Multifamily Energy Model Simulation Guidelines for Canada ACP – NECB 2011

Simulation Software

All LEED Multifamily Midrise projects are required to use simulation software that complies with the requirements in ASHRAE Standard 90.1-2010, Section G2.2. This includes the ability to perform hourly simulations, taking into account variations in occupancy, lighting, thermostat settings, etc.
ASHRAE 90.1-2010 G2.2 includes various stipulations for the simulation software. Section G2.2.1 requires that a qualified simulation program explicitly model all of the following:

- 8,760 hours per year;
- Hourly variations in occupancy, lighting power, miscellaneous equipment power, thermostat setpoints, and HVAC system operation;
- thermal mass effects;
- ten or more thermal zones;
- part-load performance curves for mechanical equipment;
- capacity and efficiency correction curves for mechanical heating and cooling equipment;
- air-side economizers with integrated control; and
- baseline building design characteristics specified in ASHRAE 90.1–2010, Section G3.

Qualified, commonly used modeling software for National Energy Code for Buildings (NECB) 2011 includes – but is not limited to – the following: DOE-2-based modeling programs (CAN-Quest, eQuest, EnergyPro, VisualDOE), HAP, TRACE, VisualDOE, EnergyPro, EnergyGauge, and EnergyPlus.

See ‘Submittal Documentation’ for the submittal requirements particular to a subset of different software pieces.

Residential Simulation Guidelines for Canada ACP - NECB

This section provides mandatory modeling guidelines for multifamily projects. These guidelines are designed to supplement the procedures in NECB 2011 Part 8 of Division B and the Canada ACP - NECB, with the interest of providing clarification and consistency in the modeling process.

Proposed Design	Baseline Design
Building Envelope	
Proposed design envelope components shall reflect the full assembly U-value, rather than a point U-value, taking into account thermal bridging. Thermal properties of the proposed design envelope to be determine in accordance with NECB 2011 Subsection 3.1.1 of Division B. All penetrations including those for balconies should be accounted for in the assembly U-value. Refer to the Canada ACP - NECB for further guidance.	Per NECB 2011 Part 3 Building Envelope of Division B.
	The envelope U-factor shall not be adjusted to account for HVAC envelope penetrations.
	Doors within the proposed design that are more than 50% glass shall be treated as 100% vertical fenestration within the baseline design. Doors within the proposed design that are 50% or less glass shall be treated as opaque doors within the baseline design.
Lighting	
In-unit lighting shall be included in the performance rating calculations and based on hard-wired lighting fixtures. Lighting energy savings credit may be claimed for reduced power density only if the fixtures are capable of meeting the recommended light	In-unit lighting shall be included in the performance rating calculations, and the baseline design LPD shall be set as 5 W/m^2.

Proposed Design	Baseline Design
levels for the given space type, per the IESNA Lighting Handbook. For areas without hard-wired fixtures, or areas that do not meet the IESNA lighting levels, the LPD shall be set as equal to the baseline design LPD. Modeled lighting power must include power consumed by the ballasts as well as the bulbs. Fixtures with screw-based sockets may be modeled based on the actual installed lights, *not the maximum labeled wattage for that fixture,* on the condition that they are visually verified by a third-party rater.	
Corridors, stairwells, and lobbies shall be modeled as lit for 24 hours/day. Other non-unit spaces shall be modeled as lit to reflect the automatic control requirements in NECB 2011 Subsection 4.2.2 of Division B. Modelers are encouraged, but not required, to use NECB 2011 default schedules for these other non-unit spaces. Garage lighting shall be modeled as lit for 18 equivalent full load hours per day, to reflect the garage lighting control requirement in 90.1-2010 Section 9.4.1.3. As per the Canada ACP - NECB, ASHRAE 90.1-2010 mandatory requirements must be met.	Lighting schedules shall be set equal to those in the proposed design.
Credit for automatic control devices shall be reflected in the proposed design lighting power density calculations, (not schedules), per the following: • Corridors – 25% power adjustment reduction • Stairwells – 35% power adjustment reduction • Lobbies – 10% power adjustment reduction	No adjustment should be made to schedules or LPD values based on lighting controls.

Proposed Design	Baseline Design
• All other – use power adjustment reductions in accordance with appropriate Control Adjustment Factor from NECB 2011 Section 4.3 of Division B. No adjustment should be made for spaces where lighting controls are already required by NECB 2011 Subsection 4.2.2 of Division B. Credit is only available for sensors that reduce lighting to zero power within 30 minutes of all occupants leaving the zone. As per the Canada ACP - NECB, ASHRAE 90.1-2010 mandatory requirements must be met.	
Exterior Lighting	
Exterior lighting is divided into allowances for tradable and nontradable surfaces. No credit may be taken for lighting reductions on nontradable surfaces.	A lighting power allowance cannot be claimed in the baseline design for surfaces that are not provided with lighting in the proposed design, and allowances cannot be double-counted for different exterior surfaces that overlap (for example, walkways through uncovered parking areas).
Façade and landscape lighting shall be modeled as lit for no more than 6 hours/day, to reflect ASHRAE Std. 90.1-2010 Section 9.4.1.7, part (b). All other exterior lighting shall be modeled as lit for 6 hours/day at 70% power and no more than 6 hours/day at full power, to reflect the requirements in 90.1-2010 Section 9.4.1.7. As per the Canada ACP - NECB, ASHRAE 90.1-2010 mandatory requirements must be met.	Lighting schedules shall be set equal to those in the proposed design.
If private balconies are specified with lighting, they shall be modeled as lit for 2-3 hours per day.	Private balconies shall be modeled using the same schedule as used in the proposed design. Private balconies can be treated as Tradable, using “Other doors”, or as Nontradable, using “Building façades”.

<table>
<tr><th>Proposed Design</th><th>Baseline Design</th></tr>
<tr><td colspan="2">HVAC</td></tr>
<tr><td></td><td>As per NECB 2011 Table 8.4.4.8.B of Division B, for baseline HVAC systems serving dwelling units, outside air requirements shall be met by a ventilation system identical to the proposed building’s ventilation system.

Where dwelling units are being served by a central MAU, baseline systems shall be “identical” to the proposed systems as follows:
• Same delivery temperature, but fan power set based on fan power requirements as per NECB 2011 Sentence 8.4.4.19(3) of Division B
• Same heating source (hot water, furnace, electric, heat pump)
• Same cooling source (chilled water, DX, none)

Where dwelling units have ventilation provided by suite-level ventilation systems (such as an in-suite HRV or unit ventilator), baseline systems shall provide ventilation directly to the zone with a separate fan that meets the fan power requirements of NECB 2011 Sentence 8.4.4.19(3) of Division B.

In all cases, heat recovery shall be included in the baseline where:
• The conditions of NECB 2011 Article 5.2.10.1 of Division B are met, or
• If a project is located in climate zone 7 and 8 and NECB 2011 Article 5.2.10.1 of Division B is not met, then Article 5.2.10.4 shall apply regardless of whether or not the proposed ventilation system is “self-contained” (i.e., suite-level). In this case, the baseline system will provide ventilation directly to the zone with a separate fan that meets the</td></tr>
</table>

Proposed Design	Baseline Design
	fan power requirements of Sentence 8.4.4.19(3)
No performance credit or adjustments to the model should be taken to reflect improvements in the proposed design distribution system (piping or ductwork) unless or until explicit approval is given by GBCI.	
If needed, use the following SEER to EER conversion: • $EER = -0.026 \times SEER^2 + 1.15 \times SEER$ If needed, using the following heating efficiency conversions: • Heat Pump: $COP = 1.48E^{-7} \times COP_{47} \times Q + 1.062 \times COP_{47}$ • Other systems: $COP = -0.0296 \times HSPF^2 + 0.7134 \times HSPF$	Use the EER and COP values from NECB 2011 Table 5.2.12.1 of Division B.
Ventilation & Infiltration	
The modeled outside air rate shall be equal to the sum of the infiltration and mechanical ventilation rates. Measured infiltration (i.e. envelope leakage) rates are not used. Default infiltration rates of 0.25 $L/s \cdot m^2$ as per NECB 2011 Article 8.4.3.4 to be used.	The infiltration rate shall be equal to the rate used in the proposed design.
The mechanical ventilation rate shall account for both whole-house fans and local exhaust fans (bathroom and kitchen fans), and reflect specified fan capacities and control schedules. If not specified, local exhaust fans should be assumed to run 2 hours per day (or may be converted to an equivalent 24-hour runtime if combined with whole-unit ventilation).	The baseline design mechanical ventilation rate shall be modeled as equal to the rates allowed by ASHRAE 62.2 (in dwelling units) or 62.1 (outside dwelling units), or the applicable local codes, whichever is more stringent. This creates a penalty for proposed designs that overventilate.

Proposed Design	Baseline Design
Ventilation controls required by ASHRAE 90.1-2010, Section 6.4.3.4 (mandatory provision) shall be represented in the model. For example, per Section 6.4.3.4.2, both outdoor air supply and exhaust systems shall be equipped with motorized dampers to automatically shut when the systems or spaces are not in use. As per the Canada ACP - NECB, ASHRAE 90.1-2010 mandatory requirements must be met. This shall be reflected such that outside air rates in applicable common spaces (e.g. community rooms, offices, laundry rooms) are zero during unoccupied periods unless the supplemental documentation supports that ventilation during unoccupied periods reduces energy cost or is required by local code.	Mechanical ventilation schedules should be equal to those used in the proposed design, unless the following exception is met: • The proposed design includes demand control ventilation see ASHRAE 90.1-2010 Appendix G) that is approved by GBCI. Note: exhaust ventilation in kitchens and bathrooms with manual control or interlocked with lighting switch does not qualify as demand control ventilation.
Fans	
In the proposed design, all fans (air-handling unit, ventilation, exhaust, etc.) shall be modeled using actual equipment specifications and project conditions and parameters. Note: heat and energy recovery ventilation systems tend to increase the pressure drop in the ductwork, leading to increased fan energy consumption. This increase shall be explicitly modeled in the proposed design, as appropriate.	Suite terminal units shall run fans by cycling on load if ventilation is provided through a separate system (e.g., central MUA unit or suite HRV). If ventilation is provided through an in-suite terminal unit, the fan shall run continuously.
Supply and exhaust fans that are installed for a purpose other than providing whole-unit ventilation, such as bathroom and kitchen local exhaust fans, laundry make-up air fans, trash room exhaust, etc. shall be modeled as process loads.	Supply and exhaust fans that serve a purpose other than providing whole-unit ventilation shall be modeled as process loads, and follow the same schedules used in the proposed design.

Proposed Design	**Baseline Design**
Kitchen and bathroom fans that are activated with manual controls or interlocked with lighting switches (i.e. not running continuously or being used to meet 62.2 whole-house ventilation requirements) should be modeled to run for 2 hours/day.	
Garages that are at least 30,000 ft^2 and/or include any space heating or cooling shall be modeled with ventilation runtimes of 8.4 hours/day (to reflect the requirements in Std. 90.1-2010, Section 6.4.3.4.5). Garage fan power shall be calculated based on design specifications. Garages that are 30,000 ft^2 or smaller and include no heating or cooling shall be modeled with ventilation runtimes of 24 hours/day. If the proposed design includes contaminant sensors that meet the requirements of Std. 90.1-2010, Section 6.4.3.4.5, the following options exist: Option 1: Model the baseline design with a garage fan power of 0.30 W/CFM, a schedule of 24 hours/day, and an air flow rate of 0.75 CFM/ft^2. Model the proposed design with a garage fan power based on design specifications, a schedule of 8.4 hours/day, and an air flow rate based on the proposed designs. Option 2: Model both the baseline and proposed design with the same garage fan power (W/CFM) and fan air flow rates (CFM/ft^2), based on the design specifications. Model both the baseline and proposed design with a schedule of 8.4 hours/day.	Garages that are at least 30,000 ft^2 and/or include any space heating or cooling shall be modeled with ventilation runtimes of 8.4 hours/day (to reflect the requirements in Std. 90.1-2010, Section 6.4.3.4.5); the garage fan power shall be modeled as equal to the proposed design garage fan power. Garages that are 30,000 ft^2 or smaller and include no heating or cooling shall be modeled with ventilation runtimes of 24 hours/day. If the proposed design includes contaminant sensors that meet the requirements of Std. 90.1-2010, Section 6.4.3.4.5, the following options exist: Option 1: Model the baseline design with a garage fan power of 0.30 W/CFM, a schedule of 24 hours/day, and an air flow rate of 0.75 CFM/ft^2. Model the proposed design with a garage fan power based on design specifications, a schedule of 8.4 hours/day, and an air flow rate based on the proposed designs. Option 2: Model both the baseline and proposed design with the same garage fan power (W/CFM) and fan air flow rates (CFM/ft^2), based on the design specifications. Model both the baseline and proposed design with a schedule of 8.4 hours/day.
Domestic Hot Water	

Proposed Design	Baseline Design
Hot water consumption associated with dwelling units shall be determined according to the exceptional calculation methodology detailed in Appendix B, Section B.1 of this manual. Hot water use reduction may be reflected in the proposed design, per that methodology, for low-flow showerheads, low-flow faucets, ENERGY STAR dishwashers, and ENERGY STAR clothes washers. The results of the exceptional calculation must be converted to hourly values within the model, using the appropriate hourly load profile as recommended by the energy modeling software tool.	Hot water consumption associated with dwelling units shall be determined according to the exceptional calculation methodology detailed in Appendix B, Section B.1 of this manual.
If a hot water recirculation system is present in the proposed design, it must be represented (along with the associated pumps and pump energy) in the model; no credit can be awarded.	Same as proposed design.
Hot water setpoint capable of delivering 120 degree water at the point of use shall be used.	The hot water setpoints shall be equal to those used in the proposed design.
Receptacles & Other Plug Loads	
Dishwashers, clothes washers, and clothes dryers shall not be included if they are not specified for the project.	The number of dishwashers, clothes washers, and clothes dryers shall match those in the proposed design.
Non-lighting dwelling unit receptacle energy use shall be determined according to the methodology highlighted in Appendix B, Section B.2 of this manual. Receptacle energy use reduction may be reflected in the proposed design, per that methodology, for the use of ENERGY STAR appliances. The results of the exceptional calculation shall be converted to the appropriate model inputs	Non-lighting dwelling unit receptacle energy use shall be determined according to the methodology highlighted in Appendix B, Section B.2 of this manual. Non-lighting receptacle energy use outside the dwelling units – including common area kitchens – must be accounted for in the model. Appendix B, Section B.2 prescribes plug load allowances for non-unit spaces.

Proposed Design	Baseline Design
(e.g. Watts/ft^2) based on the corresponding schedules being used. Non-lighting receptacle energy use outside the dwelling units – including common area kitchens – must be accounted for in the model. Appendix B, Section B.2 prescribes plug load allowances for non-unit spaces.	
The (sensible / latent) load fractions for receptacles shall be the following: • refrigerators: (1.00 / 0.00) • dishwashers: (0.60 / 0.15) • clothes washers: (0.80 / 0.00) • electric cooking ranges: (0.40 / 0.30) • gas cooking ranges: (0.30 / 0.20) • electric clothes dryers: (0.15 / 0.05) • gas clothes dryers – electric load: (1.00 / 0.00) • gas clothes dryers – gas load: (0.15 / 0.05) • dwelling unit plug loads: (0.90 / 0.10) • non-unit plug loads (1.00 / 0.00)	Same as proposed design.
All elevators specified in the project shall be included in the model, and the associated energy use shall be determined using the methodology in Appendix B, Section B.3 of this manual. 10% of elevator energy usage shall be added to space heat gains.	Same as proposed design.

Exceptional Calculations Required for Residential Projects

All projects are expected to provide certain exceptional calculations, which must conform to the Residential Simulation Guidelines. These include:

- Lighting power density – the proposed design lighting power density for the various space types must be shown, using a spreadsheet or comparable that identifies fixture counts, wattages (including bulb and ballast), credit for lighting controls, etc.
- Hot water consumption – the modeler must complete the Minimum Energy Performance calculator inputs for multifamily service water heating consumption for the baseline and proposed design. The in-unit hot water use calculations provided in the calculator are consistent with those described in Section 2 and detailed in Appendix B, Section B.1 of this manual.
- Receptacle energy use – the modeler must complete the Minimum Energy Performance calculator inputs for receptacle energy use in both the baseline and proposed design. Calculations for in-unit receptacle energy use and common area plug load energy use in the calculator are consistent with the methodology described in Section 2 and detailed in Appendix B, Section B.2 of this manual. Ensure that the energy model schedules for equipment are modeled as stated in the Minimum Energy Performance Calculator.
- Elevator energy use – the modeler must submit calculations related to elevator energy use, following the methodology described in Section 2 and detailed in Appendix B, Section B.3 of this manual.

Additional exceptional calculations may also be required, if the project team is seeking credit for measures or strategies that are not explicitly allowed or prescribed by NECB 2011 or these Simulation Guidelines.

Quality Control

The following is a broad overview of the kinds of quality control that the project modeling team should perform:

Model Inputs

- Coordinate with the project design team to ensure the proposed design reflects final design, specifications, etc. Remove or update aspects of the model that might have remained from earlier iterations of the designs.
- Ensure that all spaces and end-use loads are accounted for within the model.
- Confirm that all aspects of the Simulation Guidelines (see Section 2) were incorporated into the model.
- Confirm that modeling elements within the baseline design conform to NECB 2011, and any templates, tools, etc. used by the modeling team have been updated to reflect changes from NECB 2011.
- Where exceptional or supporting calculations are used (e.g. LPD, hot water consumption, appliance energy use), the calculations follow an approved methodologies (see Section 2 and Appendix B), and model inputs match up with calculated values.
- As appropriate, the same spaces, surfaces, schedules, etc. were used for both the baseline and proposed design.

Model Outputs

- The energy consumption and cost values reported in the Calculator match with the energy simulation outputs.
- All warning or caution errors have been reviewed and can be explained.
- Proposed and/or baseline cases have no more than 300 hours of unmet load.
- Verify that total energy consumption, energy use intensity, and energy costs are reasonable for both the baseline and proposed design; compare to other similar projects or publicly available data sources (e.g. CBECs).
- Verify that the energy use of different end-use loads seems reasonable and consistent based on the location and parameters of the project (example: if space cooling greatly exceeds space heating in a very cold climate). Identify and review outliers or discrepancies.
- Review the savings rate for each end-use, and evaluate whether each is defensible given the energy measures and strategies employed.
- Where supporting calculations were performed to estimate model inputs, confirm that the model outputs correspond with the calculations (example: if a spreadsheet calculation for total building appliance energy use was used to determine W/ft^2 inputs, the simulation output should match with the spreadsheet estimates).

Mixed-use Buildings

LEED does require that all spaces and associated end-use loads within the building must be accounted for in the energy simulation model. This includes residential, as well as nonresidential, unfinished, unconditioned spaces, etc.
In the context of LEED, the term “mixed-use” generally refers to buildings that include spaces that are not designed primarily to serve the residents (e.g. retail, commercial space other than leasing offices).

Modeling Spaces Not Yet Designed

Within LEED, the nonresidential spaces generally take one of two forms:

1. The nonresidential space is included within the design and planning process. In this case, the nonresidential spaces shall be modeled as designed and built.
2. The nonresidential space is a tenant space, and energy features of the space are undetermined through design and construction. In this case, the nonresidential space is classified as “not yet designed” and its energy features shall be modeled as equal to the baseline design and follow the guidance in ASHRAE Std. 90.1-2010, Table G3.1.

ASHRAE Std. 90.1-2010, Table G3.1, Section 1 states “When the performance method is applied to buildings in which energy-related features have not yet been designed (e.g. a lighting system), those yet-to-be designed features shall be described in the proposed design exactly as they are defined in the baseline building design. Where the space classification for a space is not yet known, the space shall be categorized as an office space.” Table G3.1 provides similar guidance for specific end uses, including lighting (Section 6), HVAC (Section 10), and service hot water (Section 11).

Gut-rehab Buildings

For gut-rehab buildings, the proposed design should be modeled to reflect the final state of the building after renovations and/or upgrades.
ASHRAE Std. 90.1-2010 does provide some guidance on how to model the baseline design envelope for existing buildings. Table G3.1, part 5(f) states "For existing building envelopes, the baseline building design shall reflect existing conditions prior to any revisions that are part of the scope of work being evaluated."
This requirement applies to the thermal properties and areas of the different envelope components. For example, if the window area is changed as part of the renovation, the pre-retrofit window area shall be modeled in the baseline and the post-retrofit window area shall be modeled in the proposed design. This requirement does not apply to air-tightness; the same leakage must be modeled in the baseline and proposed design. This should also not be interpreted as an exemption for any other envelope-related LEED requirements (e.g. EQ prerequisite: Compartmentalization).

ASHRAE Std. 90.1-2010, Table G3.1, part 5(f) ***does not*** apply to any the following:

1. New additions to existing buildings. These spaces must be treated as new construction.
2. Buildings or spaces within buildings that were previously unconditioned and are being renovated to include space conditioning. These must be treated as new construction.
3. Spaces that have undergone a change in the space use type (e.g. from non-residential to residential).
4. Any other energy-related features of the buildings, besides the building envelope (e.g. equipment, lighting).

Typical Exceptional Calculations

Hot Water Use Reduction

Baseline design hot water use

The baseline design dwelling unit hot water use shall be calculated using the following formula:

Total hot water use = Occupant use + Dishwasher use + Clothes washers use

Where:

Occupant use = [per-person use] * [# of bedrooms]

And:

Studio apartments are treated as 1 bedroom.

Per-person use = 25 gallons per day for most projects. A lower value (to 12 gallons per day) may be used where consumption is expected to be very low based on occupant demographics (e.g. all-working occupants). A higher value (to 44 gallons per day) may be used where consumption is expected to be very high based on occupant demographics (e.g. no occupants working, low-income).

Where:

Dishwasher use = 1,290 gallons/year * [# of dishwashers]

Where:

**Clothes washer use = 2,436 gallons/year * [# of in-unit clothes washers] +
5,903 gallons/year * [# of common area clothes washers]**

Proposed design hot water use

The proposed design dwelling unit hot water use shall be calculated using the following formula:

Total hot water use = Occupant use + Dishwasher use + Clothes washers use

Where:

Occupant use = Baseline occupant use * (0.36 + 0.54* LFS/2.5 + 0.1*LFF/2.5)

And:

LFS = rated flow rate for the low-flow showerheads specified in the drawings
LFF = rated flow rate for the low-flow faucets specified in the drawings[1]

Where:

Dishwasher use = 860 gal/year * [# of ENERGY STAR dishwashers] +

1,290 gal/year * [# of non-ES certified dishwashers]

Where:

Clothes washer use = 1,127 gal/year * [# of in-unit ENERGY STAR clothes washers] +
2,436 gal/year * [# of in-unit non-ES certified clothes washers] +
2,732 gal/year * [# of common area ENERGY STAR washers] +
5,903 gal/year * [# of common area non-ES certified washers]

[1]In a case where a project includes multiple different showerhead or faucets, use a weighted-average flow rate for these calculations.

Receptacle Energy Use

Baseline design receptacle energy use

Total receptacle energy use in the baseline design dwelling unit service hot water use shall be calculated using the following formulas:

Refrigerator = 529 kWh/yr * [# of refrigerators]
Dishwasher = 206 kWh/yr * [# of dishwashers]
Clothes washer = 81 kWh/yr * [# of in-unit clothes washers] +
196 kWh/yr * [# of common area clothes washers]
Cooking range = 604 kWh/yr * [# of electric ranges] +
45 therms/yr * [# of gas ranges]
Clothes dryer = [418+139*Nbr] kWh/yr * [# of in-unit electric dryers] +
[1,013+337*Nbr] kWh/yr * [# of common area electric dryers] +
[38+12.7*Nbr] kWh/yr * [# of in-unit gas dryers] +
[26.5+8.8*Nbr] therms/yr * [# of in-unit gas dryers] +
[92+30.8*Nbr] kWh/yr * [# of common area gas dryers] +
[64+21.3*Nbr] therms/yr * [# of common area gas dryers] +
Plug loads, in-unit = 1.05 kWh/yr/ft2
Plug loads, corridors, restrooms, stairs, support areas = 0.7 kWh/yr/ft2
Plug loads, offices = 4.9 kWh/yr/ft2
Plug loads, other = 1.6 kWh/yr/ft2

Where:

Nbr = average number of bedrooms in dwelling units
# of [appliance type] = # of [appliance type] installed in the proposed design

Proposed design receptacle energy use

Total receptacle energy use in the proposed design dwelling unit shall be calculated using the following formulas:

Refrigerator = 423 kWh/yr * [# of ENERGY STAR refrigerators] +
529 kWh/yr * [# of non-ENERGY STAR refrigerators]
Dishwasher = 164 kWh/yr * [# of ENERGY STAR dishwashers] +
206 kWh/yr * [# of non-ENERGY STAR dishwashers]
Clothes washer = 57 kWh/yr * [# of in-unit ENERGY STAR clothes washers] +
81 kWh/yr * [# of in-unit non-ENERGY STAR clothes washers] +
138 kWh/yr * [# of common area ENERGY STAR clothes washers] +
196 kWh/yr * [# of common area non-ENERGY STAR clothes washers]
Cooking range = 604 kWh/yr * [# of electric ranges] +

45 therms/yr * [# of gas ranges]
Clothes dryer = [418+139*Nbr] kWh/yr * [# of in-unit electric dryers] +
[1,013+337*Nbr] kWh/yr * [# of common area electric dryers] +
[38+12.7*Nbr] kWh/yr * [# of in-unit gas dryers] +
[26.5+8.8*Nbr] therms/yr * [# of in-unit gas dryers] +
[92+30.8*Nbr] kWh/yr * [# of common area gas dryers] +
[64+21.3*Nbr] therms/yr * [# of common area dryers]
Plug loads, in-unit = 1.05 kWh/yr/ft2
Plug loads, corridors, restrooms, stairs, support areas = 0.7 kWh/yr/ft2
Plug loads, offices = 4.9 kWh/yr/ft2
Plug loads, other = 1.6 kWh/yr/ft2

Where:

Nbr = average number of bedrooms in dwelling units
# of [appliance type] = # of [appliance type] installed in the proposed design

Elevator energy use

If the proposed design includes elevators, the associated elevator energy use must be accounted for in both the baseline and proposed design energy models. Two options are provided are available to projects to calculate this energy use.

Option 1: engineering analysis

In order to take credit for energy savings associated with improvements to the elevator system, baseline and proposed design energy estimates must be completed by a design engineer using a simulation based on first principles, traffic models, and engineering data from empirical studies. This energy model must include energy consumed when the elevator is idling and in stand-by as well as the energy consumed when actively transporting the cabs (loaded and unloaded) based on an appropriate traffic model for the building. Some elevator equipment manufacturers will provide these calculations upon request as part of their design assistance service.
If this approach is used, the baseline design elevator should be hydraulic for 4-6 story buildings and geared traction for 7+ story buildings. Assume all of the following for the baseline design elevators: standard efficiency DC motors; variable voltage variable frequency drive; no regeneration of braking power losses; controls based on simple elevator algorithms; hydraulic elevators have no counterweights or hydraulic accumulators; traction elevators are equipped with counterweights sized at 50% of full load capacity; worm gears for geared traction elevators; a 2-to-1 roping scheme.
The analysis must be submitted as an exceptional calculation, with detailed estimates, assumptions, and a brief narrative.

Option 2: default assumptions

This option does not allow the proposed design to take performance credit. The annual energy consumption for both the baseline and proposed design shall be based on Table B.1 below.

Table B.1. Default Elevator Energy Use (MWh/yr per elevator)			
Class	**Hydraulic (1-6 stories)**	**Geared Traction (7-20 stories)**	**Gearless Traction (21+ stories)**

Up to 6 dwelling units	1.91	NA	NA
7-20 dwelling units	2.15	3.15	NA
21-50 dwelling units	2.94	3.15	7.57
51+ dwelling units	4.12	4.55	7.57