

APPENDIX 2D

ENERGY

1. INTERPRETATION	1
1.1 Definitions	1
2. ENERGY SUPPLY AND CONSUMPTION	3
2.1 Energy Supply and Payment	3
2.2 Energy Incentive Programs	3
2.3 Recording and Monitoring of Weather Data and Energy Consumption	4
2.4 Energy Consumption Certificate	5
3. DESIGN AND CONSTRUCTION ENERGY GUARANTEE	5
3.1 Facility to Meet or Beat Design and Construction Energy Target	5
3.2 Monitoring of Energy Consumption	5
3.3 Adjustment to Energy Consumption	5
3.4 Failure to Achieve Design and Construction Energy Target	6
4. ANNUAL ENERGY TARGETS	6
4.1 Energy Monitoring Model	6
4.2 Annual Energy Target	7
4.3 Adjustment to Annual Energy Target	7
5. SHARING GAIN AND PAIN	7
5.1 Average Unit Cost	8
5.2 Energy Gainshare	8
5.3 Energy Painshare	8
5.4 Calculation and Invoicing	8
6. CONTENT AND FORMAT OF THE ENERGY ANALYSIS REPORT	8
6.1 Energy Analysis Report	8
7. ENVIRONMENTAL CREDITS	9
7.1 Entitlement to Environmental Credits	9
8. HOT WATER RETURN	10
8.1 Hot Water Return Temperature	10

ATTACHMENT 1 ENERGY MODEL ASSUMPTIONS

APPENDIX 2D

ENERGY

1. INTERPRETATION

1.1 Definitions

In this Appendix, in addition to the definitions set out in Schedule 1 of this Agreement:

“Annual Energy Target” for an Energy Year means the amount determined pursuant to Section 4.2 of this Appendix, as adjusted pursuant to Section 4.3 of this Appendix;

“Average Unit Cost” for an Energy Year means the average cost to Project Co or the Authority, as the case may be, of each MWh of Energy purchased by Project Co or the Authority for the Facility during that Energy Year, calculated in accordance with Section 5.1 of this Appendix;

“CaGBC Experienced Modellers List” means the most recent version of the Canada Green Building Council’s Experienced Modellers List;

“Cooling Degree Days” for a period means the figure obtained or calculated from the Site Weather Data setting out the extent to which the average outdoor temperature during that period at the Site was greater than a mean temperature of +18 degrees Celsius;

“Core Hours” means 24 hours per day, 7 days per week;

“Design and Construction Energy Target” means MWh per year;

“Energy” means electrical and thermal energy used within the Facility;

“Energy Analysis Report” means the report referred to as the “Energy Analysis Report” in Section 6.1 of this Appendix;

“Energy Consumption” for a period means the total amount of Energy consumed at the Facility during that period, expressed in MWh as reflected by the readings for the metered utilities and as calibrated by the Independent Energy Consultant;

“Energy Dashboard” means a password protected web-accessible tool that can display real time (with up to 2 days lag time) energy consumption for a range of time increments (including hourly, daily, monthly, and yearly) and broken down by energy type (electrical and thermal at a minimum) and major end uses, with comparison to the Annual Energy Target;

“Energy Gainshare” means the amount calculated in accordance with Section 5.2 of this Appendix;

“Energy Model” means an hourly energy simulation produced using whole building energy modelling software;

“Energy Monitoring Model” means a tool or combination of tools (such as an Energy Model and a spreadsheet tool) designed to enable transparent adjustment of energy consumption data to reflect

changes in weather, occupancy patterns, and other variables affecting energy consumption as set out in Section 4.1 of this Appendix;

“Energy Painshare” means the amount calculated in accordance with Section 5.3 of this Appendix;

“Energy Utility” means each different type of energy that is purchased or produced for use in the Facility (and may include electricity from BC Hydro, hot water/steam (including from a district energy system) and natural gas from FortisBC);

“Energy Year” means:

- (a) the 12 month period beginning on the day after the Monitoring Period;
- (b) each subsequent period of 12 months during the Term; and
- (c) the period of less than 12 months from the end of the previous Energy Year to the Termination Date;

“Environmental Credit” means any income, credit, right, benefit or advantage relating to environmental matters including type and level of emissions, means of production of Energy, input sources and compliance with any environmental laws, regulations, rules or orders;

“Facility Operation Variances” means any material variances between the actual occupancy and usage of the Facility and the assumptions for occupancy and usage set out in the Design and Construction Specifications, the Reviewed Drawings and Specifications and the Proposal Extracts (Design and Construction) regarding the occupancy and usage of the Facility;

“Heating Degree Days” for a period means the figure obtained or calculated from the Site Weather Data setting out the extent to which the average outdoor temperature during that period at the Site was less than a mean temperature of +18 degrees Celsius;

“Independent Energy Consultant” means one or more individuals who are listed on the CaGBC Experienced Modellers List and are engaged to complete the adjustments to the energy target, as described in Section 3.3 of this Appendix, to prepare an Energy Monitoring Model during the Monitoring Period, as described in Section 4.1 of this Appendix, and, if required, to determine whether and to what extent the Annual Energy Target should be adjusted to reflect the effect of non-compliance with the Energy Management Plan, as described in Section 4.3 of this Appendix;

“Megawatt hour”, or **“MWh”**, is the unit of energy to be used throughout this Appendix 2D and 1 MWh is equivalent to 3.6 GJ;

“Monitoring Period” means the period commencing on the Service Commencement Date and ending on the last day of the calendar month in which the second anniversary of the Service Commencement Date occurs;

“Non-Targeted Energy Consumption” means energy consumed by the Facility excluding energy consumed by Targeted Energy Components;

“Portfolio Manager” means the ENERGY STAR® Portfolio Manager™, an interactive energy management tool that allows tracking and assessment of facility energy and water consumption in a secure online environment;

“Site Weather Data” means the weather data for the location most applicable to this site (Vancouver International Airport) obtained from (or calculated based on) Environment Canada’s “National Climate Data and Information Archive”;

“Targeted Energy Components” means all:

- (a) hardwired lighting including exterior lighting;
- (b) elevators;
- (c) HVAC systems and mechanical equipment including pumps, fans, chillers, heaters, boilers, humidifiers, steam generators, and fan heaters; and
- (d) any other components that the Parties agree to add from time to time;

but excludes process loads (gas or electrical), HVAC systems and mechanical equipment required for conditioning and/or make-up air for process loads including fume hoods, kilns, forges, dust collectors, paint or drying booths, kitchen equipment, and kitchen exhaust hoods;

“Targeted Energy Consumption” means Energy Consumption minus Non-Targeted Energy Consumption, such consumption to be calculated from the applicable BMS and metering systems;

“Test Period” means the 12 month period commencing on the first day of the first complete calendar month that is at least 6 months after the Service Commencement Date; and

“Weather Data” means the data obtained from Environment Canada’s “National Climate Data and Information Archive” including but not limited to daily temperature.

2. ENERGY SUPPLY AND CONSUMPTION

2.1 Energy Supply and Payment

The Authority will from time to time as required enter into contracts with Energy suppliers for the supply of Energy to the Facility, and will be responsible for all payments related to such contracts. Without limiting Project Co’s obligations in Appendix 4G [Utility Management Services], Project Co will administer such contracts, including dealing with suppliers to resolve issues from time to time, and will provide such other reasonable assistance related to such contracts as may be requested by the Authority.

2.2 Energy Incentive Programs

Project Co will, on behalf of the Authority, apply to the BC Hydro Power Smart New Construction Program (and any other applicable energy incentive programs) and take all reasonable steps to obtain for the Authority the maximum benefits (funding, incentives and cost savings) offered by BC Hydro and FortisBC under such program(s). The New Construction Program is administered by BC Hydro and supported by FortisBC. Without limitation, Project Co will:

- (a) meet with BC Hydro, the Authority's representative, and FortisBC (if necessary) at an early stage of the design of the Facility;
- (b) by a date to be mutually agreed by the Authority and Project Co after consultation with BC Hydro, prepare and deliver to BC Hydro and the Authority the proposal required by BC Hydro for the energy studies and building Energy Model described in Section 2.2(c) of this Appendix 2D;
- (c) within 30 Business Days of acceptance of the proposal by BC Hydro, carry out any required energy studies and prepare and deliver to the Authority and BC Hydro a building Energy Model (developed in accordance ASHRAE Standard 90.1, 2010, Appendix G, or applicable codes at the time of application to BC Hydro) to establish baseline energy use for the purpose of measuring electrical and natural gas savings achieved through the program, with such building Energy Model to be fully compatible with BC Hydro's software and accepted by BC Hydro as compliant;
- (d) collaborate with BC Hydro and FortisBC to identify potential improvements to the Facility design that will achieve greater energy efficiency;
- (e) revise the Facility design as required to improve energy efficiency (to the extent possible without materially changing the Design and Construction Specifications or the intent of the Proposal Extracts (Design and Construction), and in compliance with the Reviewed Drawings and Specifications unless otherwise agreed by the Authority), and use all reasonable efforts to obtain for the Authority the maximum funding or incentives offered by BC Hydro and FortisBC and minimize the Authority's energy costs during the Operating Period; and
- (f) provide to the Authority all invoices and other documentation reasonably required by the Authority to complete an incentive agreement with BC Hydro and for the Authority to receive incentive funds within the time frame agreed to in the incentive agreement;

2.3 Recording and Monitoring of Weather Data and Energy Consumption

Project Co will:

- (a) install equipment to record and monitor consumption of each type of Energy in the Facility. Such equipment must be suitable and properly calibrated to enable a detailed monitoring of Energy trends and consumption to allow analysis of the data collected to enable various matters, including:
 - (1) comparisons to be made with the declared energy targets;
 - (2) early warning of malfunctions and deviations from norms; and
 - (3) provide an Energy Dashboard to the Authority.

- (b) secure all such properly recorded information so that it is not lost or degraded as a result of any equipment or service malfunctions, and will secure such information from any adjustment, modification or loss from any source.

2.4 Energy Consumption Certificate

Promptly after the end of each month following the Service Commencement Date, Project Co will deliver to the Authority a certificate showing for the Facility:

- (a) the Energy Consumption for that month with respect to:
 - (1) Energy Consumption;
 - (2) Targeted Energy Consumption; and
 - (3) Non-Targeted Energy Consumption;
- (b) the peak demand date and hour;
- (c) the Weather Data for that month, including the number of Cooling Degree Days and Heating Degree Days;
- (d) a complete set of data as required for monthly uploads to Portfolio Manager;
- (e) a record of the latest period Portfolio Manager energy performance score (out of 100)
- (f) building occupancy; and
- (g) any other variable that affects the Energy Consumption relative to the energy model assumptions set out in Attachment 1 to this Appendix.

3. DESIGN AND CONSTRUCTION ENERGY GUARANTEE

3.1 Facility to Meet or Beat Design and Construction Energy Target

Project Co warrants to the Authority that the Facility will be designed and constructed so that the Targeted Energy Consumption per year will not exceed the Design and Construction Energy Target. The consequences to Project Co for breach of this warranty are limited to those set out in Section 3.4 of this Appendix.

3.2 Monitoring of Energy Consumption

During the Monitoring Period and the Test Period, Project Co and the Authority will monitor Energy Consumption in order to determine the Energy Consumption and the Targeted Energy Consumption for the Monitoring Period and the Test Period.

3.3 Adjustment to Energy Consumption

Within 2 years after Service Commencement, Project Co will engage an Independent Energy Consultant acceptable to the Authority, acting reasonably, to determine whether and to what extent the Energy

Consumption for the Test Period should be adjusted based on factors which, in the energy consultant's professional opinion, are applicable, including actual climate conditions, occupancy, equipment use and Authority controlled effects during the Test Period, and differ from the factors taken into account in the energy model assumptions set out in Attachment 1 to this Appendix.

A more detailed methodology for this adjustment will be developed to the satisfaction of the Authority, Project Co and the Independent Energy Consultant and may use the energy model used to develop the Design and Construction Energy Target and/or another analytical tool. The detailed methodology will include a simplified summary of inputs, assumptions, and changes reasonably required by each party for purposes of clearly explaining the adjustments.

3.4 Failure to Achieve Design and Construction Energy Target

If the Targeted Energy Consumption in the Test Period (as may be adjusted pursuant to Section 3.3 of this Appendix) exceeds the Design and Construction Energy Target, then Project Co will do one of the following:

- (a) modify the Facility as required so that annual Targeted Energy Consumption does not exceed the Design and Construction Energy Target, subject to compliance with the Design and Construction Specifications and the approval of such modifications by the Authority, not to be unreasonably withheld or delayed; or
- (b) pay to the Authority a lump sum amount that the Authority agrees, acting reasonably, represents the lesser of \$750,000 and the net present value of the cost to the Authority during the expected life of the Facility of the amount by which Targeted Energy Consumption will exceed the Design and Construction Energy Target, on the assumption that the excess in the Monitoring Period will continue for the balance of the expected life of the Facility, and if this Section 3.4(b) is applied the provisions of Schedule 9 [Compensation on Termination] will be amended as necessary to ensure that the Authority will not, as a consequence of the application of this Section 3.4(b), face any additional liability upon early termination of this Agreement.

4. ANNUAL ENERGY TARGETS

4.1 Energy Monitoring Model

During the Monitoring Period, Project Co will engage an Independent Energy Consultant to prepare for the Authority's review and approval, not to be unreasonably withheld or delayed, a model (the "**Energy Monitoring Model**") that is able from time to time to be updated to determine:

- (a) the expected annual Total Energy Consumption and Targeted Energy Consumption for the ensuing 5 year period based on a pre-determined set of inputs (including actual temperatures and consumption):
 - (1) for the first 5 year period after the Monitoring Period, the Monitoring Period; and
 - (2) for each subsequent 5 year period, the immediately preceding 5 year period; and

- (b) the effect on annual Targeted Energy Consumption if actual annual average temperatures and the number of Cooling Degree Days and Heating Degree Days are higher or lower than during the previous year.

4.2 Annual Energy Target

The Annual Energy Target for the Energy Years after the Monitoring Period will be the expected annual Targeted Energy Consumption determined as follows:

- (a) for the first five years after the Monitoring Period, the expected annual Targeted Energy Consumption will be as determined by the Energy Monitoring Model at the end of the Monitoring Period;
- (b) at the end of each five Energy Year period after the Monitoring Period, Project Co will update the Energy Monitoring Model using the Weather Data and other applicable data that has been approved by the Authority from such five year period; and
- (c) for each of the five Energy Years after the Energy Monitoring Model is updated the expected annual Targeted Energy Consumption will be as determined by the updated Energy Monitoring Model, as adjusted pursuant to Section 4.3.

4.3 Adjustment to Annual Energy Target

The Annual Energy Target for that Energy Year will be adjusted to reflect the Weather Data and Core Hours within that year. The methodology for adjusting the Annual Energy Target will be agreed upon by Project Co, the Authority, and the Independent Energy Consultant at the end of the Monitoring Period. The pre-determined process will involve updating specific inputs (including Weather Data and Core Hours) in the Energy Monitoring Model.

In addition, the parties will monitor compliance with the Energy Management Plan referred to in Section 3.13 of Schedule 4 [Services Protocols and Specifications] at each meeting of the Operating Period Joint Committee. Where either Project Co or the Authority does not comply with the Energy Management Plan, then the Annual Energy Target will be adjusted by an appropriate amount to reflect the effect of non-compliance. Where the parties are unable to agree on the appropriate amount of such adjustment, Project Co will engage an Independent Energy Consultant acceptable to Project Co and the Authority, acting reasonably, to determine, within 2 months after such engagement, whether and to what extent the Annual Energy Target should be adjusted.

5. SHARING GAIN AND PAIN

The Authority may, at any time during the Contract, elect to develop a revised mechanism for sharing gain and pain, acceptable to Project Co, to facilitate a streamlined approach to energy management and to foster an effective partnership between the Authority and Project Co. Project Co is encouraged to submit a proposal to the Authority for any modification that would achieve the goal of minimizing energy consumption and the Authority's overall energy costs in accordance with Section 4 (Innovation Proposals) of Schedule 6 [Changes, Minor Works and Innovation Proposals].

5.1 Average Unit Cost

The Average Unit Cost for an Energy Year will be the amount obtained by dividing:

- (a) all amounts paid or payable by Project Co or the Authority in respect of the supply of the Energy in that Energy Year for the Energy Consumption; by
- (b) the Energy Consumption for that Energy Year.

5.2 Energy Gainshare

The Energy Gainshare for an Energy Year will be the lesser of:

- (a) 50% of the product of:
 - (1) the amount, if any, by which the Targeted Energy Consumption in that Energy Year is less than 98% of the Annual Energy Target for that Energy Year; and
 - (2) the Average Unit Cost for that Energy Year; and
- (b) \$25,000.

5.3 Energy Painshare

The Energy Painshare for an Energy Year will be the lesser of:

- (a) 50% of the product of:
 - (1) the amount, if any, by which the Targeted Energy Consumption in that Energy Year is greater than 102% of the Annual Energy Target for that Energy Year; and
 - (2) the Average Unit Cost for that Energy Year; and
- (b) \$25,000.

5.4 Calculation and Invoicing

Project Co will submit to the Authority for each Energy Year, Project Co's calculation of the Average Unit Cost and Energy Gainshare or Energy Painshare as soon as practicable, and in any event within 20 Business Days after the receipt of the last invoice containing information on all Energy use during that Energy Year. Any unresolved dispute about such calculations will be resolved in accordance with the Dispute Resolution Procedure.

6. CONTENT AND FORMAT OF THE ENERGY ANALYSIS REPORT

6.1 Energy Analysis Report

The Energy Analysis Report will present findings of actual consumption for each separate Energy Utility for the relevant Contract Year. The parties will agree upon the exact form of the Energy Analysis Report from time to time but as a minimum the Energy Analysis Report will include the following.

- (a) For each Payment Period (within 10 Business Days of the end of the Payment Period):
- (1) the Targeted Energy Consumption in MWh and the Targeted Energy Consumption in MWh for each Energy Utility and each major end use in that month (including lighting, heating, cooling, pumps, and fans, or a more detailed end use breakdown);
 - (2) the Non-Targeted Energy Consumption in MWh for each type of Energy in that month;
 - (3) the consumption data for all other Utilities;
 - (4) Weather Data for that month;
 - (5) a record of the latest period Portfolio Manager energy performance score (out of 100)
 - (6) a complete set of data as required for monthly uploads to Portfolio Manager
 - (7) Facility Operation Variances; and
 - (8) any other variable that affects the Targeted Energy Consumption relative to the energy model assumptions.
- (b) For each Contract Year (within 20 Business Days after the receipt of the last invoice containing information on all Energy use during that Contract Year):
- (1) all of the items reported for each Payment Period in Section 6.1(a), but for the Contract Year;
 - (2) a record of the annual Portfolio Manager energy performance score (out of 100)
 - (3) a calculation showing Energy Painshare or Energy Gainshare (if applicable); and
 - (4) a revised Energy Monitoring Model showing the Annual Energy Target for the upcoming Contract Year.

7. ENVIRONMENTAL CREDITS

7.1 Entitlement to Environmental Credits

The Authority will be entitled to any and all Environmental Credits related to the Facility and its operation and Project Co will use commercially reasonable efforts to assist the Authority in achieving the maximum Environmental Credits available.

8. HOT WATER RETURN

8.1 Hot Water Return Temperature

The Authority will provide district heating service to the Facility as per Section 5.6.1.2 of Schedule 3 [Design and Construction Specifications] and Section 1.2.2.1(5) of Schedule 4 [Services Protocols and Specifications].

Project Co will ensure that the maximum hot water return temperature satisfies the City of Vancouver's Neighbourhood Energy Connectivity Standards Design Guidelines (available online at <http://vancouver.ca/files/cov/neighbourhood-energy-design-guidelines.pdf>). Refer to the latest edition for heat exchanger secondary sizing and temperature approach. Project Co will be solely responsible for all costs, liabilities and obligations imposed by the City of Vancouver for failure to meet all ongoing requirements, including hot water return temperature requirements.

ATTACHMENT 1

ENERGY MODEL ASSUMPTIONS

Project Co used the following energy model methodology and assumptions to determine the Design and Construction Energy Target:

- (a) identify the energy consumption by fuel type, i.e. electricity, thermal (steam or hot water), fuel oil, on-site renewable;
- (b) include a summary table of major assumptions and values utilized in modelling the Facility (including an explanation for assumptions that deviate from the defaults provided);
- (c) use modelling procedures for the Facility in accordance with applicable modelling protocols of the Canada Green Building Council Leadership in Energy and Environmental Design (LEED);
- (d) to ensure comparable simulations while allowing flexibility in modeling approach, use the default assumptions shown in the following table to determine operating parameters for the various spaces, unless other Authority-provided data contradicts these assumptions, or where knowledge or experience dictate that a different assumption would better reflect actual operating conditions;
- (e) use the appropriate combination of individual space type categories and grouped space type categories in the table below to define the inputs to best represent the Facility design based on the particular zoning strategy and modeling approach used; and
- (f) identify specific room requirements that may affect energy consumption.

Modeling Assumptions

Task Lighting		As per ASHRAE 90.1-1999 Section 9.3 and 9.3.1 or MNECB Section 4.3.1.2	
Domestic Hot Water		ASHRAE 90-1-1999 or MNEBC	
Lighting		Determine lighting space functions for the Reference Case in accordance with ASHRAE 90.1-1999 or MNECB	
Scheduled Space	Design Occupancy	Operating Schedule As per <u>MNECB Performance Compliance for Buildings</u> Table 4.3.2.C	Equipment Power (Plug Load) As per <u>MNECB Performance Compliance for Buildings</u> Table 4.3.2.B

Utility Rooms	0	(Note 1)	Storage / Warehouse: Active Storage, Fine
Electrical / Mechanical Rooms	0	(Note 1)	Service and Common: Mechanical / electrical room
Corridors	30 m ² per person	Operating Schedule H	Service and Common: Corridors
Meeting Rooms, Offices, & Admin. Areas	20 m ² per person	Operating Schedule A	Office: Category 1 (Enclosed offices)
Other Public Spaces, including Atria and Lobbies	10 m ² per person	Operating Schedule H	Assembly: Lobby
Small videoconference rooms and medium videoconference room	Based on intended use	Operating Schedule B	Assembly: Conference / Meeting
Lecture theatre Videoconference Rooms	Based on intended use	Operating Schedule B	Education: Classroom

Note 1: Operating Schedule to be the same as the adjacent area in the most similar thermal zone.