



## ***Carli, Inc.***

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### **Technical Report:**

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### **Comparative Energy Analysis of *Sample Commercial Building* WRT *Customers Windows***

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*Report prepared for:*

#### **Customer**

*Report prepared by:*

Dr. Charlie Curcija

## Introduction:

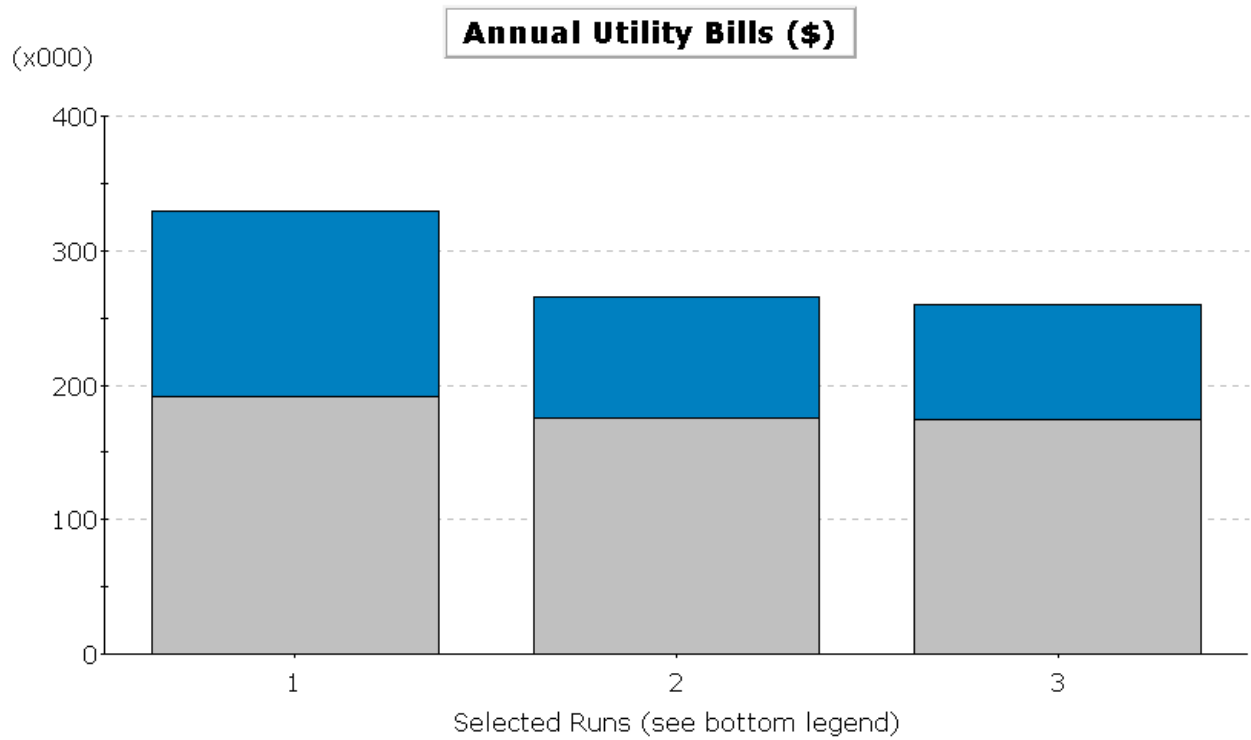
This report presents the results of an energy analysis of a *sample commercial building* located at *Location*. The goal of the analysis was to compare different window and glazing options from *Customer* and to compare with the existing state. All input data was provided by *Customer*. Number of modeling assumptions were made and are listed below. It should be noted that ***this analysis is appropriate for the comparison of different window options, and it is not intended to provide absolute energy performance of the building.*** The analysis was carried out using DOE 2 computer program and its derivatives.

The building consists of two wings located at an angle of 150° between them and connected with the common area, approximately 40 ft long. Each wing is 165' long and 54' wide. The total square footage of the building is 345,700 ft<sup>2</sup>. Existing windows are Aluminum framed, single glazed units with dimensions ranging from 39" x 62" to 113" x 62". Existing windows are assumed to be very leaky and the infiltration rate is assumed to be 1.5 cfm/ft<sup>2</sup>. The new proposed replacement windows are the same size and are constructed of thermally broken Aluminum frame. Measured infiltration rate for the new windows is 0.15 cfm/ft<sup>2</sup>. Two glazing options are considered, clear double glazing and hard coat low-e double glazing with emissivity on one of the surfaces of 0.1. Sketched drawings of the building are provided. The following are the assumptions that were further made:

- a) Exterior walls are made of poured concrete with brick facade and poorly insulated
- b) Gas fired boiler is used for hot water heating
- c) Packaged unitary systems (Fan-coil units) are used for cooling and heating. Cooling efficiency is assumed to be SEER 9.7. Heating is provided by hot water circulated through fan-coil units with average heating efficiency of 80%
- d) The building was simulated as rectangular shaped as a closest approximation to its real shape. The main orientation of the building is NE/SW.
- e) Utility rates are provided by *Customer* in a simple form of \$/unit. No demand or block charges were considered.
- f) Default schedules, lighting levels, and internal equipment loads were specified,
- g) Cooling thermostat set point was 76° and heating thermostat set point was 70°.
- h) Default air flows, pump and fan configurations, with standard efficiencies were assumed.

The results are presented as a series of tables and graphs. Each time three cases were presented,

- 1) Existing Single Glazed, Aluminum Frame Windows
- 2) Replacement Windows with Clear Double Glazing
- 3) Replacement windows with Low-e/Argon (e=0.1)

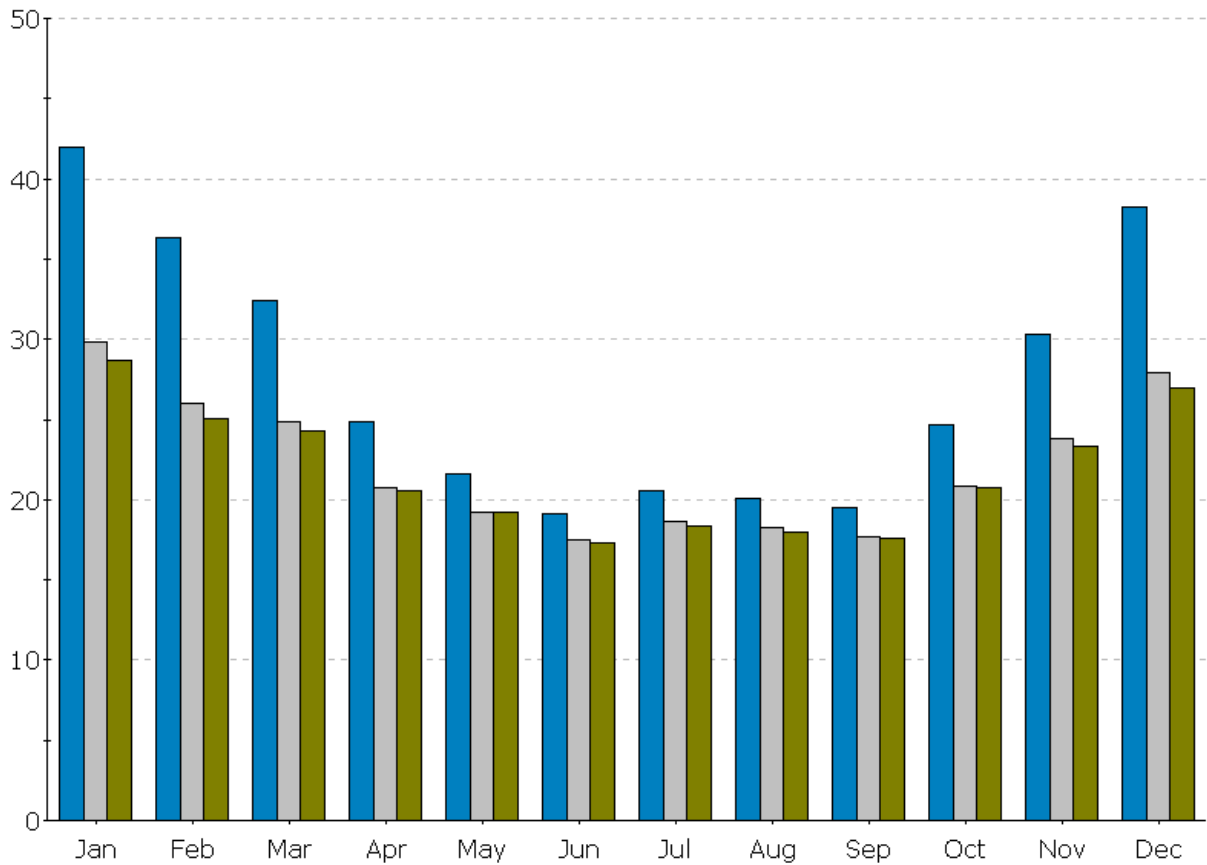


Electric Rate
  Gas Rate

1. Existing Single Glazed, Aluminum Frame Windows (annual bill: \$329,597)
2. Replacement Windows with Clear Double Glazing (annual bill: \$265,253)
3. Replacement with Low-e/Argon (e=0.1) (annual bill: \$260,138)

### Monthly Utility Bills (\$)

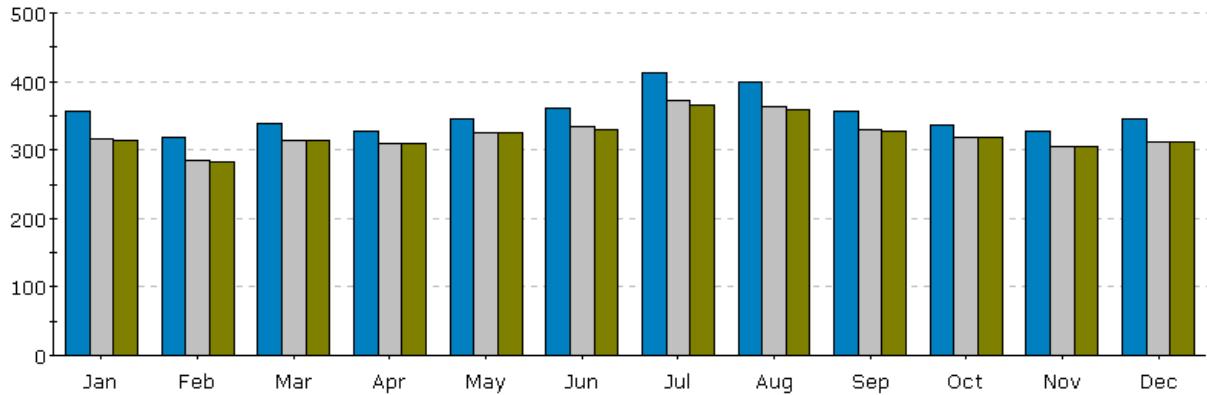
(x000)



- Existing Single Glazed Al Windows
- Replacement Windows with Clear Double Glazing
- Replacement Windows with Low-e/Argon Glazing (e3=0.1)

### Electric Consumption (kWh)

(x000)

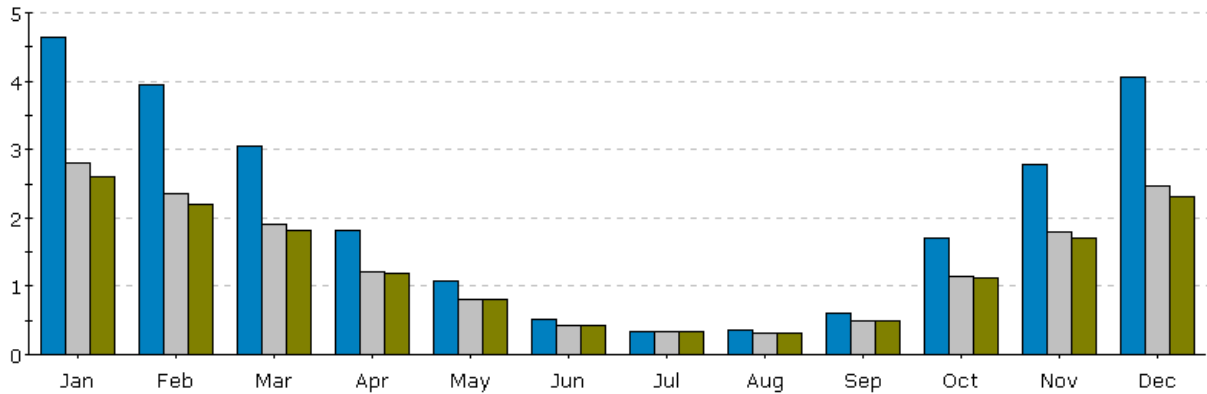


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	355.5	317.4	339.0	327.0	345.3	360.0	412.2	398.9	356.1	337.1	327.7	346.4	4,222.5
Run 2.	315.0	283.7	314.2	309.0	325.7	333.7	371.4	363.6	330.2	319.5	304.9	312.6	3,883.6
Run 3.	314.5	283.3	314.1	308.7	324.8	330.5	365.4	357.9	327.6	319.0	304.7	311.7	3,862.3

- Existing Single Glazed Al Windows
- Replacement Windows with Clear Double Glazing
- Replacement Windows with Low-e/Argon Glazing (e3=0.1)

### Gas Consumption (Btu)

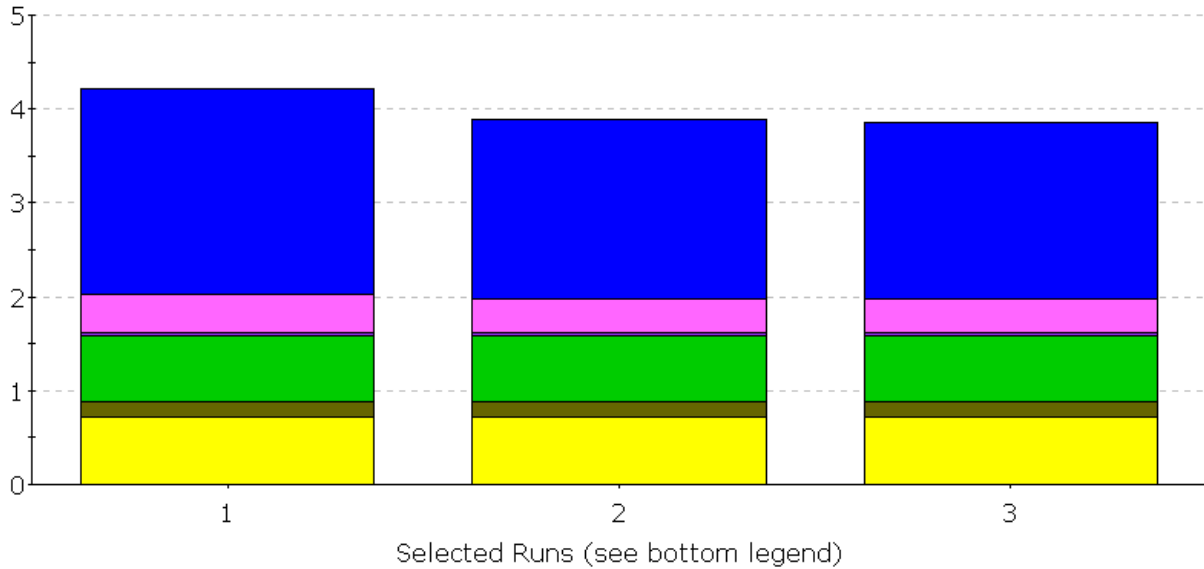
(x000,000,000)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	4.64	3.94	3.06	1.81	1.07	0.51	0.34	0.36	0.61	1.69	2.79	4.05	24.86
Run 2.	2.79	2.36	1.90	1.21	0.81	0.42	0.33	0.32	0.50	1.15	1.80	2.47	16.06
Run 3.	2.60	2.20	1.81	1.19	0.81	0.42	0.33	0.32	0.50	1.13	1.71	2.30	15.31

### Annual Electric Consumption (kWh)

(x000,000)



- |  |  |  |   |
|--|--|--|---|
| <span style="color: yellow;">■</span> Area Lighting  | <span style="color: gray;">■</span> Exterior Usage   | <span style="color: orange;">■</span> Water Heating  | <span style="color: cyan;">■</span> Refrigeration       |
| <span style="color: brown;">■</span> Task Lighting   | <span style="color: purple;">■</span> Pumps & Aux.   | <span style="color: darkred;">■</span> Ht Pump Supp. | <span style="color: lightblue;">■</span> Heat Rejection |
| <span style="color: green;">■</span> Misc. Equipment | <span style="color: pink;">■</span> Ventilation Fans | <span style="color: red;">■</span> Space Heating     | <span style="color: blue;">■</span> Space Cooling       |

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