Calculating Heat Load from Lighting Fixtures

Whenever doing heat-load calculations, we must always count 100% of the fixture wattage-any fixture's wattage-as heat, regardless of efficiencies at the source. In any enclosed space, virtually all of the light produced by a lighting fixture is eventually absorbed by surrounding materials (walls, ceilings, etc.). When light gets absorbed by these materials, photons are converted into heat.

New lighting technologies, such as LEDs, allow luminaires to produce light more efficiently, or with higher efficacy than incandescent lamps. This means that we get more lumens per watt; however, heat per watt is constant. What matters is that fewer watts are used to produce comparable brightness, not that these fixtures somehow produce less heat for the wattage that they consume.

1 watt of electricity used by a luminaire = 3.412 BTUs per hour

The same math works for any lighting fixture.

For average industrial heat-pump or electric air-conditioner types of HVAC equipment, it takes approximately 0.4 watts of cooling power to offset each 1 watt of power consumed by a light source. Smaller-scale HVAC systems might require more power than this, and certain specialized systems (such as evaporative coolers) may use somewhat less, but this is a useful generalization for most applications.

Occasionally users have commented, "I work in a cold climate, and the tungsten light fixtures provide heating to my space. If I change over to more energy-efficient lighting, I'll then have to use the HVAC system for heat, which would cancel out any energy savings." It is true that in cold environments some additional heating may be required due to the lower heat output of LEDs, but there will still be overall savings in the system. Industrial heating equipment utilizes energy sources like natural gas that are much less expensive for producing heat than electricity. In addition, it is much better at sending heat only where it's needed, rather than letting it pool unused in ceilings.

Some people include Carbon Footprint savings on an ROI spreadsheet, because it can help sell the green aspect of energy-efficient lighting. This varies by region, but an average calculation for many U.S. locations is 1.5 pounds (0.68kg) of CO² per kilowatt-hour of electricity.

1 watt at luminaire = 3.412 BTUs per hour
1 watt at luminaire = 0.4 watts of air conditioning

1 watt at luminaire = 0.0015 pounds (0.00068kg) of CO$_2$ per hour

so...

a 575 HPL * 3.412 = 1961.9 BTU's per hour

and...

a 750 HPL * 3.412 = 2559 BTU's per hour