ECO J.A.B. ENTERPRISES, LLC

# Satic Pulse CFL Lamps

## 3rd Party Power Verification

**Eco JAB Enterprises**

**10/28/2011**

This report outlines a series of tests comparing Satic Pulse CFL lamps with comparable lamps marketed by competitors commonly found on retail shelves and shows the distinct differences in power usage and efficiency in the comparison.

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## Introduction

My name is Jerrod Brown, President of EcoJAB Enterprises, LLC. It is EcoJAB's objective to gather and present accurate, understandable and usable data to help both individuals and businesses make quality decisions on both "going green" and saving money.

The U.S. has been given an energy related mandate as a result of "The Energy Independence and Security Act of 2007." In light of what is frequently seen as a pending energy crisis, the legislation requires that general-purpose lamps, starting in January 2012 be at least 25% more efficient than those using standard incandescent technology invented by Thomas Edison in 1879. Compact fluorescent lighting has emerged as one of three technologies proposed to fulfill this federally mandated obligation.

As to the reason for this document, EcoJAB was hired by Satic Incorporated to work in conjunction with Dr. Bradley Layton, Energy Technology Department Chairman, and Tom Gallagher, Electronics Technology Department Chairman, at The University of Montana College of Technology to conduct an independent third party assessment and evaluation of their compact fluorescent lighting products. This evaluation was to include testing and comparisons with some commonly marketed brands of compact fluorescent lighting (CFL) bulbs which are marked as energy efficient and sold for the typical American home. Effort was made to select bulbs of similar wattage values for testing comparisons thus ensuring validation of quality and efficiency, as well as using testing equipment considered to be industry standard.

This report includes findings from a recently conducted study of several popular lamps as well as a technical description of our testing equipment and procedures. The results of this study support the use of Satic's lighting products to meet both the federal mandates as well as being preferable to other products on the market in terms of energy consumption and quality of lighting.

Under full disclosure, EcoJAB Enterprises is not certified under the 10 C.F.R. PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS.

If you have any questions, please feel free to contact EcoJAB directly.

Sincerely,

Jerrod Brown

# Assessment Design Overview

EcoJAB provided data collection and analysis of the Satic 12W, 15W, 20W, and 23W CFL lamps after establishing testing guidelines and data collection methodologies for the purposes of presenting technical information for the benefit of the typical American consumer. Data collection of the CFL lamps was accomplished using commercial equipment that is widely accepted by the industry.

**Testing Environment:**

To test the CFL lamps, an isolated utility power panel was configured with a testing board configured with three medium base screw-in lamp receptacles wired to three toggle switches that controlled power to each receptacle and a 10-foot power cord plugged into a P3 Kill-a-Watt meter that was plugged into a power outlet attached to the isolated test line attached to the utility test panel. A Fluke True RMS 335 clamp meter and a Mastech 2203 KVAR clamp multi-meter were installed around the circuit source wire and a Powersave CC128 Current Cost energy monitor was attached around the corresponding phase utility service line which was attached by lug to the breaker panel bus bar.

The three toggle switches allowed comparison testing between lamps and concurrent measurement using the P3 Kill-A-Watt meter, the ENVI Powersave CC128 Current Cost energy monitor, the Fluke 335 True RMS clamp meter, and the Mastech 2203 KVAR clamp multi-meter. The P3 Kill-A-Watt meter provided voltage, amperage watts, and power factor efficiency information at the load. The Fluke 335 meter and Mastech 2203 provided amperage measurements for consistency. The ENVI monitor provided monetary costs and secondary energy information in wattage at the power source, the utility source line in the dedicated breaker panel. In addition a Fluke 62 Mini IR thermometer was utilized on each lamp to accurately record temperature readings in Fahrenheit degrees of the lamp surface. Data was collected over a two week duration under identical ambient laboratory conditions using the methods and equipment outlined in the report.

The data collection and the design described above involved certain measurement issues that included:

- When reviewing data involving watts and costs with the ENVI Powersave there was one watt of power at a relatively high PF value of 95 being used by the P3 Kill-A-Watt.
- The Fluke 334 and Mastech 2203 only provide information to one significant digit which results in some instrument rounding which lowers precision but provides relative accuracy.
- The ENVI Powersave cost analysis also had a limitation. Monthly costs above $10.00 are rounded up to the nearest dollar value. Because of this rounding, there is some loss of precision with the ENVI instrumentation. Despite this limitation, our test results still demonstrated significant potential monetary

savings when the Satic bulbs were used. The ENVI meter was set at $0.099 per kWh base cost for electricity which, it must be noted, is relatively low by industry standards.

For CFL lamp comparison purposes, a set of commonly used CFL lamps were included in the testing and analysis. A list of these CFL lamps with their applicable name, manufacturer, marketed wattage and name plate specifications can be found in Table 1. Comparison testing between the Satic Pulse CFL lamps and competitive lamps involved measurement of energy conservation, power consumption and heat produced as a byproduct of work done.

**Economic and Energy Test:**

A combination of the P3 Kill-A-Watt and an ENVI Powersave monitor were used to collect data related to energy usage in terms of voltage, amperage, watts, and power factor. The results of these assessments can be found in Table 2 and Table 3. The Fluke clamp and Mastech clamp were used to provide additional amperage readings to ensure accuracy and consistency and are reported in Table 4. Data was collected when the CFL lamps were initially energized. It was observed that there are often up to four minutes of irregular activity in power consumption. After assessment of trends, a period of five minutes was selected as a secondary data collection time for all tests. Energy consumption and heat buildup demonstrated stability after this period of time.

**Heat Test**

The heat test was a comparison of operational temperature after the standard duration of five minutes. The laboratory ambient air temperature was 70° Fahrenheit. The lamp temperatures were taken before being installed in the test board. Data collection points are the top center of the CFL transition loop which is the tip of the CFL twists and the ballast at midpoint between the cylinder edges. The lamps were then energized for the five minute test duration and new temperature data was recorded. Heat loss is the loss of energy in a system often in the form of infrared energy waves which is typically a byproduct of poor system efficiencies and can create a net increase in unit temperature. The temperature tests were completed with the Fluke 62 Mini IR thermometer and results listed in Table 5.

## Table 1: CFL Information Sheet for Satic Pulse Comparison

| Wattage | Lamp Description | Name Plate Information | Model # | Name Plate Volt/Amps |
|---|---|---|---|---|
| 12 | Satic Pulse 12 watt CFL lamp | 120V/100mA- 50/60Hz- 6000k | SATIC12W | 12.0 |
| 10 | GE Helical 10 watt CFL lamp | 120V/140mA- 60Hz | FLE10HT3/2/SW | 16.8 |
| 10 | Soft White (generic) 10 watt CFL lamp | 120V/140mA- 60Hz | FLE10HT3/2/SW | 16.8 |
| 10 | GE Helical 10 watt (mini) CFL lamp | 120V/160mA- 60Hz- 6500K | FLE10HT2/2/SL/D | 19.2 |
| | | | | |
| 15 | Satic Pulse 15 watt CFL lamp | 120V/115mA- 50/60Hz- 6000k | SATIC15W | 13.8 |
| 14 | EcoSmart 14 watt CFL lamp | 120V/230mA- 60Hz- 5000k | EDXO-14 | 27.6 |
| 13 | GE Helical 13 watt CFL lamp | 120V/180mA- 60Hz | FLE13HT3/2/SW | 21.6 |
| 13 | Sylvania micro-mini 13 watt CFL lamp | 120V/200mA- 60Hz- 2700K | CF13EL/MICRO | 24.0 |
| 13 | Conserv-Energy 13 watt CFL lamp | 120V/210mA- 60Hz | BCPE13T/8 | 25.2 |
| | | | | |
| 20 | Satic Pulse 20 watt CFL lamp | 120V/165mA- 50/60Hz- 6000k | SATIC20W | 19.8 |
| 20 | OptoLight 20 watt CFL Lamp | 120V/365mA- 60Hz | (Broken/lost) | 43.8 |
| 20 | GE Helical 20 watt CFL Lamp | 120V/340mA- 60Hz | FLE20HT3/2/SW | 40.8 |
| 20 | Soft White (generic) 20w CFL lamp | 120V/340mA- 60Hz | FLE20HT3/2/SW/10k | 40.8 |
| | | | | |
| 23 | Satic Pulse 23 watt CFL lamp | 120V/190mA- 50/60Hz- 6000k | SATIC23W | 22.8 |
| 23 | OptoLight 23 watt CFL lamp | 120V/420mA - 60Hz | (Broken/lost) | 50.4 |
| 23 | Phillips 23 watt CFL lamp | 120V/380mA- NA - 2700k | EL/mdT 23W LL | 45.6 |
| 23 | Sylvania 23 watt CFL lamp | 120V/390mA- 60Hz- 3000k | CF23EL/SUPER | 46.8 |
| 23 | Conserv-Energy 23 watt CFL lamp | 120V/380mA- 60Hz | BPCE23TM/4 | 45.6 |

Note: All lamps are medium base screw in with helical twisted CFL tubes.

## Table 2: CFL Energy Consumption Comparison Test- Lamp Ignition

| | Values at point of Energizing | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | P3 Kill-a-Watt data | | | | | ENVI-Powersave data | | |
| **Product** | **Volts** | **Amps** | **Watts** | **VA** | **PF** | **watts** | **Cost per 24 hr** | **Cost per month** |
| Satic Pulse 12 watt | 120.4 | 0.09 | 10.6 | 11.3 | 96 | 15 | $ 0.03 | $ 0.90 |
| GE Helical 10 watt | 120.7 | 0.13 | 9.5 | 16.1 | 57 | 17 | $ 0.04 | $ 1.20 |
| Soft White 10 watt (generic) | 120.5 | 0.13 | 9.0 | 15.8 | 57 | 17 | $ 0.04 | $ 1.21 |
| GE Helical 10 watt (mini) | 120.5 | 0.14 | 9.5 | 17.2 | 56 | 19 | $ 0.04 | $ 1.36 |
| | | | | | | | | |
| Satic Pulse 15 watt | 120.1 | 0.10 | 11.6 | 12.0 | 97 | 15 | $ 0.04 | $ 1.14 |
| EcoSmart 14 watt | 119.6 | 0.19 | 13.9 | 23.6 | 60 | 25 | $ 0.06 | $ 1.79 |
| GE Helical 13 watt | 120.8 | 0.16 | 11 | 19.8 | 57 | 23 | $ 0.05 | $ 1.64 |
| Sylvania 13 watt (micro-mini) | 120.7 | 0.16 | 11.4 | 19.6 | 58 | 23 | $ 0.05 | $ 1.64 |
| Conserv-Energy 13 watt | 121.3 | 0.21 | 15.0 | 25.7 | 58 | 26 | $ 0.06 | $ 1.86 |
| | | | | | | | | |
| Satic Pulse 20 watt | 119.9 | 0.16 | 18.6 | 19.9 | 95 | 23 | $ 0.05 | $ 1.69 |
| OptoLight 20 watt | 120.5 | 0.26 | 18.2 | 34.9 | 55 | 37 | $ 0.08 | $ 2.72 |
| GE Helical 20 watt | 120.7 | 0.26 | 17.6 | 32.0 | 56 | 33 | $ 0.08 | $ 2.36 |
| Soft White 20w (generic) | 119.8 | 0.25 | 17.0 | 31.0 | 56 | 33 | $ 0.07 | $ 2.36 |
| | | | | | | | | |
| Satic Pulse 23 watt | 119.8 | 0.19 | 20.5 | 22.1 | 94 | 25 | $ 0.06 | $ 1.79 |
| OptoLight 23 watt | 120.5 | 0.35 | 24.0 | 42.4 | 56 | 42 | $ 0.09 | $ 2.77 |
| Phillips 23 watt | 120.4 | 0.32 | 25.3 | 44.1 | 57 | 44 | $ 0.10 | $ 3.08 |
| Sylvania 23 watt | 119.8 | 0.34 | 23.7 | 43.2 | 57 | 42 | $ 0.10 | $ 3.00 |
| Conserv-Energy 23 watt | 121.1 | 0.33 | 22.6 | 41.2 | 56 | 41 | $ 0.10 | $ 3.00 |

## Table 3: CFL Energy Consumption Comparison Test- 5 Minutes

| | After 5 Minutes of Operation | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | P3 Kill-a-Watt data | | | | | ENVI-Powersave data | | |
| Product | Volts | Amps | Watts | VA | PF | watts | Cost per 24 hr | Cost per month |
| Satic Pulse 12 watt | 120.4 | 0.09 | 10.6 | 11.1 | 95 | 15 | $ 0.03 | $ 1.07 |
| GE Helical 10 watt | 120.2 | 0.14 | 9.9 | 17.0 | 58 | 20 | $ 0.04 | $ 1.36 |
| Soft White 10 watt (generic) | 120.4 | 0.14 | 9.7 | 16.6 | 58 | 19 | $ 0.04 | $ 1.43 |
| GE Helical 10 watt (mini) | 120.1 | 0.16 | 11.4 | 20.1 | 56 | 23 | $ 0.05 | $ 1.64 |
| | | | | | | | | |
| Satic Pulse 15 watt | 120.1 | 0.11 | 13.3 | 14.2 | 92 | 17 | $ 0.04 | $ 1.21 |
| EcoSmart 14 watt | 119.6 | 0.20 | 14.6 | 24.5 | 59 | 26 | $ 0.06 | $ 1.79 |
| GE Helical 13 watt | 120.7 | 0.16 | 11.2 | 19.8 | 57 | 23 | $ 0.05 | $ 1.64 |
| Sylvania 13 watt (micro-mini) | 120.4 | 0.18 | 12.6 | 21.6 | 58 | 24 | $ 0.05 | $ 1.71 |
| Conserv-Energy 13 watt | 121.3 | 0.34 | 23.4 | 41.0 | 56 | 39 | $ 0.09 | $ 2.79 |
| | | | | | | | | |
| Satic Pulse 20 watt | 120.2 | 0.16 | 18.2 | 19.8 | 93 | 23 | $ 0.05 | $ 1.64 |
| OptoLight 20 watt | 120.5 | 0.29 | 19.1 | 34.1 | 55 | 33 | $ 0.08 | $ 2.36 |
| GE Helical 20 watt | 120.5 | 0.29 | 19.0 | 34.5 | 55 | 33 | $ 0.07 | $ 2.43 |
| Soft White 20w (generic) | 119.3 | 0.29 | 19.3 | 34.0 | 57 | 34 | $ 0.08 | $ 2.43 |
| | | | | | | | | |
| Satic Pulse 23 watt | 120.4 | 0.17 | 19.9 | 21.2 | 93 | 24 | $ 0.05 | $ 1.71 |
| OptoLight 23 watt | 120.5 | 0.33 | 22.7 | 41.2 | 55 | 39 | $ 0.09 | $ 2.79 |
| Phillips 23 watt | 120.7 | 0.32 | 22.1 | 39.2 | 56 | 38 | $ 0.09 | $ 2.72 |
| Sylvania 23 watt | 120.5 | 0.34 | 22.9 | 41.5 | 55 | 41 | $ 0.09 | $ 2.93 |
| Conserv-Energy 23 watt | 121.3 | 0.34 | 23.4 | 41.0 | 56 | 39 | $ 0.09 | $ 2.79 |

## Table 4: Reported Amp Values - Clamp Meters

| Product | Values at point of Energizing | | After 5 Minutes of Operation | |
|---|---|---|---|---|
| | Fluke 335 | Mastech 2203 | Fluke 335 | Mastech 2203 |
| Satic 12 watt CFL Lamp Screw-in | 0.0 | 0.0 | 0.0 | 0.0 |
| GE Helical 10 watt CFL Lamp Screw-in | 0.1 | 0.1 | 0.1 | 0.1 |
| Soft White (generic) 10 watt CFL | 0.1 | 0.1 | 0.1 | 0.1 |
| GE Helical 10 watt (mini) CFL Lamp Screw-in | 0.1 | 0.1 | 0.1 | 0.1 |
| | | | | |
| Satic 15 watt CFL Lamp Screw-in | 0.1 | 0.1 | 0.1 | 0.1 |
| EcoSmart 14 watt CFL Lamp Screw-in | 0.2 | 0.2 | 0.2 | 0.2 |
| GE Helical 13 watt CFL Lamp Screw-in | 0.2 | 0.1 | 0.2 | 0.1 |
| Sylvania micro-mini 13 watt CFL screw-in | 0.2 | 0.1 | 0.2 | 0.1 |
| Conserv-Energy 13 watt CFL Screw-in | 0.2 | 0.2 | 0.2 | 0.2 |
| | | | | |
| Satic 20 watt CFL Lamp Screw-in | 0.2 | 0.1 | 0.2 | 0.1 |
| OptoLight 20 watt CFL Lamp Screw-in | 0.3 | 0.2 | 0.3 | 0.2 |
| GE Helical 20 watt CFL Lamp Screw-in | 0.3 | 0.2 | 0.3 | 0.2 |
| Soft White (generic) 20w CFL | 0.2 | 0.2 | 0.2 | 0.2 |
| | | | | |
| Satic 23 watt CFL Lamp Screw-in | 0.2 | 0.1 | 0.2 | 0.1 |
| OptoLight 23 watt CFL Lamp Screw-in | 0.3 | 0.3 | 0.3 | 0.3 |
| Phillips 23 watt CFL Lamp Screw-in | 0.3 | 0.3 | 0.3 | 0.3 |
| Sylvania 23 watt CFL Lamp Screw-in | 0.3 | 0.3 | 0.3 | 0.3 |
| Conserv-Energy 23 watt CFL Lamp Screw-in | 0.3 | 0.3 | 0.3 | 0.3 |

## Table 5: CFL Temperature Comparison

| Product | Temperature is Fahrenheit degrees: Temperature before current is applied | | temp after 5 minutes operation | |
|---|---|---|---|---|
| | Base Temp | Coil temp | Base temp | Coil temp |
| Satic 12 watt CFL Lamp Screw-in | 69.5 | 69.5 | 79.0 | 104 |
| GE Helical 10 watt CFL Lamp Screw-in | 68.5 | 69.0 | 82.0 | 125 |
| Soft White (generic) 10 watt CFL | 68.5 | 69.0 | 81.5 | 126 |
| GE Helical 10 watt (mini) CFL Lamp Screw-in | 68.5 | 69.0 | 97.5 | 143 |
| | | | | |
| Satic 15 watt CFL Lamp Screw-in | 68.5 | 68.5 | 72.5 | 117.5 |
| EcoSmart 14 watt CFL Lamp Screw-in | 70.5 | 71.5 | 74.5 | 151 |
| GE Helical 13 watt CFL Lamp Screw-in | 69.5 | 69.5 | 73.5 | 129.5 |
| Sylvania micro-mini 13 watt CFL screw-in | 68.5 | 70.0 | 72.5 | 164 |
| Conserv-Energy 13 watt CFL Screw-in | 70.0 | 69.5 | 83.5 | 153.5 |
| | | | | |
| Satic 20 watt CFL Lamp Screw-in | 68.5 | 69.0 | 74.0 | 131 |
| GE Helical 20 watt CFL Lamp Screw-in | 68.5 | 69.5 | 74.5 | 146 |
| Soft White (generic) 20w CFL | 70.5 | 69.0 | 72.5 | 152 |
| | | | | |
| Satic 23 watt CFL Lamp Screw-in | 68.5 | 68.5 | 70.0 | 132.5 |
| Phillips 23 watt CFL Lamp Screw-in | 70.5 | 70.0 | 78.0 | 151 |
| Conserv-Energy 23 watt CFL Lamp Screw-in | 71.0 | 70.5 | 92.0 | 148.5 |

## Test Results

Comparison testing with the sample of CFL lamps used in this study showed the Satic Pulse lamps are more efficient in electrical consumption and operate at lower temperatures than the other models tested. In addition, the Satic Pulse CFL lamps used the advertised energy and provided superior power factor efficiencies in the transformation of electricity to full spectrum illumination. Testing and observation showed that the marked wattage of the other CFL lamps used in the study do not equal the mathematical results obtained when multiplying the name plate values printed on the lamp ballast. Please see the Addendum for a discussion of the mathematics behind this issue.

The Satic Pulse lamps are also more economical to use. For this study a value of $0.10 cents per kWh was used in the ENVI Powersave unit which is slightly lower than the national average but common to the region of testing. Actual monetary savings will be case dependent, however, as consumer habits and utility charges vary. In all of the lamp comparisons the Satic Pulse lamps were more cost efficient to operate based on the data gathered from the ENVI Powersave CC128 Current Cost energy monitor.

Satic Pulse bulbs are reported to be created with a proprietary ballast technology which has a near perfect Power Factor. This heightened efficiency inherently allows for a lower operating temperature and potentially greater lifespan due to lower operating temperatures. The current testing period has not yet been long enough to fully confirm Satic Pulse lamps will last longer than the other CFL lamps used in this study but preliminary results with increased power factor and cooler operating temperatures would tend to support this hypothesis.

## Conclusion

The results of this independent third party product comparison study suggest the following with respect to the Satic Pulse lamps:

- Satic Pulse lamps operate with a higher power factor.
- Satic Pulse lamps require less electricity than comparable CFL products.
- Satic Pulse lamps usually operate at lower temperatures than comparable CFL products.
- Satic Pulse lamps are more cost effective to operate.

## Addendum

This report contains both the measured energy usage and the labeled energy requirements of the tested lamps. It is obvious that there is a mathematical discrepancy in labeling versus actual usage. The math is not complex and after repeated testing with multiple meters the common CFL lamp does not "pencil out" in terms of the expected usage data. Testing and observations have shown that the marketed wattage of a typical CFL bulb does not equal the mathematical results obtained when multiplying the name plate values printed on the lamp ballast. This study shows that it is common for CFL bulbs marketed in the USA to actually have poor Power Factor (PF) ratings that range from 50% to 65% efficiency. This has a direct impact on the consumer as losses in PF are losses in efficiency and are billable by the utility companies.

The standard for the United States residential and light commercial power grid is 60 Hz 120 Volts. CFL lamps sold on shelves for the US consumer are stamped accordingly along with an amperage value typically listed as milliamps. It is commonly known that voltage combined with amperage demands when using A/C current equates to A/C Volt Amps (VA). VA is the total value of the current being drawn by electrical equipment that is actually the total power of both real and apparent power to do work. Apparent power is often lost through inductance in equipment and wires and is often calculated in KVAR and defined as Power Factor (PF) efficiencies. Apparent power lost in an inefficiency usually returned to the utility company or dissipated as heat. The stamped VA rating is a limit of the maximum permissible current often drawn.

For example, if a CFL lamp claims 13 watts of power usage, the name plate values stamped on the ballast might actually read 120V/210mA - 60Hz. Now also assume the CFL lamp has a PF rating of 58. Table 6 illustrates what is frequently happening in terms of lamp ratings and actual power usage in this kind of scenario.

| | | | | | | |
|---|---|---|---|---|---|---|
| 120V | × | 0.210mA | = | 25.2 | Volt Amps total current demand | (*Charged value at the meter)* |
| 25.2 VA | × | 0.58 PF | = | 14.62 | Volt Amps of work providing illumination | (*Advertised power*) |
| 25.2 VA | – | 14.62 W | = | 10.58 | Volt Amps lost in apparent power and heat | (*Unreported waste*) |

**Table 6: Math Example**

This study supports that the name plate amperage is frequently far from the true consumption under controlled test conditions. The VA stamp is after all the limit of the maximum permissible current the lamp requires. A discrepancy becomes evident in marketing the effective power creating desired work and the real power demands of the equipment. Strong evidence is emerging that many products provide misleading information to consumers. In the above example there is a 1.94 times greater power requirement above marketed wattage claims.

It should also be considered that at this time, the American consumer is typically only charged by the kilowatt hour (KWH – real power), but with the implementation of smart meters, the utilities will be able to charge consumers for kilowatt and reactive power (VA), as well as power inefficiencies or poor power factor (KVAR). As the Smart Power Grid is implemented and use of smart meters becomes more widespread, the billable power charges will probably increase, unless the consumer has taken steps to improve their power factor.

When the math is done on the typical US compact florescent bulb electrical current demand does not equal the advertised wattage. Furthermore wattage is marketed as a saleable value of power demand but it is not relevant to many current lamp power demands. The discrepancy is found in the Power Factor losses created by poor ballast designs.