributes

Attribute	Generator			
	1	2	3	4
Description	Generator 1	Generator 2	Generator 3	Generator 4
Make/Model	Caterpillar / 3512B	Caterpillar / 3512B	Caterpillar / 3512B	Caterpillar / 3512B
Generator rated kW	1500	1500	1500	1500

The following table summarizes diesel activity data for 6880 Financial Drive:

Diesel Fuel Activity Data

Year	Total Cost of Fuel	Avg. Price ($/l, incl tax)	Fuel Consumption (l)
Base Year	$31,800	1.58	10,084
Performance Period			10,084

3.1.4 Refrigerants

Refrigerants are found in 6 chillers at 6880 Financial Drive, all of which are maintained regularly. Actual leakage rates are not available, so leakage rates have been estimated based of 2% of the charge capacity, as per LEED EB credit Ac5[3], for all units.

The following table summarizes refrigerant activity data for 6880 Financial Drive:

Cooling Equipment Containing Refrigerants

Building	Unit(s)	# of Units	Refrigerant	Charge Capacity (lb/unit)	Estimated Leakage Rate	Leakage (lbs)	Leakage (kg)
Tower 1	York 600 Ton YKEBEDH5-CTES	3	R-134A	1400	2%	84.0	38.1
Tower 2	York 500 Ton YKEDDDH4-CRES	3	R-134A	1400	2%	84.0	38.1
Totals		6				168.0	76.2

Refrigerant leakage was assumed to be equal in the Base Year and Performance Period.

3 Canada Green Building Council, LEED Canada for Existing Buildings: Operations and Maintenance 2009 Rating System, 2009, page 322.

3.2 GHG Emission Factors and Global Warming Potentials (GWPs)

The following tables provide the GHG emissions factors and GWPs used in this report:

GHG Emission Factors with Sources

GHG Source	CO2	CH4		N20		Factor	Units	Factor Source
	gCO2	gCH4	gCO2e	gN2O	gCO2e			
Electricity	97	0.02	0.42	0.00	0.62	98	gCO2e /kWh	National Inventory Report (1990-2011) Greenhouse Gas Sources and Sinks in Canada
Natural Gas	1,879	0.04	0.78	0.04	10.85	1,891	gCO2e /m3	National Inventory Report (1990-2011) Greenhouse Gas Sources and Sinks in Canada
Diesel Fuel	2,663	0.1330	2.79	0.400	124	2,790	gCO2e /l	National Inventory Report (1990-2011) Greenhouse Gas Sources and Sinks in Canada

Note that, as per the GHG Protocol, the electricity emission factors used do not account for emissions due to transmission and distribution.

Global Warming Potentials

Emission Type	GWP (gCO2e/g)	Source
CO2	1	National Inventory Report (1990-2011) Greenhouse Gas Sources and Sinks in Canada
CH4	21	National Inventory Report (1990-2011) Greenhouse Gas Sources and Sinks in Canada
N20	310	National Inventory Report (1990-2011) Greenhouse Gas Sources and Sinks in Canada
HFC-134a	1,300	ISO 14064-1 Part 1: Specification with guidance at the organization level for quantification and reporting of GHG emissions and removals, Annex C, 2006

4.0 GHG INVENTORY COMPONENTS

4.1 Base Year and Reporting Period

A base year of October 1, 2011 – September 30, 2012 was selected for this project, in keeping with LEED submission requirements.

The LEED performance period for the project is October 1, 2012 – September 30, 2013.

4.1.1 Base Year Recalculation Policy

Bentall Kennedy (Canada) LP commits to recalculating baseline activity data and emissions in subsequent GHG inventories to account for the following factors, as per ISO 14064:

a) Changes to operational boundaries
b) Changes to the ownership and control of GHG sources or sinks transferred into or out of organizational boundaries
c) Changes to GHG quantification methodologies that result in significant changes to quantified GHG emissions or removals.

The base-year GHG inventory will not be recalculated to account for changes in facility use or occupancy.

4.2 Activity Data

The following table summarizes the activity data for the base year and performance period, as described in Section 4.1:

Activity Data: Base Year vs. Performance Period

Activity	Base Year	Performance Period	Increase vs. Base Year
Electricity (kWh)	19,151,363	18,774,488	-376,874
Natural Gas (m3)	660,533	795,707	135,174
Diesel (l)	10,072	10,072	0
HFC-134a (kg)	76.2	76.2	0

It should be noted that the significant increase in natural gas consumption in the performance period vs. the base year is largely attributed to colder winter weather during the performance period.

4.3 GHG Emissions and Removals: Performance Period vs. Base Year

The following table details GHG emissions during the project's Performance Period vs. the Base year, by emission source:

Emissions by Source: Base Year vs. Performance Period

Emission Souce	Base Year (tCO2e)	Performance Period (tCO2e)	Increase vs. Base Year
Electricity (kWh)	1,877.6	1,840.7	-36.9
Natural Gas (m3)	1,248.8	1,504.4	255.6
Diesel (l)	28.1	28.1	0
HFC-134a	99.1	99.1	0
Total	3,253.6	**3,472.2**	218.6

The following table details GHG emissions during the project's Performance Period vs. the Base year, by scope:

Total Emissions by Scope: Base Year vs. Performance Period

Scope	Base Year (tCO2e)	Performance Period (tCO2e)	Increase vs. Base Year
Direct	1,376.0	1,631.5	255.6
Energy Indirect	1,877.6	1,840.7	-36.9
Total	3,253.6	**3,472.2**	218.6

The following table details direct GHG emissions during the project's Performance Period vs. the Base Year, by GHG type:

Direct Emissions by GHG Type: Base Year vs. Performance Period

GHG Type	Base Year (tCO2e)	Performance Period (tCO2e)	Increase vs. Base Year
CO2	1,268.0	1,522.0	254.0
CH4	0.5	0.6	0.1
N2O	8.4	9.9	1.5
Refrigerants	99.1	99.1	0.0
Total	1,376.0	**1,631.5**	255.6

The following table details energy indirect GHG emissions during the project's Performance Period vs. the Base Year, by GHG type:

Energy Indirect Emissions by GHG Type: Base Year vs. Performance Period

GHG Type	Base Year (tCO2e)	Performance Period (tCO2e)	Increase vs. Base Year
CO2	1,857.7	1,821.1	-36.6
CH4	8.0	7.9	-0.2
N2O	11.9	11.6	-0.2
Total	1,877.6	1,840.7	-36.9

The following table details total GHG emissions during the project's Performance Period vs. the Base year, by GHG Type:

Total Emissions by GHG Type: Base Year vs. Performance Period

GHG Type	Base Year (tCO2e)	Performance Period (tCO2e)	Increase vs. Base Year
CO2	3,125.6	3,343.1	217.4
CH4	8.6	8.5	-0.1
N2O	20.3	21.5	1.2
Refrigerants	99.1	99.1	0
Total	3,253.6	3,472.2	218.6

4.4 Organizational Activities to Reduce GHG Emissions

Bentall Kennedy (Canada) LP has an ongoing initiative to improve the energy performance of 6880 Financial Drive and thus reduce their GHG emissions.

Building operations staff conducted a recommissioning study at 6880 Financial Drive site in 2011-2012 covering all mechanical systems. Many operational improvements were made during this time, including the addition of VSDs, CO_2 controls, schedules for exhaust fans and a night set back on all floors.

An ASHRAE Level II Energy Audit was completed in February 2013 recommending further opportunities. Implementation of the following measures from this audit are in progress or planned for future years:

1. Base Building Lighting Retrofit to include a fully addressable system complete with motion detection and daylight harvesting (in progress)
2. Washroom and Loading Dock Occupancy Sensors (2014)
3. Cafeteria Lighting Upgrade to LED pot lights (2014)
4. VSDs on Primary Hot Water Loop Pump Motors (2015)
5. VSDs on Secondary Constant Hot Water Loop Pump Motors (2015)

4.5 Certainty

The following table shows the level of certainty in the activity data and emission factors used in preparing the 6880 Financial Drive emissions inventory. Note that the combined emissions from natural gas and electricity account for over 96% of total emissions. As such, the overall certainty of this emission inventory is considered to be high.

Certainty of Emissions Calculations by Emission Source

Emission Source	Certainty		
	Activity Data	Emission Factor	Explanation
Natural Gas	High	High	Consumption is measured via revenue grade meters by Enbridge. The emission factor is consistent with published values from multiple sources.
Refrigerants	Low	High	Refrigerant leakage data is not measured. The emission factors are published by the U.S. Department of Energy.
Diesel	Low	High	Consumption is estimated based on total diesel costs and average commodity rates. The emission factor is consistent with published values from multiple sources.
Electricity	High	High	Consumption is measued via a revenue grade meter by Enersource. The emission factor is published by Environment Canada.

5.0 GHG INVENTORY QUALITY MANAGEMENT

5.1 GHG Data Management

6880 Financial Drive's GHG Inventory is updated on an ongoing basis by EPL as part of Bentall Kennedy (Canada) LP's ongoing utility tracking initiatives via the following process:

- Utility bills and submeter data are provided to EPL by Bentall Kennedy (Canada) LP on a monthly basis.
- Utility data is verified and entered into a database by EPL
- Anomalies or inconsistencies in utility data are investigated by EPL to ensure data quality
- Emission factors are updated annually by EPL by based on the most recent National Inventory Report

5.2 Roles and responsibilities

The following roles and responsibilities have been assigned to ensure completeness, accuracy and continuity in GHG reporting at 6880 Financial Drive in accordance to ISO 14064-1.

Responsibility:	Delivery of utility bills to EPL
Owner:	Lello Gugliucciello
Role:	Property Manager
Company:	Bentall Kennedy (Canada) LP
Responsibility:	Verify and enter utility data into EPL database; Investigate data anomalies/inconsistencies
Owner:	Natasha Condic
Role:	Data Integrity and Support
Company:	Energy Profiles Limited
Responsibility:	Update emission factors and prepare emissions reports
Owner:	Conan O'Connor, P. Eng., LEED AP
Role:	Senior Energy Strategist
Company:	Energy Profiles Limited

Responsibility:	Verify that GHG reports meet ISO 14064 requirements for the CleanStart Registry
Owner:	Evan Jones
Role:	Independent Verifier
Company:	3P Analysis and Consulting

5.3 Document Retention and Record Keeping

Monthly utility bill and emissions data from 2007 forward is retained on EPL's database on a secure server with full redundancy. Annual emission reports are archived for future reference.

6.0 VERIFICATION ACTIVITIES

Third party verification of this GHG inventory has been completed by Evan Jones of 3P Analysis and Consulting in accordance with ISO 14064-3-06 and LEED EB EAc6.

APPENDIX A DETAILED GHG DATA FOR UTILITIES

Electricity Consumption and Emissions

Performance Period

Start Date	End Date	Consumption (kWh)	Emissions (tCO2e)			
			CO2	CH4	N2O	Total
1/10/2012	31/10/2012	1,578,005	153.1	0.7	1.0	154.7
1/11/2012	30/11/2012	1,502,626	145.8	0.6	0.9	147.3
1/12/2012	31/12/2012	1,499,309	145.4	0.6	0.9	147.0
1/1/2013	31/1/2013	1,567,574	152.1	0.7	1.0	153.7
1/2/2013	28/2/2013	1,357,186	131.6	0.6	0.8	133.1
1/3/2013	31/3/2013	1,506,055	146.1	0.6	0.9	147.7
1/4/2013	30/4/2013	1,548,658	150.2	0.7	1.0	151.8
1/5/2013	31/5/2013	1,587,670	154.0	0.7	1.0	155.7
1/6/2013	30/6/2013	1,569,511	152.2	0.7	1.0	153.9
1/7/2013	31/7/2013	1,753,004	170.0	0.7	1.1	171.9
1/8/2013	31/8/2013	1,719,907	166.8	0.7	1.1	168.6
1/9/2013	30/9/2013	1,584,982	153.7	0.7	1.0	155.4
Total		18,774,488	1,821.1	7.9	11.6	1,840.7

Base Year

Start Date	End Date	Consumption (kWh)	Emissions (tCO2e)			
			CO2	CH4	N2O	Total
1/10/2011	31/10/2011	1,638,427	158.9	0.7	1.0	160.6
1/11/2011	30/11/2011	1,589,283	154.2	0.7	1.0	155.8
1/12/2011	31/12/2011	1,577,501	153.0	0.7	1.0	154.7
1/1/2012	31/1/2012	1,603,295	155.5	0.7	1.0	157.2
1/2/2012	29/2/2012	1,467,309	142.3	0.6	0.9	143.9
1/3/2012	31/3/2012	1,600,744	155.3	0.7	1.0	156.9
1/4/2012	30/4/2012	1,518,490	147.3	0.6	0.9	148.9
1/5/2012	31/5/2012	1,567,896	152.1	0.7	1.0	153.7
1/6/2012	30/6/2012	1,617,219	156.9	0.7	1.0	158.6
1/7/2012	31/7/2012	1,749,380	169.7	0.7	1.1	171.5
1/8/2012	31/8/2012	1,690,204	163.9	0.7	1.0	165.7
1/9/2012	30/9/2012	1,531,615	148.6	0.6	0.9	150.2
Total		19,151,363	1,857.7	8.0	11.9	1,877.6

Natural Gas Consumption and Emissions

Performance Period

Start Date	End Date	Consumption (m^3)	Emissions (tCO2e)			
			CO2	CH4	N2O	Total
1/10/2012	31/10/2012	59,618	112.0	0.0	0.6	112.7
1/11/2012	30/11/2012	77,731	146.1	0.1	0.8	147.0
1/12/2012	31/12/2012	125,177	235.2	0.1	1.4	236.7
1/1/2013	31/1/2013	182,762	343.4	0.1	2.0	345.5
1/2/2013	28/2/2013	126,177	237.1	0.1	1.4	238.6
1/3/2013	31/3/2013	116,783	219.4	0.1	1.3	220.8
1/4/2013	30/4/2013	54,150	101.7	0.0	0.6	102.4
1/5/2013	31/5/2013	23,416	44.0	0.0	0.3	44.3
1/6/2013	30/6/2013	6,671	12.5	0.0	0.1	12.6
1/7/2013	31/7/2013	4,581	8.6	0.0	0.0	8.7
1/8/2013	31/8/2013	4,942	9.3	0.0	0.1	9.3
1/9/2013	30/9/2013	13,699	25.7	0.0	0.1	25.9
Total		795,707	1,495.1	0.6	8.6	1,504.4

Base Year

Start Date	End Date	Consumption (m^3)	Emissions (tCO2e)			
			CO2	CH4	N2O	Total
1/10/2012	31/10/2012	46,802	87.9	0.0	0.5	88.5
1/11/2012	30/11/2012	78,003	146.6	0.1	0.8	147.5
1/12/2012	31/12/2012	135,156	254.0	0.1	1.5	255.5
1/1/2013	31/1/2013	133,172	250.2	0.1	1.4	251.8
1/2/2013	28/2/2013	121,923	229.1	0.1	1.3	230.5
1/3/2013	31/3/2013	59,536	111.9	0.0	0.6	112.6
1/4/2013	30/4/2013	46,926	88.2	0.0	0.5	88.7
1/5/2013	31/5/2013	7,272	13.7	0.0	0.1	13.7
1/6/2013	30/6/2013	4,543	8.5	0.0	0.0	8.6
1/7/2013	31/7/2013	4,165	7.8	0.0	0.0	7.9
1/8/2013	31/8/2013	4,283	8.0	0.0	0.0	8.1
1/9/2013	30/9/2013	18,752	35.2	0.0	0.2	35.5
Total		660,533	1,241.1	0.5	7.2	1,248.8