

## Green Apple Energy: T8-LED

Green-Buildings' team of accredited green building professionals performed a benchmark analysis of GA T8 LED against Green-Buildings' proprietary Green Building Accepted Environment Principles Process™ and determined that GA T8 LED will:

- A. **Conserve Energy and Electricity**
- B. **Reduce GhG Emissions and Pollution**
- C. **Improve Building Durability**

Green-Buildings also believes that the use of the GA T8 LED is an effective choice when seeking to achieve certification under green building rating systems, such as LEED.



## EXECUTIVE SUMMARY

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The Green Apple Energy T8 LED (“GA T8 LED”), manufactured by Green Apple Energy Company, LLC, is a self-ballasted, light-emitting-diode (LED) lamp.

Green-Buildings.com (“Green-Buildings”) worked with Green Apple Energy Company, LLC to complete a review and evaluation of GA T8 LED. Green-Buildings believes that the GA T8 LED meets several important accepted green building principles and, as such, the product is applicable to high-performance building.



Green-Buildings’ team of accredited professionals performed a benchmark analysis of the GA T8 LED against Green-Buildings’ proprietary Green Building Accepted Environment Principles Process™ and determined that use of the GA T8 LED will:

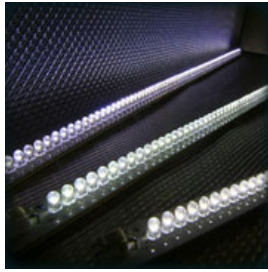
- A. **Conserve Energy and Electricity**
- B. **Reduce GhG Emissions and Pollution**
- C. **Improve Building Durability**

Additionally, Green-Buildings believes that the characteristics of the GA T8 LED lamp make it an ideal option when seeking to obtain certification through various green building rating systems, such as LEED. While no single product may guarantee a building certification in a green building rating system, Green-Buildings believes that the use of the GA T8 LED may be effective in earning points in LEED Certification<sup>1</sup> in at least one of the following categories:

- a. **Sustainable Sites (SS):** 1 Point
- b. **Energy & Atmosphere (EA):** 1-10 Points
- c. **Indoor Environmental Quality (EQ):** 1 Point
- d. **Innovation in Design (ID):** 1-4 Points

## DETAILS

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Green Apple Energy Company has developed the GA T8 LED as a replacement for the various less efficient, traditional lighting technologies commonly found in conventional buildings. The characteristics of the GA T8 LED provide several benefits over conventional lighting.

As described below, the GA T8 LED provides a highly controlled, long-lasting, energy efficient light which is consistent with green building.

### ***A. Conserve Energy and Electricity:***

According to the U.S. Department of Energy, buildings are responsible for approximately 39% of the energy consumed in the United States. Of the electricity used, building operations result in approximately 74% of total U.S. consumption. Lighting in buildings represents approximately one third (28%) of this demand in commercial buildings and approximately twelve percent (12%) in residential buildings.

A key green building principle is the conservation of energy and electricity through the use of energy efficient technologies and controls. The simplest way to reduce electricity demand is to use less of it by eliminating unnecessary use of lighting. Taking steps to replace inefficient lamps and/or lighting components has also been shown to greatly improve the effectiveness and efficiency of green building energy strategies, while simultaneously reducing the demand, and carbon output from, coal-fired power facilities.

Buildings that incorporate high-performance building components, such as the GA T8 LED, will use much less electricity than conventional buildings and result in a cleaner environment. This is because the underlying technological design of the GA T8 LED produces light in a far more efficient way than incandescent bulbs or even compact fluorescent lamps. The result is that the same amount of light is delivered from the LED with the use of far less energy.

Specifically, incandescent or “Edison” bulbs may require up to ten (10) times as much energy to produce the same amount of light. A 60-watt incandescent bulb consumes approximately 525 kWh of electricity per year, whereas an LED producing the same amount of light may consume only 65 kWh of electricity per year. Even compact fluorescent lamps, which are considered highly efficient, may use twice as much energy as an LED.

The additional energy required by the incandescent bulb is then lost in the form of heat to the surrounding environment. In indoor environments, the additional heat causes building temperatures to rise putting incremental pressure on AC systems and greater demand for increased cooling loads. Over the long term, this incremental heat will add significantly to the amount of energy required to keep the building cool.

**By incorporating the GA T8 LED into a holistic, energy-saving green building strategy, building owners and operators may not only save money and realize a positive return over**

**the life of the product, but also save energy and reduce the environmental impacts of greenhouse gas emissions and other harmful pollutants.**

## ***B. Reduce GhG Emissions and Pollution:***

### **i. Reduce GhG Emissions**

The vast majority of electricity consumed in the U.S. is initially generated through the burning of fossil fuels, such as coal, at conventional power plants. A byproduct of the operation of coal-fired power plants is the production of a significant amount of greenhouse gases (GhG) and other harmful pollutants.

According to the U.S. Green Building Council and the U.S. Environmental Protection Agency, for each megawatt of coal generated electricity produced, an average of 2,249 pounds of carbon dioxide, 13 pounds of sulfur dioxide and 6 pounds of nitrogen oxides are released into the atmosphere. Indeed, more than 65% of the sulfur dioxide pollution in the U.S., or approximately 13 million tons per year, is the result of coal fired power generation.

Considering that the average national emissions factor for electricity in the United States is 1.37 pounds of CO<sub>2</sub> per kWh, and using the conservative assumption that the life of the GA T8 LED is 30,000 hours, when replacing one hundred (100) Phillips F32T8s, Green-Buildings calculated the benefits of utilizing the GA T8 LED in total CO<sub>2</sub> eliminated below (also please refer to additional performance characteristics mentioned in the section on ROI calculations herein):

<b>Total kWh Saved per Year</b>	<b>3640</b>
<b>Total lifetime of LED:</b>	11.54 years
<b>Pounds of Co2 Saved:</b>	57,540
<b>Tons of Co2 Saved:</b>	26.15

### **ii. Reduce Pollution**

The U.S. Environmental Protection Agency (EPA) estimates that indoor pollution levels may be two to five times (potentially up to one hundred times) higher than outdoor pollution levels. As indoor pollution levels and exposure to harmful toxins are also a concern, products that help reduce exposure to potential harmful air pollutants and the presence of biological contaminants are an important consideration in green building. While compact fluorescent lamps (CFL) are significantly more efficient than traditional incandescent bulbs, they also contain mercury. Because CFLs contain mercury, they must be carefully handled and properly disposed of to prevent potentially significant environmental hazards that may occur throughout a product's life. Exposure to mercury poses risks not only to indoor occupants, but also to others in any surrounding environment downstream. The GA T8 LED contains no mercury and presents an alternative to the potential dangers associated with CFLs.

**The use of energy efficient lighting, such as the GA T8 LED, reduces electricity demand and, therefore, reduces the amount GhG emissions released into the atmosphere from coal-fired power generation. Furthermore, the GA T8 LED may reduce incremental mercury pollution**

**in the environment by presenting an affordable alternative to CFLs, the use of which requires special care due to their mercury content.**

### ***C. Improve Building Durability***

A key green building principle is to deliver durable, high-performance design and construction to create a built environment that will last. Indeed, according to a survey by PPG Industries, architects report that durability is the most important attribute for a green building product. The use of durable, high-performance building materials and construction may result in a building that may require less frequent renovation, repair and replacement.

By reducing the environmental impacts of materials chosen for construction, i.e. by using materials that provide longer life and performance, builders can reduce waste and system failures, enjoy more predictable maintenance schedules and benefit from a lower cost of ownership.

According to the manufacturer, depending on their environment and use, the GA T8 LED is capable of lasting between 30,000 and 100,000 hours while most LED lamps maintain their lumen output between 32,000 and 50,000 hours. For the purposes of our calculations herein, we conservatively estimate the life of the GA T8 LED to be 30,000 hours.

**The extremely long operating life of the GA T8 LED provides real estate owners and operators with the benefit of reduced labor and materials costs while decreasing the frequency and amount of waste from replacement bulbs that would otherwise be sent to landfills. See ROI calculations below.**

### ***LEED Scoring and Certification:***

Use of LED lighting products, such as the GA T8 LED, may contribute materially to the Leadership in Energy and Environmental Design® (“LEED®”) green building certification process. Accordingly, use of the GA T8 LED may provide measurable performance in the following LEED credit categories:

#### **Sustainable Sites: SS (1 Point)**

The use of the GA T8 LED and other Green Apple Energy LED lights provide the ability to direct light in a more efficient and direct beam angle than is provided by fluorescent tubes or incandescent lighting. This results in the important “full-cutoff” characteristic in LEED, which helps reduce light pollution in built environments and outdoor habitats where electric lighting is in use.

#### **Energy & Atmosphere: EA (1 to 10 Points)**

Energy efficiency reduces the negative environmental consequences associated with the production and use of energy. As buildings are commonly powered by fossil fuels, energy savings are critical to green building. The EA credit category represents the primary area where the inherent efficiencies and long life of the GA T8 LED product can deliver significant positive impact. (1-10 Points)

#### **Indoor Environmental Quality: EQ (1 Point)**

LEDs such as the GA T8 LED provide greater control and responsiveness to building occupants. Control of lighting systems in multi-occupant spaces may result in improved indoor environmental quality and greater human productivity.

**Innovation in Design (ID)**

The use of innovative new technologies or designs that improve the performance and/or promote the education and awareness of green building may earn between 1-4 points in the LEED Building Design and Construction rating system. The LED lighting industry is evolving rapidly and existing and/or new technologies and products, such as the GA T8 LED, may qualify.

***Return on Investment (ROI) Considerations:***

For better or worse, the relatively short-term incentive to profit by keeping less efficient, less expensive, systems in place may be considered by some to be more important than any potential negative implications that could occur to the environment in the future. Therefore, calculating the potential financial benefits of green building investments is critical to their adoption by the commercial real estate industry.

Green-Buildings computed the return on investment (ROI) as well as the total lifetime savings from replacing one hundred (100) parabolic fluorescent tubes with the GA T8 LED. Using conservative assumptions, Green-Buildings calculated the following:

<b>Initial investment:</b>	<b>\$5,500.00</b>
<b>Total lifetime savings:</b>	<b>\$8270.00</b>
<b>Annual total savings:</b>	<b>\$716.73</b>
<b>Simple payback:</b>	<b>7.87 years</b>
<b>Return on Investment:</b>	<b>13.00%</b>
<b>Tons of CO2 eliminated:</b>	<b>47.23</b>

Green-Buildings compared the GA T8 LED with the Phillips Lighting F32T8. Both bulbs are designed for parabolic luminaires. The model details are as follows:

Model #	Watts Per Bulb	Fixture type	Life (hours)	Unit cost/bulb	Color	CRI	Lumens	Volts
<b>GA T8 LED</b>	18	Parabolic	>30000	\$55	5500	84	1200	90-290
<b>Phillips F32T8</b>	32	Parabolic	20000	\$10	5000	95	1860	139

The following formula illustrates the total lifetime cost savings that may be realized when using the GA T8 LED in place of a less efficient, less expensive bulb with a shorter life. The calculation considers factors including labor, inventory and frequency of replacement. The Phillips F32T8 is a relatively efficient bulb by comparison to the GA T8 LED and, as such, the returns from replacing a less efficient bulb with the GA T8 LED would be greater:

**Total lifetime Cost Savings** = A/B x (C+D) x E-F  
**Total lifetime energy savings** = A/G x (J x I)

<b>A = Replacement Bulb Life (hours)</b>	<b>&gt;30000</b>
<b>B = Original Bulb Life (hours)</b>	<b>20000</b>
<b>C = Labor cost (\$) to Change Original Bulb</b>	<b>\$1.00</b>
<b>D = Cost (\$) of Original Bulb</b>	<b>\$10.00</b>
<b>E = Number of Replacement Bulbs</b>	<b>100</b>
<b>F = Cost (\$) to Install Replacement Bulbs</b>	<b>\$100.00</b>
<b>G = Hours of Operation/Year</b>	<b>2600</b>
<b>H = kW Saved</b>	<b>1.4</b>
<b>I = kWh Saved/Year (H x G)</b>	<b>3640</b>
<b>J = Cost per kWh</b>	<b>.16</b>
<b>L = Labor Cost/Hour to Replace</b>	<b>\$21.00</b>

<b>Total lifetime cost savings</b> <b>30000/20000 x (\$1.00+\$10.00) x 100 - \$100.00</b>	<b>\$1550.00</b>
<b>Total lifetime energy savings</b> <b>30000/2600 x (.16 x 3640)</b>	<b>\$6720.00</b>
<b>Total Savings from Investment</b>	<b>\$8270.00</b>

## CONCLUSION

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Green Buildings believes that the GA T8 LED by Green Apple Energy Company, LLC meets three significant criteria used in green building initiatives: **Conserve energy and electricity, reduce GhG emissions and pollution and increase building durability**. Furthermore, use of the GA T8 LED is an effective choice when seeking to achieve certification under a green building rating system, such as LEED, by potentially earning points in the areas of Sustainable Sites, Energy and Atmosphere, Indoor Environmental Quality and Innovation in Design. Finally, the use of the GA T8 LED should result in a positive return on investment (ROI) for owners and operators who are considering the benefits of LEDs in a new building or green building retrofit.

Product Reviewed by: Rob Freeman, Jr., LEED AP

<sup>i</sup> Green-Buildings.com has evaluated and reviewed this product using its own methodology. While Green-Buildings.com believes that certain products have characteristics that may allow users of the products to earn points in a LEED certification, only the Green Building Certification Institute (GBCI) may award points and grant certification. Accordingly, Green-Buildings.com does not make any assurances, guarantees, representations, or warranties, express or implied, and specifically disclaims all warranties or representations, that products will earn LEED points, or any project that utilizes such products, will receive LEED® certification.