# Commercial Audit Report

Prepared For: Carl's Gym  
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Portland, OR 97201  
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## Disclaimer

This energy audit report intents to identify energy savings opportunities associated with lighting at this site. Approximate saving ranges are included in this report to make decisions about reducing energy use at the facility. However, this report is not intended to serve as a detailed engineering design document.

As a result, OptiMiser is not liable if estimated savings ranges or economics are not actually achieved. All savings and cost estimates in the report are for informational purposes, and are not to be construed as a design document or as guarantees. In no event will OptiMiser be liable for the failure of the customer to achieve a specified amount of energy savings, the operation of customer’s facilities, or any incidental or consequential damages of any kind in connection with this report or the installation of the recommended measures.

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## Section 1

### Executive Summary

The goal of this audit is to identify and prioritize potential energy and demand savings opportunities at Carl's Gym in Portland, OR. The following measures were identified:

| **Measure Description** | **Electric Energy Savings (kWh)** | **Peak Electric Demand Savings (kW)** | **Heating Energy Savings (Therm)** | **Cost ($)** | **Incentive ($)** | **CO2 Equivalent Reduction (t)** |
| --- | --- | --- | --- | --- | --- | --- |
| Improve Light Fixtures | 8,748 | 2.68 | 0 | $6,467 | $0 | 6.03 |
| Total | 8,748 | 2.68 | 0 | $6,467 | $0 | 6.03 |

These measures, if implemented, could result in annual energy savings of 8,748 kWh and 0 Therm, with 3 kW of peak demand savings. These are equivalent to annual energy cost savings of $919 and will pay for themselves in about 7 years. The energy savings from recommended measures are approximately 58% of the electric consumption and 0% of the gas consumption for the facility’s most recent 12 months of usage, based on billing data for this facility.

### Greenhouse Gas Emissions

| **Performance Metric** | **Pre-Implementation** | **Post-Implementation** | **% of Savings** |
| --- | --- | --- | --- |
| Total Energy Use |  |  |  |
| kbtu/yr | 51,224,581 | 21,374,907 | 58.27% |
| Greenhouse Gas Emissions | |  |  |
| GHG Emissions (MtCO₂e/yr) | 9.17 | 3.82 | 58.27% |
| GHG Emissions (MtCO₂e/sf/yr) | 0.00037 | 0.00015 | 58.27% |
| Energy Cost (excluding water) | |  |  |
| Current Year ($/yr) | $1,576.31 | $657.76 | 58.27% |
| Cost Intensity ($/sf/yr) | $0.06305 | $0.02631 | 58.27% |

## Section 2 - Audit & Facility Info

### Introduction

An inefficient building wastes both energy and operational costs. By reducing the amount of energy the building wastes, the owner and occupants save operational costs for years to come, enjoy a more comfortable working environment, and help make the environment cleaner now and for future generations.

An energy audit investigates and determines where, when, why and how energy is used in a facility, and to identify opportunities to improve energy efficiency. It is the first important step toward developing a broad overall energy plan with the priority of making the building more energy efficient. Major objectives of the audit are to identify and assess opportunities for the facility to:

##### Reduce energy usage and expenditures

##### Reduce operation and maintenance expenditures

##### Improve interior thermal conditions and occupants’ thermal comfort

This energy audit will provide sufficient information to the owner to make decisions regarding the implementation of lighting measures for the building.

### Contact Information

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### Building

Carl's Gym consists of 1 building/s whose functions, areas, occupancy periods and other information are listed in the table below.

| **Building** | **Main Function(s)** | **Year Built** | **Area (sf.)** | **No. of Floors** | **Schedule** |
| --- | --- | --- | --- | --- | --- |
| Carl's Gym | Fitness Center/Health Club/Gym | 1998 | 25,000 | 2 | Default |

### Facility Schedule

The following table shows the schedule details for the building/s associated with this project.

| **Building** | **Monday Occupancy** | **Tuesday Occupancy** | **Wednesday Occupancy** | **Thursday Occupancy** | **Friday Occupancy** | **Saturday Occupancy** | **Sunday Occupancy** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Carl's Gym | 8:00 AM to 5:00 PM | 8:00 AM to 5:00 PM | 8:00 AM to 5:00 PM | 8:00 AM to 5:00 PM | 8:00 AM to 5:00 PM | 9:00 AM to 12:00 PM | 9:00 AM to 12:00 PM |

### Lighting

The following tables present lists of equipment installed in Carl's Gym.

| **Equipment** | **Quantity** | **Watt** | **Occupancy Sensor** | **Building** | **Location** |
| --- | --- | --- | --- | --- | --- |
| HO Hi-bay, 6-lamp | 16 | 169 | No | Not Specified | Gym |
| T12 40W, 2-lamp | 4 | 97 | Yes | Not Specified | Mens Locker Room |
| T12 40W, 2-lamp | 4 | 97 | Yes | Not Specified | Mens Locker Room |
| 20W CFL | 1 | 20 | No | Not Specified | Womens Locker Room |
| T12 34W, 2-lamp | 2 | 84 | No | Not Specified | Office |
| Inc recessed downlight | 3 | 65 | No | Not Specified | Break Room |
| 100W HID wall pack | 8 | 125 | No | Outside | Oustide |

## Section 3 - Recommended Energy Efficiency Opportunities

The following sections briefly describe recommended measures, categorized by measure cost and type:

**Lighting  —  Improve Light Fixtures**

Est. Install Cost: $6,467  
Total Annual Savings: $919  
Simple Payback Period (Yrs): 7  
CO2 Equivalent Reduction: 6.03 tons  
Electric Savings: 8,748 kWh  
Fuel Savings: - Therm

Interior lighting of the facility consists of T-12 linear fluorescent fixtures and HO Highbay lamps. Replacing these fixtures with more efficient linear fluorescent lamps/fixtures or LEDs can reduce interior lighting energy use while by using less electric lighting power to maintain the same lighting level. Indirect benefits include reduced HVAC energy consumption due to reduced building cooling load from lower internal loads.

## Indoor Light Improvements

### Observations

With lighting accounting for more than 25 percent of the energy used in most commercial buildings, increased efficiency can make a significant impact to monthly energy bill. Lighting in the office area is on 10 hrs/day, 7 days/wk which is longer than the space is occupied with no special controls or occupancy sensors. Making sure someone turns off these lights when they are not in use is a way to reduce energy at no cost. These lights are manually operated by staff personnel by an on/off switch.

### Recommendations

All fixtures should be removed and upgraded with high efficiency LED lights . The introduction of occupancy sensors to the Locker rooms will help reduce wasted energy. For lights that have a manual switch, it is important to have staff remember to turn off lights when they are not in use.



| **Location** | **Light Type** | **Quantity** | **Savings** | **Cost** |
| --- | --- | --- | --- | --- |
| Break Room | LED Downlight fixture | 3 | $66 | $60 |
| Gym | Hi-Bay LED Fixture, 6-lamp equivalent | 16 | $375 | $4,000 |
| Mens Locker Room | LED equivalent 2-lamp fixture | 8 | $109 | $520 |
| Office | LED equivalent 2-lamp fixture | 2 | $35 | $130 |
| Womens Locker Room | LED Bulb, 20W CFL equivalent | 1 | $3 | $9 |
| **Total** |  | **30** | **$588** | **$4,719** |

## Outdoor Light Improvements

DOE estimates that 303 terawatt-hours (TWh) of electricity was used by the commercial sector for lighting in 2009, which includes commercial and institutional buildings and public street and highway lighting (DOE EIA 2010). This 303 TWh is roughly 23 percent of commercial electricity consumption. Definitive estimates for interior versus exterior lighting energy usage are hard to come by, but exterior lighting accounts for at least 8 percent of lighting energy use and probably more (Navigant 2002). In the case of this building, there are 8 wall mounted lights on the exterior we recommend replacing with LED equivalents.

| **Location** | **Light Type** | **Quantity** | **Savings** | **Cost** |
| --- | --- | --- | --- | --- |
| Oustide | LED Wallpack, 100 W equivalent | 8 | $320 | $1,600 |
| **Total** |  | **8** | **$320** | **$1,600** |

## Occupancy Sensor Improvements

It is recommended to install occupancy sensors in rooms with sporadic use (e.g. bathrooms) and photo-sensors in rooms where day-lighting is sufficient. The list of recommended sensor locations below is estimated to save 102 kWh or 1% of lighting energy costs.

| **Location** | **Occupancy Sensor Type** | **Quantity** | **Savings** | **Cost** |
| --- | --- | --- | --- | --- |
| Mens Locker Room | Wall Switch Sensor | 2 | $11 | $37 |
| **Total** |  | **2** | **$11** | **$37** |

## Appendix

### Lighting Schedules

| **Equipment** | **Quantity** | **Use (Hrs/ Wk)** | **Operation Schedule** | **Location** |
| --- | --- | --- | --- | --- |
| HO Hi-bay, 6-lamp | 16 | 51 | 51 Hrs/Wk | Gym |
| T12 40W, 2-lamp | 4 | 51 | 51 Hrs/Wk | Mens Locker Room |
| T12 40W, 2-lamp | 4 | 51 | 51 Hrs/Wk | Mens Locker Room |
| 20W CFL | 1 | 51 | 51 Hrs/Wk | Womens Locker Room |
| T12 34W, 2-lamp | 2 | 70 | 70 Hrs/Wk | Office |
| Inc recessed downlight | 3 | 70 | 70 Hrs/Wk | Break Room |
| 100W HID wall pack | 8 | 84 | 84 Hrs/Wk | Oustide |

### Lighting by Floor

| **Light Type** | **Quantity** | **Floor** |
| --- | --- | --- |
| HO Hi-bay, 6-lamp -> Hi-Bay LED Fixture, 6-lamp equivalent | 16 | 1 |
| T12 40W, 2-lamp -> LED equivalent 2-lamp fixture | 8 | 1 |
| 20W CFL -> LED Bulb, 20W CFL equivalent | 1 | 1 |
| T12 34W, 2-lamp -> LED equivalent 2-lamp fixture | 2 | 2 |
| Inc recessed downlight -> LED Downlight fixture | 3 | 2 |

### Lighting by Location

| **Location** | **Light Type** | **Quantity** |
| --- | --- | --- |
| Break Room | Inc recessed downlight -> LED Downlight fixture | 3 |
| Gym | HO Hi-bay, 6-lamp -> Hi-Bay LED Fixture, 6-lamp equivalent | 16 |
| Mens Locker Room | T12 40W, 2-lamp -> LED equivalent 2-lamp fixture | 8 |
| Office | T12 34W, 2-lamp -> LED equivalent 2-lamp fixture | 2 |
| Womens Locker Room | 20W CFL -> LED Bulb, 20W CFL equivalent | 1 |

### Improved Lighting by Floor

| **Light Type** | **Quantity** | **Cost** | **Floor** |
| --- | --- | --- | --- |
| Hi-Bay LED Fixture, 6-lamp equivalent | 16 | $4,000 | 1 |
| LED equivalent 2-lamp fixture | 8 | $520 | 1 |
| LED Bulb, 20W CFL equivalent | 1 | $9 | 1 |
| LED equivalent 2-lamp fixture | 2 | $130 | 2 |
| LED Downlight fixture | 3 | $60 | 2 |

### Improved Lighting by Location

| **Location** | **Light Type** | **Quantity** | **Savings** | **Cost** |
| --- | --- | --- | --- | --- |
| Break Room | LED Downlight fixture | 3 | $66 | $60 |
| Gym | Hi-Bay LED Fixture, 6-lamp equivalent | 16 | $375 | $4,000 |
| Mens Locker Room | LED equivalent 2-lamp fixture | 8 | $109 | $520 |
| Office | LED equivalent 2-lamp fixture | 2 | $35 | $130 |
| Womens Locker Room | LED Bulb, 20W CFL equivalent | 1 | $3 | $9 |
| **Total** |  | **30** | **$588** | **$4,719** |

### Exterior Lighting by Location

| **Location** | **Light Type** | **Quantity** |
| --- | --- | --- |
| Oustide | 100W HID wall pack -> LED Wallpack, 100 W equivalent | 8 |

### Improved Exterior Lighting by Location

| **Location** | **Light Type** | **Quantity** | **Savings** | **Cost** |
| --- | --- | --- | --- | --- |
| Oustide | LED Wallpack, 100 W equivalent | 8 | $320 | $1,600 |
| **Total** |  | **8** | **$320** | **$1,600** |

### Glossary

**Annual Fuel Utilization Efficiency (AFUE)**

A measurement of efficiency for heating appliances. This laboratory-based figure accounts for chimney losses, equipment jacket losses, and cycling losses, but does not include distribution losses or fan/pump energy.

**British Thermal Unit (Btu, BTU)**

The amount of heat required to raise the temperature of 1 pound (0.454 kg) of liquid water by 1°F (0.56°C) at a constant pressure of one atmosphere. Several definitions of Btu exist, which are based on different water temperatures and therefore vary by up to 0.5 percent. A Btu can be approximated as the heat produced by burning a single wooden match. In the United States, the power of HVAC systems is sometimes expressed in Btu/hour instead of watts.

**Commercial Buildings Energy Consumption Survey (CBECS)**

A national sample survey that collects information on the stock of U.S. commercial buildings, including their energy-related building characteristics and energy usage data (consumption and expenditures).

**Centum Cubic Feet (100 cubic feet) (CCF)**

A measurement of space or volume. It is the amount of gas contained in a space equal to one hundred cubic feet. A CCF of natural gas produces around 1 therm of heat. Convert CCFs to therms to perform price comparisons.

**Compact Fluorescent Light (CFL)**

A light bulb that uses 65 percent less energy than a traditional incandescent bulb. Compared to an incandescent bulb, a single CFL saves approximately $30 over its lifetime and will pay for itself in about six months.

**Coefficient of Performance (COP)**

A heat pump or air conditioner's output in watt-hours of heat moved divided by watt-hours of electrical input.

**Coil**

Equipment that performs heat transfer to air when mounted inside an air handling unit or ductwork, a coil is heated or cooled by electrical means or by circulating liquid or steam within it.

**Economizer**

An HVAC component that uses outside air to reduce the need for mechanical cooling. It allows a building's mechanical ventilation system to bring in outside air when the outside air's enthalpy is less than that of the supply air for cooling.

**Energy Conservation Measure (ECM)**

Any type of project conducted, or technology implemented, to reduce the consumption of energy in a building.

**Energy Efficiency Ratio (EER)**

A commonly used measurement for air conditioning equipment, often used with a seasonal energy efficiency ratio (SEER). The higher the EER number for an air conditioner, the more efficiently it will perform at high outdoor temperatures. See also Seasonal Energy Efficiency Ratio.

**ENERGY STAR®**

An EPA (Environmental Protection Agency) designation attached to a wide variety of energy-using products that meet or exceed EPA guidelines for energy-efficient performance above the standard government minimum levels.

**Energy Utilization Intensity (EUI)**

Expresses a building's energy use as a function of its size or other characteristic. Common units for EUI is thousand British thermal units per square foot (kBtu/ft2). The lower an EUI, the more efficiency a facility is.

**Heating Seasonal Performance Factor (HSPF)**

An efficiency factor equal to the total heating output of a central air conditioning heat pump in BTUs during its normal usage period for heating divided by the total electrical energy input in watt-hours during the same period. A heat pump with a high HSPF is more efficient than one with a low HSPF.

**High Intensity Discharge Lamp (HID)**

A type of electrical gas-discharge lamp which produces light by means of an electric arc between tungsten electrodes housed inside a translucent or transparent fused quartz or fused alumina arc tube.

**Kilowatt (kW)**

1,000 watts, where a watt is a unit of electrical power calculated as the rate of energy transfer equivalent to one ampere flowing under a potential difference of one volt. Ten 100-watt bulbs operating at full power would require 1 kW.

**Kilowatt-Hour (kWh)**

A measurement that appears on your electric bill to show your usage. One thousand watt-hours equal one kWh. A typical United States household uses approximately 27,022 kilowatt-hours of electricity per year. Ten 100-watt incandescent bulbs lit for one hour consume one kWh of energy.

**Light-Emitting Diode (LED)**

Semiconductor devices that produce visible light when an electrical current is passed through them. LED lamps are a type of solid state lighting, as are Organic Light-Emitting Diodes (OLEDs) and Light-Emitting Polymers (LEPs). LEDs use 75 percent less electricity than incandescent bulbs to produce the same amount of light and last 25,000-50,000 hours (25 to 50 times longer).

**National Renewable Energy Laboratory (NREL)**

The United States' primary laboratory for renewable energy and energy efficiency research and development. The National Renewable Energy Laboratory (NREL) is a government-owned, contractor-operated facility, and is funded through the U.S. Department of Energy (DOE).

**Payback Period**

A payback period, in the energy efficiency industry, is the ratio of the estimated total cost of a conservation measure divided by its annual financial savings. This figure is one way to determine whether a conservation measure is cost-effective. More sophisticated versions of this calculation may take interest rates and discount rates into account.

**R-Value**

A measure of a material's resistance to heat flow. The higher the R-value, the better the insulation material's ability to resist the flow of heat through it.

**Seasonal Energy Efficiency Ratio (SEER)**

A commonly used measurement for air conditioning equipment, often used with an energy efficiency ratio. The higher the SEER, the more efficient an air conditioner is during average conditions. See also EER.

**Site EUI**

Site EUI expresses the buildings energy use in respect to only the energy that enters the facility at the utility meters.

**Source EUI**

Source EUI expresses the buildings energy use in respect to source energy. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses. By taking all energy use into account, the score provides a complete assessment of energy efficiency in a building. Source EUIs are derived from Source-Site Rations developed by EPA/Energy Star.

**Therm**

A standard unit for measuring the energy in the natural gas one has used. It is equal to 100,000 Btu. The therm is the industry standard, used by most gas utilities in the U.S.

**Watt (W)**

A watt is the unit of electrical power that can cause one ampere of current to flow under an electrical potential difference of one volt. Electrical potential is like pressure in a water piping system.