

## APPENDIX 2C

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### ATTACHMENT 1 ENERGY MODEL ASSUMPTIONS

## APPENDIX 2C

### ENERGY

#### 1. ENERGY SUPPLY AND CONSUMPTION

##### 1.1 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 Schedule 4 [Services Protocols and Specifications], 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.

##### 1.2 Recording and Monitoring of Weather Data and Energy Consumption

Project Co will collect Weather Data for the Facility from the Site Weather Monitoring Station and will install equipment to record and monitor consumption of each type of Energy in the Facility which will:

- (a) be suitable and properly calibrated to enable the Authority to undertake real time:
  - (1) collection and monitoring of:
    - (A) Energy trends, including current and historic Energy consumption;
    - (B) consumption of all Utilities, with energy end uses broken down by heating, cooling, heat-rejection, pumps, fans, interior lighting, exterior lighting, hot-water and equipment loads, and including domestic hot and cold water consumption; and
    - (C) all applicable weather data from the Site Weather Monitoring Station;
  - (2) analysis of the data collected, including:
    - (A) graphical comparisons to:
      - (i) historical (year over year) consumption;
      - (ii) weather data;
      - (iii) utility bills;
      - (iv) consumption against declared energy targets; and
      - (v) energy cost by end use against declared energy targets;
    - (3) provide early warning of malfunctions and deviations from norms;
    - (4) be provided in a readable and editable format consistent with industry practice; and

- (5) be remotely accessible by the Authority through a web-based browser and portable devices such as smartphones;
- (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.

### **1.3 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 per energy source in Gigajoules for that month organized by;
  - (1) total Energy Consumption;
  - (2) Targeted Energy Consumption, organized by Targeted Electricity Consumption and Targeted Gas Consumption;
  - (3) Non-Targeted Energy Consumption, organized by Non-Targeted Electricity Consumption and Non-Targeted Gas Consumption;
  - (4) metered electrical and Thermal Energy output from cogeneration;
- (b) the peak demand date and hour;
- (c) the Weather Data for that month, including the number of Heating Degree Days and Cooling Degree Days;
- (d) building occupancy, which will be determined jointly by the Authority and Project Co based on Authority records and Project Co recorded data; and
- (e) any other variable that affects the Energy Consumption relative to the energy model assumptions set out in Attachment 1 to this Appendix.

## **2. DESIGN AND CONSTRUCTION ENERGY GUARANTEES**

### **2.1 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 for the Monitoring Period and the Test Period.

### **2.2 Adjustment to Targeted Energy Consumption**

Within 2 years after Service Commencement, Project Co and the Authority will engage an Independent Energy Consultant to review Energy Consumption data gathered during the Test Period and determine whether and to what extent the Targeted Energy Consumption should be adjusted based on factors which, in the Independent Energy Consultant's professional opinion, are applicable, including actual

climate conditions, occupancy, equipment use and Authority controlled effects during the Test Period that differ from the factors taken into account in the energy model assumptions set out in Attachment 1 to this Appendix. Project Co and the Authority will share equally in the cost of the Independent Energy Consultant. The adjusted Targeted Energy Consumption for the Test Period is referred to in this Appendix as the “**Adjusted Targeted Energy Consumption**”.

### **2.3 Failure to Achieve Adjusted Targeted Energy Consumption**

If the Targeted Energy Cost during the Test Period exceeds the Design and Construction Energy Cost Target, then Project Co will do one of the following:

- (a) modify the Facility as required so that annual Targeted Energy Cost will not exceed the Design and Construction Energy Cost 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 \$1,000,000 and the net present value of the cost to the Authority during the 30 year Operating Period of the amount by which Targeted Energy Cost during the Test Period exceeds the Design and Construction Energy Cost Target (calculated by applying an annual discount rate of 3.8% and the Service Commencement Date as the discounting base date), on the assumption that the excess in the Test Period will continue for the balance of the expected life of the Facility, and if this Section 2.3(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 2.3(b), face any additional liability upon early termination of this Agreement.

## **3. ANNUAL ENERGY TARGETS**

### **3.1 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**”) for the Facility that is able from time to time to be updated to determine:

- (a) the expected annual Energy Consumption, Targeted Electricity Consumption and Targeted Gas Consumption for the ensuing 5 year period for the Facility based on a pre-determined set of inputs (including actual temperatures and consumption) in:
  - (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 Electricity Consumption and Targeted Gas Consumption for the Facility if the actual annual average temperatures are higher or lower than during the previous year.

### 3.2 Annual Energy Targets

The Annual Electricity Target and Annual Gas Target for the Facility for the Energy Years after the Monitoring Period will be the expected annual Targeted Electricity Consumption and Targeted Gas Consumption, respectively, determined as follows:

- (a) for the first five years after the Monitoring Period, the expected annual Targeted Electricity Consumption and Targeted Gas 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 and re-run 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 and re-run the expected annual Targeted Electricity Consumption and Targeted Gas Consumption will be as determined by the updated and re-run Energy Monitoring Model, as adjusted pursuant to Section 3.3.

### 3.3 Adjustment to Annual Energy Targets

If the temperature set out in the Weather Data for an Energy Year as measured by the Site Weather Monitoring Station is different from the temperature used in the Energy Monitoring Model to set the Annual Energy Targets for that Energy Year for the Facility, or if there is a significant change to the operating hours of the Facility described in the Clinical Specifications, then the Annual Energy Targets for that Energy Year will be appropriately adjusted to reflect such variances.

In addition, the parties will monitor compliance with the Energy Management Plan referred to in Section 3.6 of Schedule 4 [Services Protocols and Specifications] at each meeting of the Operating Period Joint Committee. If:

- (a) either Project Co or the Authority does not comply with the Energy Management Plan, then the Annual Energy Targets for the relevant Facility will be appropriately adjusted by to reflect the effect of non-compliance; and
- (b) the parties are unable to agree on the appropriate 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 Targets for the Facility should be adjusted.

## 4. SHARING GAIN AND PAIN

### 4.1 Average Unit Cost

In respect of the Facility:

- (a) the “**Average Electricity Unit Cost**” for an Energy Year will be the amount obtained by dividing:

- (1) all amounts paid or payable by Project Co or the Authority in respect of the supply of the electrical Energy in that Energy Year for the Energy Consumption in the Facility; by
- (2) the electricity energy consumed for that Energy Year in the Facility.
- (b) the “**Average Gas Unit Cost**” for an Energy Year will be the amount obtained by dividing:
  - (1) all amounts paid or payable by Project Co or the Authority in respect of the supply of natural gas Energy in that Energy Year for the Energy Consumption in the Facility; by
  - (2) the natural gas energy consumed for that Energy Year in the Facility.

#### 4.2 Energy Gainshare

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

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

#### 4.3 Energy Painshare

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

- (a) the sum of:
  - (1) 50% of the product of:
    - (A) the amount, if any, by which the Targeted Electricity Consumption in that Energy Year for the Facility is greater than of the Annual Electricity Target for that Energy Year for the Facility; and

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

#### **4.4 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 and Energy Painshare for the Facility basis 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. Within 30 Business Days of the delivery of such calculation, Project Co will pay the Energy Painshare (if any) to the Authority and the Authority will pay the Energy Gainshare (if any) to Project Co.

### **5. ENVIRONMENTAL CREDITS**

#### **5.1 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.

## ATTACHMENT 1

### ENERGY MODEL ASSUMPTIONS

#### 1. General Requirements Of Energy Models And Simulations

Project Co will use one of the following eligible energy modelling software tools for its energy model (the “Energy Model”):

- (a) eQUEST;
- (b) Energy Plus;
- (c) DOE 2.1e; or
- (d) EE4.

Project Co will use a single energy modelling software at all stages of the Project.

Project Co may:

- (a) use additional supplementary software tools, such as RetScreen or Excel, in conjunction with one of the above eligible energy modelling software tools; and
- (b) modify the underlying simulation code for the purposes of modeling systems and energy efficiency measures not managed by the modelling software, in which case Project Co will fully describe and justify any such changes to the Authority.

Project Co will retain an individual on the CaGBC Experienced Modellers List to prepare the Energy Model.

#### 2. Energy Model Assumptions

Project Co will use the following energy model assumptions to determine the Design and Construction Energy Target:

- (a) Take-Offs:
  - (1) Use interior wall dimensions for determining building areas. Wall heights will be full floor-to-floor height. Window areas will represent the total area of the rough opening.
- (b) Location and Weather Files:
  - (1) Set “Saskatoon, Saskatchewan” as the selected location and use the associated EE4 default weather file.
- (c) Occupancy Load and Operating Schedules:



- (1) Occupancy schedules will be in accordance with the assumptions outlined in Appendix 3A [Clinical Specifications], including the 'Hours of Operation' stated throughout the document and Attachment 1 [Staffing Model] to Appendix 3A [Clinical Specifications]. Where a range of occupancy is stipulated, use the highest value.
- (d) Fan Schedules:
- (1) For all zones, fans schedules are to be set to "on" for all occupied hours (i.e. schedule value equals 100% for all occupied hours)
- (e) Cooling Thermostat Setpoint Schedules:
- (1) Set cooling thermostat set-point schedules for all zones at 24°C unless otherwise specified in Schedule 3 [Design and Construction Specifications]. Apply this setting for all hours.
  - (2) Model zones without cooling based on a cooling thermostat set-point schedule set to 99°C for all hours.
  - (3) Where modeled zones contain spaces with different cooling set-points (based on the requirements set out in Schedule 3 [Design and Construction Specifications]), model the zone using the set-point for the space requiring the lowest set-point temperature.
  - (4) For the purposes of these simulations, "set-back" of cooling temperatures (e.g. during unoccupied hours) is not permitted.
- (f) Heating Thermostat Set Point Schedules:
- (1) Set heating thermostat set-point schedules for all zones at 22°C unless otherwise specified in Schedule 3 [Design and Construction Specifications]. Apply this setting for all hours.
  - (2) Where modeled zones contain spaces with different heating set-points (based on the requirements set out in Schedule 3 [Design and Construction Specifications]), model the zone using the set-point for the space requiring the highest set-point temperature.
  - (3) For the purposes of these simulations, "set-back" of heating temperatures (e.g. during unoccupied hours) is not permitted.
- (g) Lighting, Receptacle, and Service Water Heating ("SWH") Schedules:
- (1) For all zones, set the lighting schedules to the best matching NECB Schedule based on space function.

- (2) Determine the service water load for the Facility utilizing tables in the NECB, 2011 Version.
  - (3) Community Reintegration Units: Receptacles shall be assumed to require 5 W/m<sup>2</sup> of power and shall follow NECB Fractional Operating Schedule 'G' Receptacles. Service water heating shall follow MNECB Fractional Operating Schedule 'G' Hot Water.
  - (4) Main Facility: Receptacles shall be assumed to require 1 W/m<sup>2</sup> of power and shall follow NECB Fractional Operating Schedule 'C' Receptacles. Service water heating shall follow NECB Fractional Operating Schedule 'C' Hot Water.
  - (5) Regional Administration: Receptacles shall be assumed to require 1 W/m<sup>2</sup> of power and shall follow NECB Fractional Operating Schedule 'G' Receptacles. Service water heating shall follow NECB Fractional Operating Schedule 'G' Hot Water.
  - (6) Energy Centre: Receptacles shall be assumed to require 2.5 W/m<sup>2</sup> of power and shall follow NECB Fractional Operating Schedule 'H' Receptacles. Service water heating shall follow NECB Fractional Operating Schedule 'H' Hot Water.
- (h) Equipment Loads:
- (1) Use equipment information to model the effect of equipment on energy usage and, if the equipment is located within the conditioned building envelope, any effects on interior heat gain. Plug, non-regulated loads, or process loads for equipment located outside of the building envelope are to be calculated separately if not supported as an exterior load within the modelling environment. Any energy cost savings claimed for plug, non-regulated loads, or process loads, must be substantiated by comparison against a recognized third party standard, for example the most current ASHRAE 90.1 standard for exterior lighting or Energy Star Minimums for computer equipment. Include all annual energy consumption resulting from equipment loads in the model used to determine the Design and Construction Energy Target. Include such loads in the model used to assess effects on the Design and Construction Energy Target, while not necessarily forming part of the Design and Construction Energy Target.
  - (2) The process cooling load shall be modeled at 100%, 24 hours per day, 7 days per week, assuming the following:
    - (A) main computer room: 75kW;
    - (B) UPS/battery chargers: 50kW;
    - (C) TR/LV closets: 15kW; and
    - (D) elevators/elevator machine rooms 10kW;

- (3) Community Reintegration Units: Equipment shall follow MNECB Fractional Operating Schedule 'G' Receptacles.
  - (4) Main Facility: Equipment shall follow NECB Fractional Operating Schedule 'C' Receptacles.
  - (5) Regional Administration: Equipment shall follow NECB Fractional Operating Schedule 'G' Receptacles.
  - (6) Energy Centre: Equipment shall follow NECB Fractional Operating Schedule 'H' Receptacles.
- (i) Ventilation Rates:
- (1) The Design will comply with current ASHRAE Standard 62 or superseding standard ventilation requirements as required.
  - (2) The ventilation rates will be the same in the proposed and reference cases except as follows. Designs that utilize excessive ventilation rates (i.e. 20% or more above the required rates as defined in ASHRAE 62 or superseding standards) will be modeled with the energy penalty described in NRCan's "Modeling Guide for EE4 Version 1.7" (February 2008)".
  - (3) Demand controlled ventilation (DCV) will only be used as an energy efficiency measure where permitted. Model designs using DCV in accordance with the CaGBC's "LEED Canada 2009 Supplementary Energy Modelling Guidelines".
- (j) Windows, Glazing, Curtainwall and Spandrel Walls
- (1) In accordance NRCan's "Modeling Guide for EE4 Version 1.7" (February 2008)", the U-value for windows, glazing, curtainwall or spandrel walls must include the thermal bridging impacts of framing.
- (k) Motor Power:
- (1) Modelling of motors must include total power requirements and not brake power.
- (l) Fixed Parameters:
- (1) lighting area factor (must be 1.00);
  - (2) desired winter temperature;
  - (3) desired summer temperature; and
  - (4) any EE4 inputs marked by the "non-compliance input" symbol (i.e. red circle and slash).

eQUEST or other software inputs will follow the same intent as EE4 fixed parameters.

(m) Miscellaneous Modeling Requirements:

- (1) Where redundant equipment capacity has been provided, only model or calculate for the number of pieces of equipment intended to operate under normal conditions.
- (2) For simulation purposes only, no zone is permitted to have unmet heating or cooling load hours in excess of 100 per year (excluding zones with no cooling requirements)
- (3) Include fuel usage associated with statutory testing of the emergency generators.
- (4) Assume that all laundry machines will operate for eight (8) full loads daily on all days of the year. The Authority will provide load counters with the laundry machines for use by the Independent Energy Consultant for the purposes of Section 3 of this Appendix.
- (5) Assume that the Kitchen will serve three meals daily on all days of the year.