## Lighting End Use

The commercial lighting measures use a standard set of variables for hours or use, waste heat factors, coincident factors and HVAC interaction effects. This table has been developed based on information provided by the various stakeholders. For ease of review, the table is included here and referenced in each measure.

| **Building Type** | **Fixture Annual Operating Hours**[[1]](#footnote-2) | **[Screw based bulb Annual Operating hours](\\\\SUN\\Direct Services\\Consulting\\Illinois_TRM\\Lighting Models\\Waste Heat Calculations1.xlsx" \l "RANGE!#REF!)**[[2]](#footnote-3) | **Waste Heat Cooling Energy WHFe**[[3]](#footnote-4) | **Waste Heat Cooling Demand****[WHFd](\\\\SUN\\Direct Services\\Consulting\\Illinois_TRM\\Lighting Models\\Waste Heat Calculations1.xlsx" \l "RANGE!#REF!)** | **Coincid-ence Factor**  **[CF](\\\\SUN\\Direct Services\\Consulting\\Illinois_TRM\\Lighting Models\\Waste Heat Calculations1.xlsx" \l "RANGE!#REF!)**[[4]](#footnote-5) | **Waste Heat Gas Heating**  **[IFTherms](\\\\SUN\\Direct Services\\Consulting\\Illinois_TRM\\Lighting Models\\Waste Heat Calculations1.xlsx" \l "RANGE!#REF!)**[[5]](#footnote-6) | **Waste Heat Electric Resistance Heating**[**IFkWh**](file:///\\SUN\Direct%20Services\Consulting\Illinois_TRM\Lighting%20Models\Waste%20Heat%20Calculations1.xlsx#RANGE!#REF!)[[6]](#footnote-7) | **Waste Heat Electric Heat Pump Heating IFkWh** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Assisted Living | 7,862 | 5,950 | 1.14 | 1.30 | 0.66 | 0.035 | 0.823 | 0.358 |
| College | 3,395 | 2,588 | 1.06 | 1.39 | 0.63 | 0.020 | 0.462 | 0.201 |
| Convenience Store | 4,672 | 3,650 | 1.09 | 1.26 | 0.76 | 0.035 | 0.828 | 0.360 |
| Elementary School | 3,038 | 2,118 | 1.17 | 1.29 | 0.72 | 0.018 | 0.420 | 0.183 |
| Garage | 3,401 | 3,540 | 1.00 | 1.00 | 0.92 | 0.000 | 0.000 | 0.000 |
| Garage, 24/7 lighting | 8,766 | 8,766 | 1.00 | 1.00 | 1.00 | 0.000 | 0.000 | 0.000 |
| Grocery | 4,650 | 3,650 | 1.05 | 1.22 | 0.73 | 0.022 | 0.511 | 0.222 |
| Healthcare Clinic | 3,890 | 4,207 | 1.40 | 1.85 | 0.65 | 0.006 | 0.144 | 0.063 |
| High School | 3,038 | 2,327 | 1.18 | 1.39 | 0.72 | 0.028 | 0.656 | 0.285 |
| Hospital - CAV no econ | 7,616 | 4,207 | 1.11 | 1.29 | 0.76 | 0.022 | 0.527 | 0.229 |
| Hospital - CAV econ | 7,616 | 4,207 | 1.06 | 1.27 | 0.75 | 0.023 | 0.533 | 0.232 |
| Hospital - VAV econ | 7,616 | 4,207 | 1.37 | 1.79 | 0.70 | 0.010 | 0.241 | 0.105 |
| Hospital - FCU | 7,616 | 4,207 | 1.38 | 1.29 | 0.73 | 0.001 | 0.033 | 0.015 |
| Manufacturing Facility | 4,618 | 2,629 | 1.02 | 1.04 | 0.81 | 0.012 | 0.270 | 0.117 |
| MF - High Rise - Common | 6,138 | 5,950 | 1.14 | 1.32 | 0.64 | 0.025 | 0.596 | 0.259 |
| MF - Mid Rise - Common | 6,138 | 5,950 | 1.14 | 1.32 | 0.64 | 0.025 | 0.596 | 0.259 |
| Hotel/Motel - Guest | 2,390 | 777 | 1.18 | 1.36 | 0.28 | 0.020 | 0.463 | 0.201 |
| Hotel/Motel - Common | 6,138 | 4,542 | 1.20 | 1.24 | 0.73 | 0.032 | 0.748 | 0.325 |
| Movie Theater | 3,506 | 5,475 | 1.11 | 1.38 | 0.53 | 0.029 | 0.673 | 0.293 |
| Office - High Rise - CAV no econ | 2,886 | 3,088 | 1.00 | 1.07 | 0.57 | 0.037 | 0.874 | 0.380 |
| Office - High Rise - CAV econ | 2,886 | 3,088 | 1.00 | 1.07 | 0.57 | 0.039 | 0.905 | 0.394 |
| Office - High Rise - VAV econ | 2,886 | 3,088 | 1.27 | 1.65 | 0.53 | 0.022 | 0.510 | 0.222 |
| Office - High Rise - FCU | 2,886 | 3,088 | 1.35 | 1.56 | 0.59 | 0.015 | 0.346 | 0.150 |
| Office - Low Rise | 2,698 | 3,088 | 1.11 | 1.31 | 0.52 | 0.016 | 0.371 | 0.161 |
| Office - Mid Rise | 3,068 | 3,088 | 1.26 | 1.61 | 0.52 | 0.024 | 0.557 | 0.242 |
| Religious Building | 2,085 | 1,664 | 1.12 | 1.37 | 0.48 | 0.015 | 0.356 | 0.155 |
| Restaurant | 5,571 | 4,784 | 1.17 | 1.31 | 0.68 | 0.021 | 0.491 | 0.213 |
| Retail - Department Store | 5,478 | 2,935 | 1.12 | 1.31 | 0.95 | 0.022 | 0.514 | 0.223 |
| Retail - Strip Mall | 4,093 | 2,935 | 1.12 | 1.29 | 0.71 | 0.019 | 0.450 | 0.196 |
| Warehouse | 5,087 | 4,293 | 1.00 | 1.22 | 0.68 | 0.011 | 0.257 | 0.112 |
| Unknown | 3,379 | 3,612 | 1.09 | 1.36 | 0.58 | 0.022 | 0.522 | 0.227 |
| Exterior | 4,903 | 4,903 | 1.00 | 1.00 | 0.00 | 0.000 | 0.000 | 0.000 |
| Low-Use Small Business | 2,954 | 2,954 | 1.31 | 1.53 | 0.66 | 0.023 | 0.524 | 0.262 |
| Uncooled Building | Varies | varies | 1.00 | 1.00 | 0.66 | 0.014 | 0.320 | 0.160 |
| Refrigerated Cases | 5,802 | n/a | 1.29 | 1.29 | 0.69 | 0.000 | 0.000 | 0.000 |
| Freezer Cases | 5,802 | n/a | 1.50 | 1.5 | 0.69 | 0.000 | 0.000 | 0.000 |

1. Fixtures hours of use are based upon schedule assumptions used in the eQuest models, except for those building types where Illinois based metering results provide a statistically valid estimate (currently: College, Elementary School, High School, Manufacturing, Low and Mid rise Office, Retail Department Store and Warehouse). Miscellaneous is a weighted average of indoor spaces using the relative area of each building type in the region (CBECS). [↑](#footnote-ref-2)
2. Hours of use for screw based bulbs are derived from DEER 2008 by building type for cfls. Garage, exterior and multi-family common area values are from the Hours of Use Table in this document. Miscellaneous is an average of interior space values. Some building types are averaged when DEER has two values: these include office, restaurant and retail. Healthcare clinic uses the hospital value. [↑](#footnote-ref-3)
3. The Waste Heat Factor for Energy and is developed using EQuest models for various building types base on Chicago Illinois (closest to statewide average HDD and CDD). Exterior and garage values are 1, unknown is a weighted average of the other building types. [↑](#footnote-ref-4)
4. Coincident diversity factors are based on either combined IL evaluation results (College, Elementary School, High School, Manufacturing, Low and Mid rise Office, Retail Department Store and Warehouse) or based upon schedules defined in the eQuest models described (all others). [↑](#footnote-ref-5)
5. IF Therms value is developed using EQuest models consistent with methodology for Waste Heat Factor for Energy. [↑](#footnote-ref-6)
6. Electric heat penalty assumptions are based on converting the IFTherm multiplier value in to kWh and then applying relative heating system efficiencies. The gas efficiency was assumed to be 78% AFUE based upon standard TRM assumption for existing unit average efficiency, and the electric resistance is assumed to be 100%, for Heat Pump is assumed to be 2.3COP:

   IFElectricHeat = IFTherms \* 29.3 kWh/therm \* 78% (Gas Heating Equipment Efficiency) / 100% (Electric Resistance Efficiency) [↑](#footnote-ref-7)