

This document will analyze a residential building in Lakewood, CO using the SABER tool. The details of the building are given in the .pdf document in this folder. SABER will be used to analyze the building and provide recommendations for energy efficiency improvements. First the table below provides the inputs required for the analysis. The description of each of the inputs is provided in the [DetailedDocumentation.md](#) file in the docs folder of this repository. The screenshots of the various input screens are also provided in the [DetailedDocumentation.md](#) file.

# Inputs

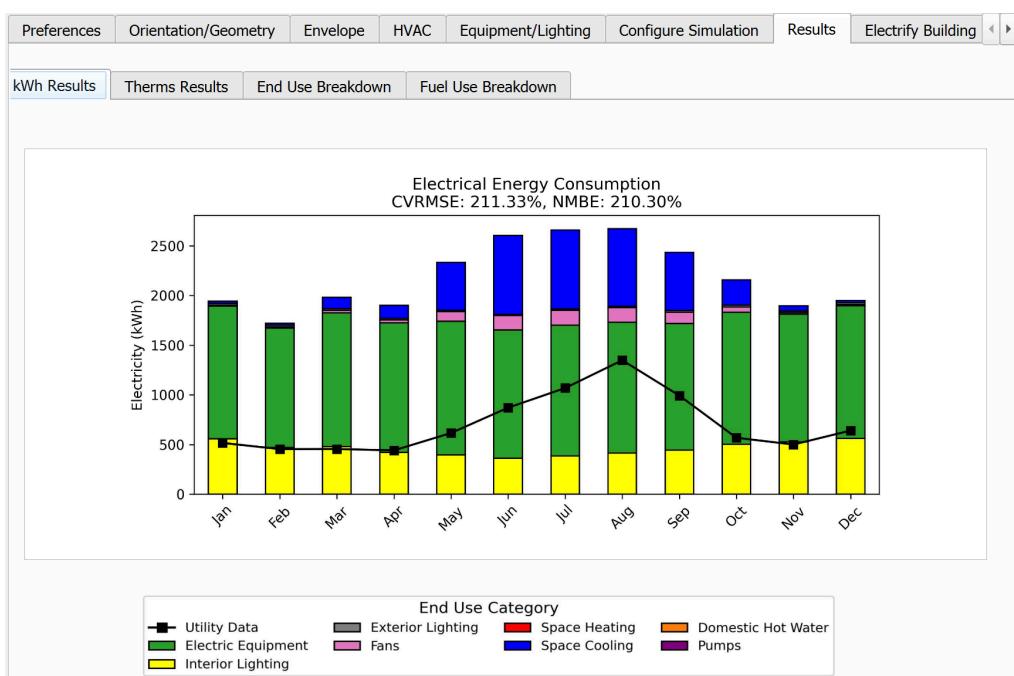
Input Parameter	Value
Project Name	LakewoodResidentialBuilding
Building Type	Single Family Residential Building
Location	Denver, CO
Floor Plan	Rectangle
Orientation	East
Floor Area (sqft)	1800
Floor Quantity	2
Wall Height (ft)	8
x1 (ft)	36
x2 (ft)	0
y1 (ft)	24
y2 (ft)	0
Exterior Wall Construction	2x4 insulated wood stud with brick finish
Exterior Wall Insulation Level	R-7 Fiberglass
Exterior Roof Construction	Asphalt shingles
Exterior Roof Insulation Level	R-30 Fiberglass
Foundation Type	Slab on Grade

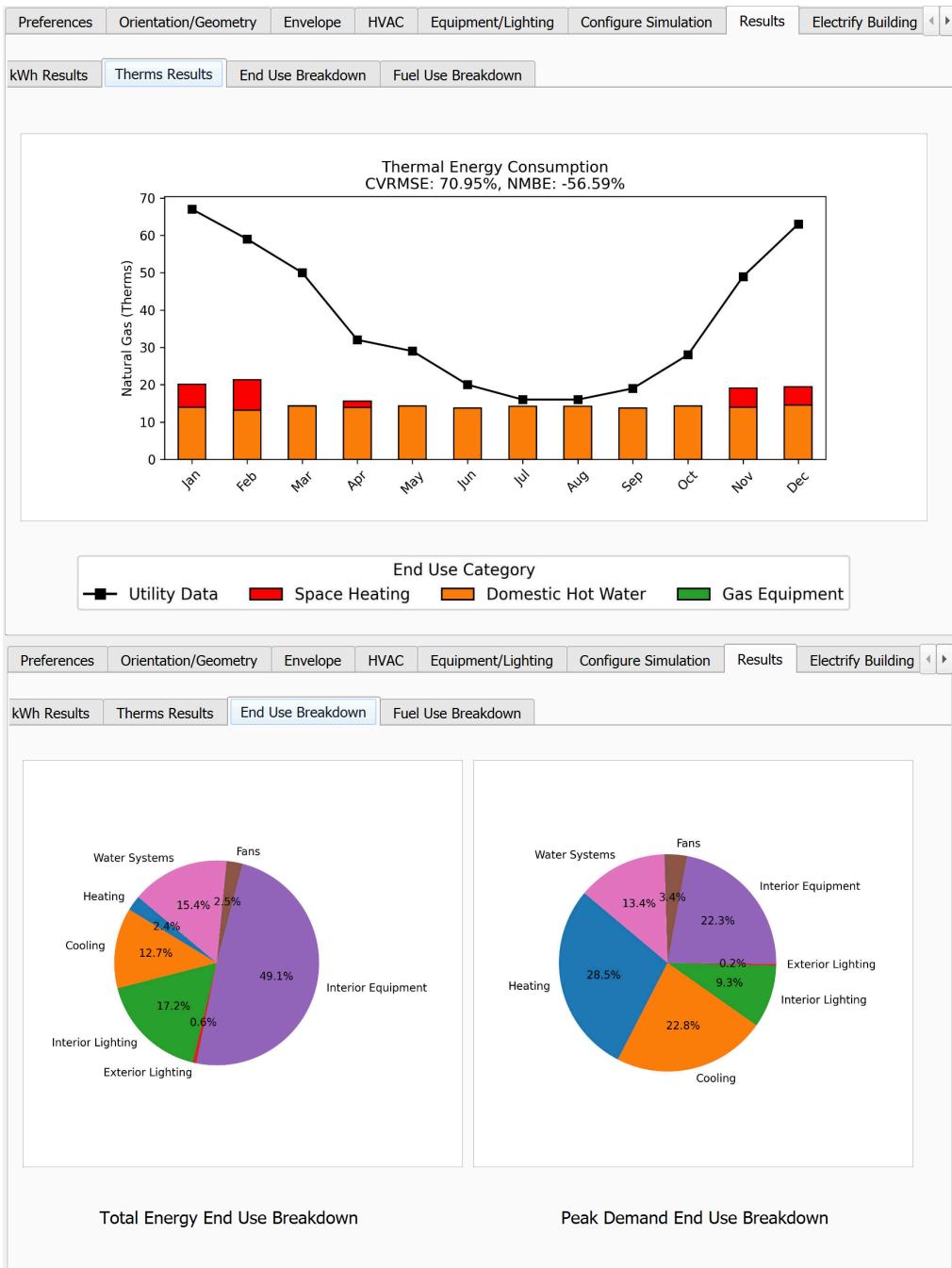
<b>Input Parameter</b>	<b>Value</b>
Infiltration Air Leakage Rate (ACH50)	4.0
Window Material	Single Pane Clear
WWR Front (%)	5.5%
WWR Back (%)	5.5%
WWR Left (%)	8.3%
WWR Right (%)	0.1%
Shading Overhang Depth (ft)	0
Window Height (ft)	3
Number of windows per wall	2
Cooling Equipment Type	Air Conditioner
SEER	Other.. - 11
Cooling Setpoint Temperature (°F)	74
Cooling Setback (°F)	0
Heating Equipment Type	Gas Furnace
AFUE	92.5%
Heating Setpoint Temperature (°F)	65
Night Setback (°F)	0
Hot Water Equipment Type	Gas Boiler
Tank Size (gallons)	40
Cooking Range Type	Range-Radiant; Not Energy Star Certified;
Refrigerator Type	Small; Not Energy Star Certified;
Dishwasher Type	None
Clothes Washer Type	Medium; Not Energy Star Certified;
Clothes Dryer Type	Medium; Not Energy Star Certified;

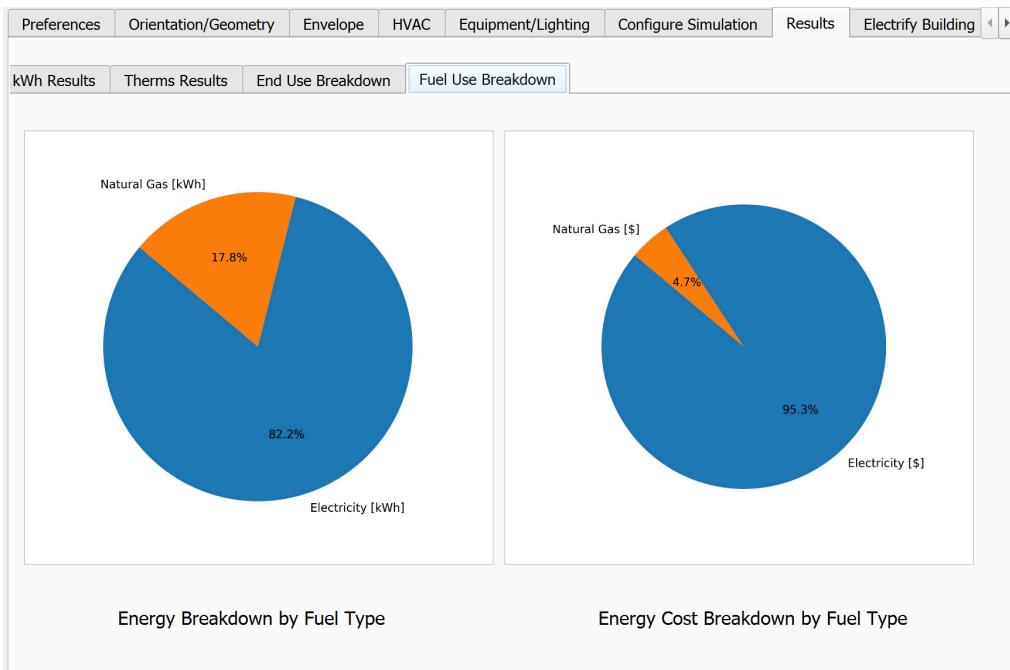
Input Parameter	Value
Miscellaneous Plug Loads	None
Interior Lighting	#26 Fluorescent; #20CFL
Exterior Lighting	#5 Fluorescent
Daylight Controls	No
Occupancy Controls	No

# Outputs

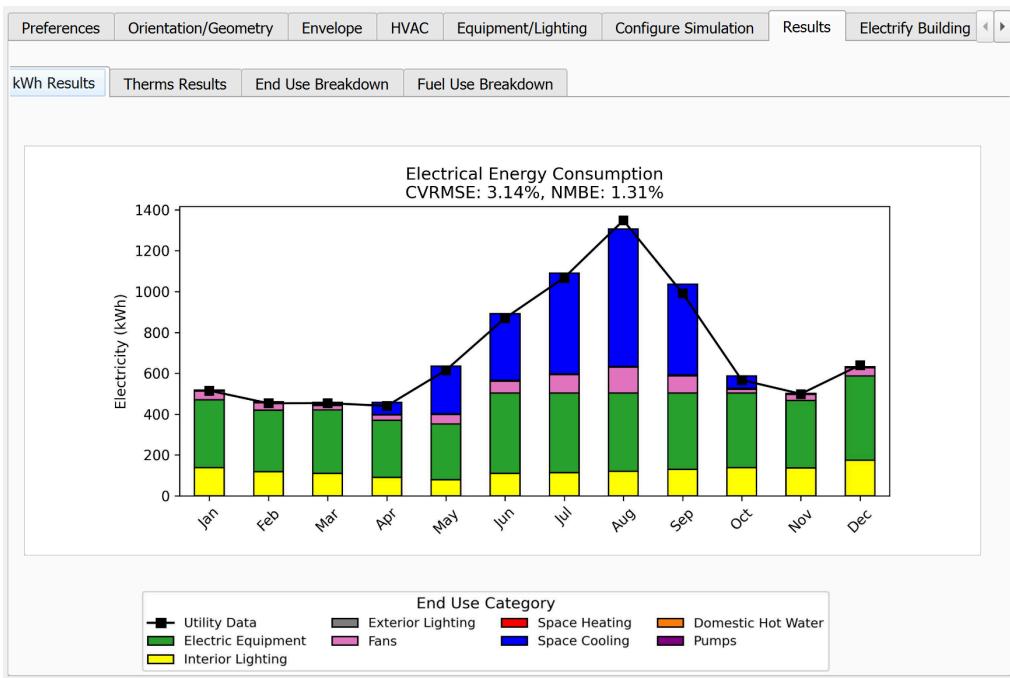
## Pre-Calibration

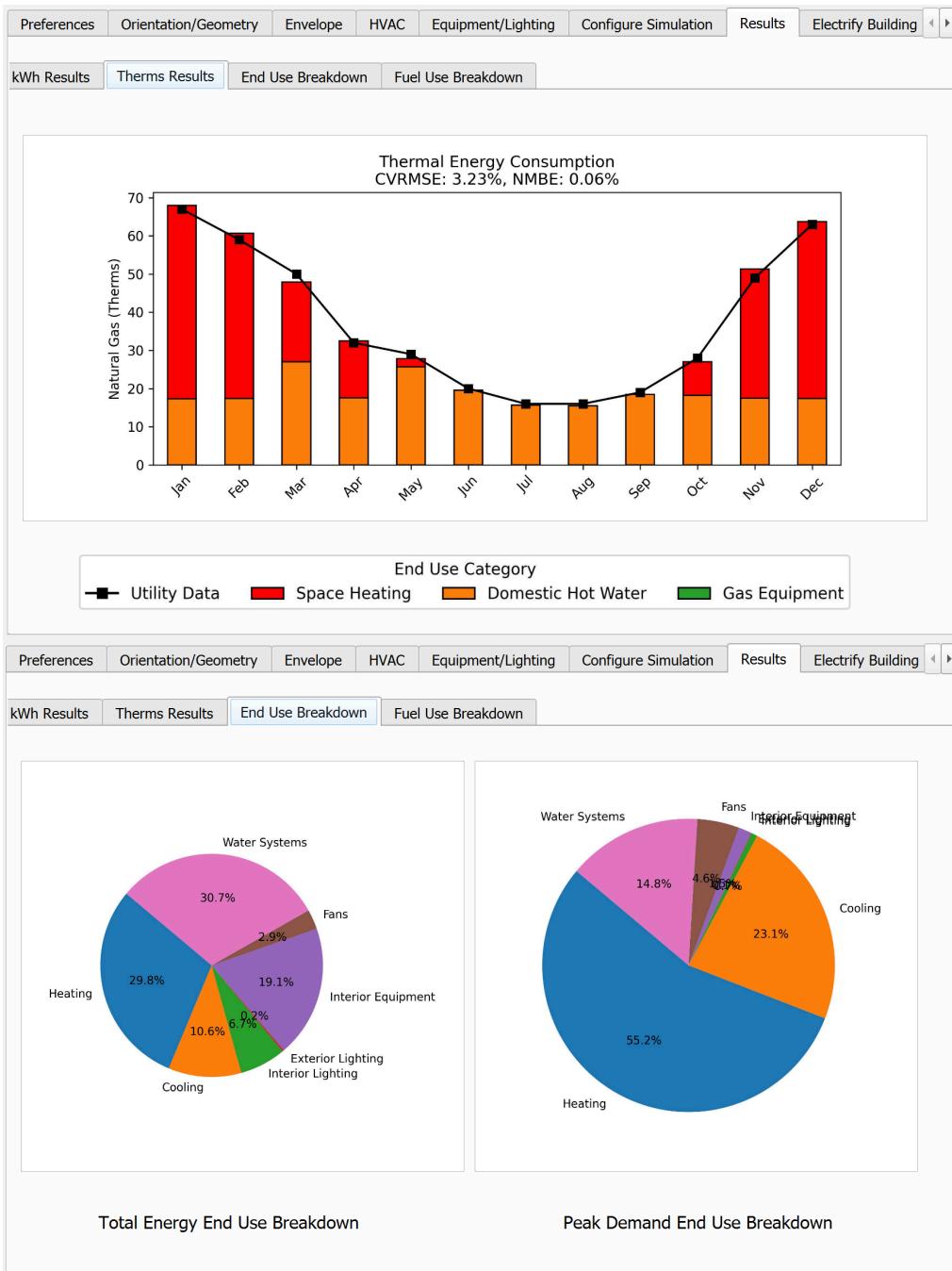


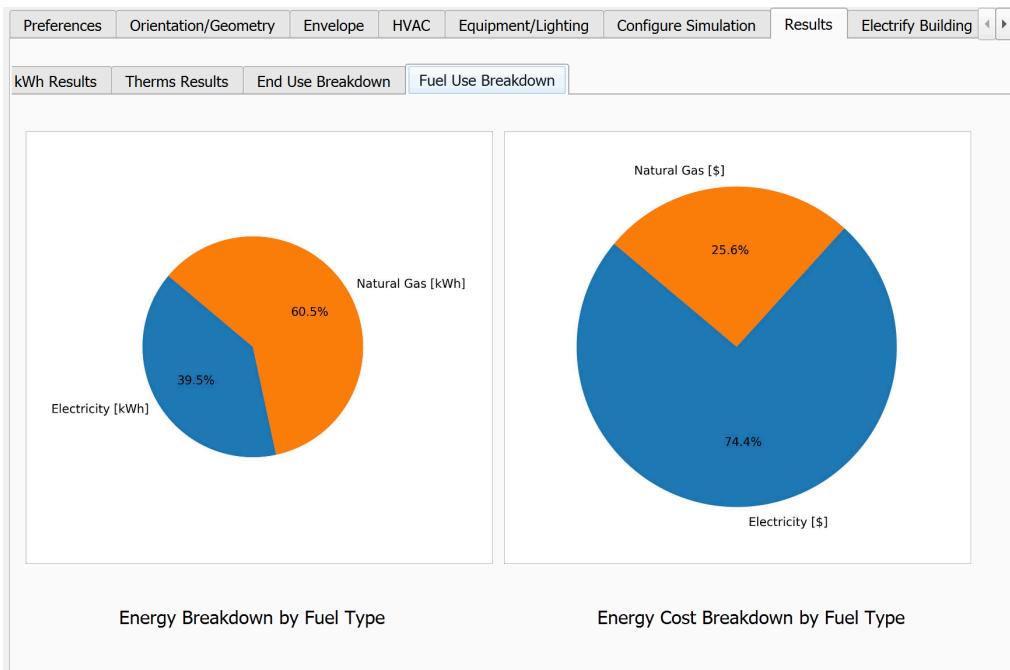




## Post-Calibration







# Measure Evaluation

The calibration model can now be used to evaluate various energy efficiency measures. The following measures were evaluated for this building:

## Infiltration Level

Reduce infiltration from 4.0 ACH50 to 2.0 ACH50

The screenshot shows the 'Evaluate Measure' tab selected in the top navigation bar of the EEM Evaluation tool.

**Baseline:**

	Total Electricity Consumption (kWh)	Total Natural Gas Consumption (therms)
Original Calibrated Building	8349	448
	Annual Operating Cost (\$)	Life Cycle Cost (\$)
	1624	22891

**Measures:**

Measure Selection	Selection	Base Property	New Property
1 Wall Insulation	<input type="checkbox"/>	R7 Fiberglass	R7 Fiberglass
2 Infiltration	<input checked="" type="checkbox"/>	4.0	2.0
3 Ceiling Insulation	<input type="checkbox"/>	R30 Fiberglass	R30 Fiberglass
4 Window Material	<input type="checkbox"/>	Single Pane Clear	Single Pane Cle
5 Night SetBack	<input type="checkbox"/>	0.0	0.0
6 Daylighting	<input type="checkbox"/>	No	No
7 Economizer	<input type="checkbox"/>	No	No
8 Occupancy Sensor	<input type="checkbox"/>	No	No
9 Percentage LED	<input type="checkbox"/>	0	0.0

**Results:**

% Change in Electricity	-3.39%
% Change in Natural Gas	-23.17%
Total Initial Cost (\$)	1717.54
Life Cycle Cost (\$)	21400.11

**Buttons:**

- Evaluate
- Save Results

# Insulation Level

Increase wall insulation from R-7 to R-19

Economic Data Evaluate Measure

Baseline

Original Calibrated Building	Total Electricity Consumption (kWh)	8349	Total Natural Gas Consumption (therms)	448
	Annual Operating Cost (\$)	1624	Life Cycle Cost (\$)	22891

Measures

Measure Selection	Selection	Base Property	New Property
1 Wall Insulation	<input checked="" type="checkbox"/>	R7 Fiberglass	R19 Fiberglass
2 Infiltration	<input type="checkbox"/>	4.0	4.0
3 Ceiling Insulation	<input type="checkbox"/>	R30 Fiberglass	R30 Fiberglass
4 Window Material	<input type="checkbox"/>	Single Pane Clear	Single Pane Cle
5 Night SetBack	<input type="checkbox"/>	0.0	0.0
6 Daylighting	<input type="checkbox"/>	No	No
7 Economizer	<input type="checkbox"/>	No	No
8 Occupancy Sensor	<input type="checkbox"/>	No	No
9 Percentage LED	<input type="checkbox"/>	0	0.0

% Change in Electricity -1.36%  
% Change in Natural Gas -6.45%  
Total Initial Cost (\$) 4509.98  
Life Cycle Cost (\$) 26463.59

Evaluate Save Results

# Night Setback

Implement a night setback of 10°F for heating

Economic Data Evaluate Measure

Baseline

Original Calibrated Building	Total Electricity Consumption (kWh)	8349	Total Natural Gas Consumption (therms)	448
	Annual Operating Cost (\$)	1624	Life Cycle Cost (\$)	22891

Measures

Measure Selection	Selection	Base Property	New Property
1 Wall Insulation	<input type="checkbox"/>	R7 Fiberglass	R7 Fiberglass
2 Infiltration	<input type="checkbox"/>	4.0	4.0
3 Ceiling Insulation	<input type="checkbox"/>	R30 Fiberglass	R30 Fiberglass
4 Window Material	<input type="checkbox"/>	Single Pane Clear	Single Pane Cle
5 Night SetBack	<input checked="" type="checkbox"/>	0.0	10.0
6 Daylighting	<input type="checkbox"/>	No	No
7 Economizer	<input type="checkbox"/>	No	No
8 Occupancy Sensor	<input type="checkbox"/>	No	No
9 Percentage LED	<input type="checkbox"/>	0	0.0

% Change in Electricity -0.54%  
% Change in Natural Gas -9.3%  
Total Initial Cost (\$) 0.0  
Life Cycle Cost (\$) 21689.35

Evaluate Save Results

# Cooling Equipment

Replace existing AC with a SEER 13 unit

The screenshot shows the EnergyPlus software interface with the 'Cooling Equipment' measure selected. The top navigation bar includes tabs for Envelope, HVAC, Equipment/Lighting, Configure Simulation, Results, Electrify Building, EEM Evaluation, and EEM Optimization. Below the tabs, there are two buttons: 'Economic Data' and 'Evaluate Measure'. The 'Evaluate Measure' button is highlighted.

The main area is divided into two sections: 'Baseline' and 'Measures'.

**Baseline:** Displays consumption and cost data for the 'Original Calibrated Building'.

	Total Electricity Consumption (kWh)	Total Natural Gas Consumption (therms)
Original Calibrated Building	8349	448
Annual Operating Cost (\$)	1624	Life Cycle Cost (\$)
	22891	

**Measures:** A table listing various energy measures with their current selection status and base vs. new properties.

	Measure Selection	Selection	Base Property	New Property
3	Ceiling Insulation	<input type="checkbox"/>	R30 Fiberglass	R30 Fiberglass
4	Window Material	<input type="checkbox"/>	Single Pane Clear	Single Pane Cle
5	Night SetBack	<input type="checkbox"/>	0.0	0.0
6	Daylighting	<input type="checkbox"/>	No	No
7	Economizer	<input type="checkbox"/>	No	No
8	Occupancy Sensor	<input type="checkbox"/>	No	No
9	Percentage LED	<input type="checkbox"/>	0	0.0
10	Heating ...	<input type="checkbox"/>	Gas Furnace - ...	Gas Furnace - C
11	Cooling ...	<input checked="" type="checkbox"/>	Air Conditioner - ...	Air Conditioner

On the right side of the 'Measures' section, there are four input fields showing the impact of the selected measure:

- % Change in Electricity: -3.29%
- % Change in Natural Gas: 0.0%
- Total Initial Cost (\$): 2770.0
- Life Cycle Cost (\$): 25312.02

At the bottom right of the 'Measures' section are two buttons: 'Evaluate' and 'Save Results'.

## Measure Package

Combine all the above measures into a single package

The screenshot shows the EnergyPlus software interface with a combined 'Measure Package' selected. The top navigation bar and 'Evaluate Measure' button are identical to the previous screenshot.

The 'Baseline' section shows the same consumption and cost data for the 'Original Calibrated Building'.

The 'Measures' section displays a different set of measures, all of which are selected (indicated by checked checkboxes in the 'Selection' column).

	Measure Selection	Selection	Base Property	New Property
1	Wall Insulation	<input checked="" type="checkbox"/>	R7 Fiberglass	R19 Fiberglass
2	Infiltration	<input checked="" type="checkbox"/>	4.0	2.0
3	Ceiling Insulation	<input type="checkbox"/>	R30 Fiberglass	R30 Fiberglass
4	Window Material	<input type="checkbox"/>	Single Pane Clear	Single Pane Cle
5	Night SetBack	<input checked="" type="checkbox"/>	0.0	10.0
6	Daylighting	<input type="checkbox"/>	No	No
7	Economizer	<input type="checkbox"/>	No	No
8	Occupancy Sensor	<input type="checkbox"/>	No	No
9	Percentage LED	<input type="checkbox"/>	0	0.0

On the right side of the 'Measures' section, there are four input fields showing the impact of the selected measures:

- % Change in Electricity: -7.6%
- % Change in Natural Gas: -33.28%
- Total Initial Cost (\$): 8997.52
- Life Cycle Cost (\$): 26989.17

At the bottom right of the 'Measures' section are two buttons: 'Evaluate' and 'Save Results'.