Permit Energy Report

Steamboat Gold Walk, Promenade, and Plaza

05.19.21

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Executive Summary

The Steamboat Gold Walk, Promenade, and Plaza buildings have been evaluated for energy permit compliance using the Gold Walk and Promenade Bid & Permit set dated May 19, 2021 along with input from the design team. This is a unique building with high seasonal variability in its usage. The building is located in Climate Zone 7 of the 2016 ASHRAE 90.1 Energy Standard for Buildings Except Low-Rise Residential Standard (ASHRAE 90.1-2016).

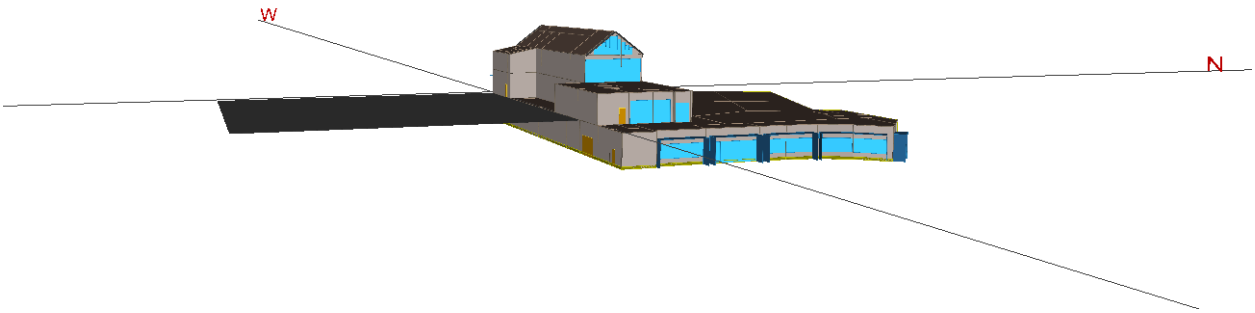
This project is achieving energy code compliance for the city of Steamboat through the ASHRAE 90.1-2016 Section 11 Energy Cost Budget (ECB) method. Compliance with this section requires that all requirements of Sections 5.4, 6.4, 7.4, 8.4, 9.4, 10.4 are met, that the design energy cost does not exceed the energy cost budget, and that the energy efficiency level of components specified in the building design meet or exceed the efficiency levels used to calculate the design energy cost. *The design energy cost does not exceed the energy cost budget and therefore complies with this requirement.*

This project is unique since it is being designed and constructed in phases. All three buildings were modeled together as they share a central heating and cooling plant. The energy model includes the completed Core and Shell design for the Gold Walk and Promenade, as well as the Plaza design as it stands. Along with these buildings this set includes a snowmelt system serving Plaza and Gold Walk spaces, as well as an 8,000 square foot ice rink. As the other buildings and spaces are finalized in their design, the energy model and permit report will be updated to show continued compliance.

- **Gold Walk and Promenade Bid & Permit Set Results:** The systems and measures included in the Permit Set drawings indicate an energy cost savings of $12,990 over the budget building design which exceeds the requirements of Section 11 ECB.
    - Minimum R-17 exterior walls
    - Minimum R-35 roof
    - R-16 below grade walls
    - Performance specified glazing requirements
        - Fixed fenestration assembly U-0.28
        - Operable fenestration assembly U-0.40
        - SHGC 0.45
    - Exterior shading devices as indicated on the Permit set
    - 2 energy recovery ventilators (ERVs) with chilled cooling, hot water coils, and sensible wheels providing all ventilation and pressurization requirements
    - 4-pipe fan coil units providing all space conditioning
    - Condensing boilers providing serving ERVs, FCUs, and snowmelt
    - Screw chiller with evaporative pre-cooling serving ERVs and FCUs
    - Ice chiller plant serving ice rink
    - 48,000 square feet of snowmelt

Methodology

The simulation software used for the permit evaluation was eQUEST version 3.65. eQUEST is a whole building energy simulation software that utilizes the DOE-2.2 energy calculation engine. eQUEST is available for free at www.doe2.com.



3-D Image of Steamboat Energy Model

Results

The systems and measures included in the Permit Set drawings indicate an energy cost savings of approximately $13,000 over the Budget Building which exceeds the requirements of ASHRAE 90.1-2016 Section 11 Energy Cost Budget (ECB). The following table summarizes the energy usage and cost of both the Budget and proposed design.

“EUI (kBtu/sqft-yr)” indicated in the following table shows the site energy use intensity in kBtu/sqft-yr. Note that the high EUI is due primarily to the snowmelt system.

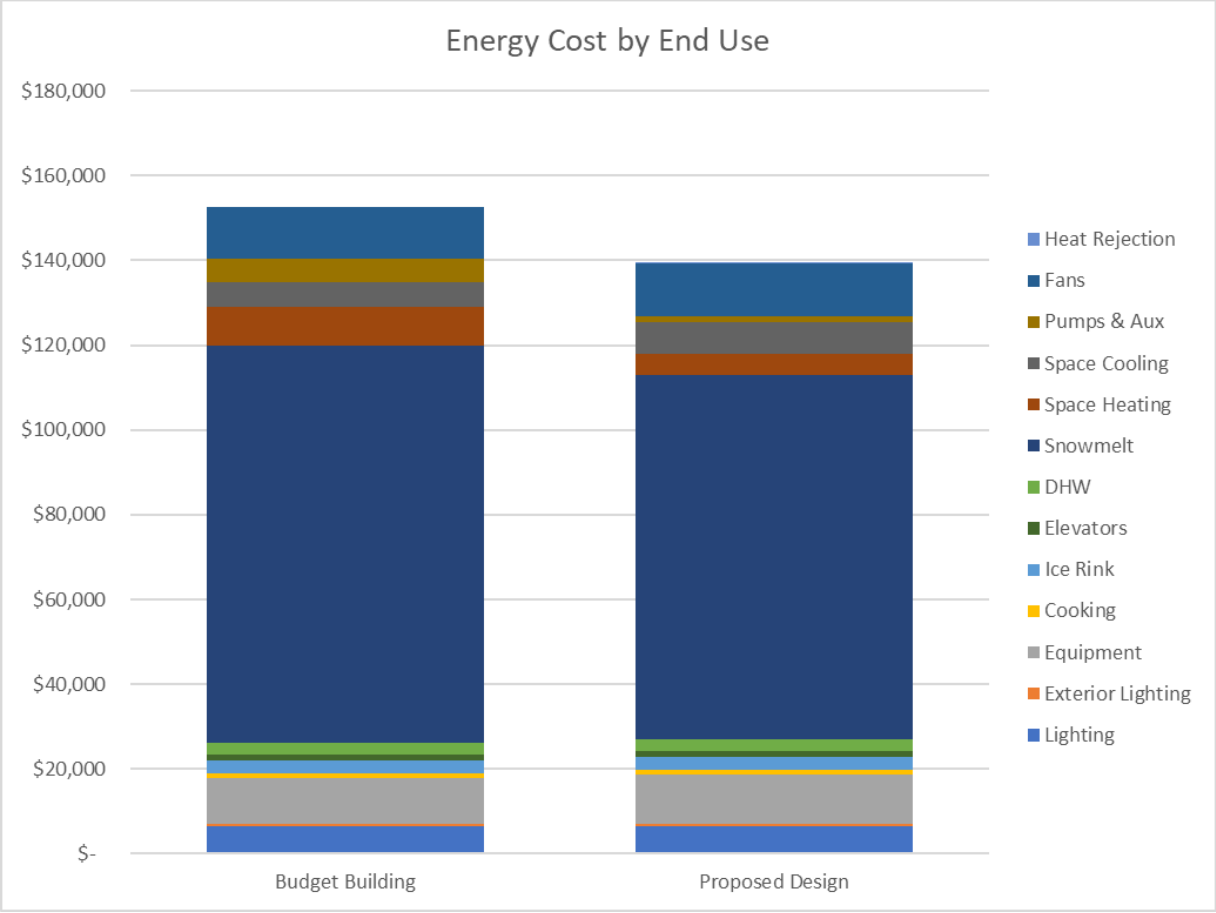
“Total Energy Cost” indicated in the following table includes overall energy cost for all fuel types.

“Energy Cost Savings above Baseline” indicated in the following tables refers to the relative performance of the proposed design over the Budget Building. This shows that the proposed cost does not exceed the energy cost budget.

Steamboat Gold Walk, Promenade, Plaza Permit Results

Parametric Run	EUI (kBtu/ sqft-yr)	Energy Cost	Energy Cost Savings over Baseline
Budget Building (ASHRAE 90.1-2016 Section 11 ECB)	439.6	$ 152,630	n/a
Proposed Design	393.2	$ 139,640	$ 12,990

The following graph shows the energy cost by end use for the budget building and the proposed design. As can be seen below, the energy cost and energy usage are dominated by the snowmelt system.



Energy Model Parameters

The Permit Set energy model has been constructed based on the Gold Walk and Promenade Bid & Permit set dated 05/19/2021 and input from the design team. The following items have been included in the analysis.

System Assumptions

System Type	ASHRAE 90.1 2016 ECB	Permit Drawing Set
Architecture		
Window-to-Gross Wall Ratio	40%	40%
Exterior Walls	Conditioned: R-13 + R-12.5 c.i. Semi-heated: R-13 + R-7.5 c.i.	EW1-ST1: R-18.04 EW1-WD1: R-17.6 EW1-MT1: R-17.6 FN2: R-15.84
Below Grade Walls	R-15 c.i.	FN1: R-15.84
Roof	Conditioned: R-35 c.i. Semi-heated: R-25 c.i.	RF2-CN3: R-35.85 RF3-CN4: R-47.85 RF3-MT2: R-50.25
Slab-on-Grade Floors	F-0.510	F-0.730
Glazing SHGC	0.45	0.45
Glazing Assembly U-value	0.28 fixed fenestration 0.40 operable fenestration	SF 1: 0.28 SF 2: 0.28 OW: 0.40
Shading Devices	None	Shading Devices per Construction Documents
Internal Plug Load		
Cafeteria/Seating	0.25 W/SF	0.25 W/SF
Electrical Rooms	5 W/SF	5 W/SF
Food Prep	4 W/SF	4 W/SF
Loading Dock	0.1 W/SF	0.1 W/SF
Locker Rooms	0.25 W/SF	0.25 W/SF
Mechanical Rooms	1 W/SF	1 W/SF
UC Health/Ski Patrol	1 W/SF	1 W/SF
Food Storage	3 W/SF	3 W/SF
Zamboni Room	2 W/SF	2 W/SF
Elevators	2 25 hp motor	2 25 hp motor
Cooking Gas	50 kBtu/h	50 kBtu/h
Other Loads		
Ice Rink	0.5 W/SF	0.5 W/SF
Snowmelt	8,200 kBtu/h	8,200 kBtu/h
Lighting		
Interior Lighting Power	Space-by-space per ASHRAE 90.1 2016 Table 9.6.1	Space-by-space per ASHRAE 90.1 2016 Table 9.6.1 (Core and Shell)
Cafeteria/Seating	0.63 W/SF	0.63 W/SF
Corridor	0.66 W/SF	0.66 W/SF
Electrical Rooms	0.43 W/SF	0.43 W/SF
Food Prep	1.06 W/SF	1.06 W/SF
Lobby	1.00 W/SF	1.00 W/SF
Loading Dock	0.58 W/SF	0.58 W/SF
Locker Rooms	0.48 W/SF	0.48 W/SF
Mechanical Rooms	0.43 W/SF	0.43 W/SF
UC Health/Ski Patrol	1.03 W/SF	1.03 W/SF
Restroom	0.85 W/SF	0.85 W/SF
Stairs	0.58 W/SF	0.58 W/SF
Storage	0.46 W/SF	0.46 W/SF
Zamboni Room	0.56 W/SF	0.56 W/SF
Exterior Lighting Power	2 kW	2 kW
Energy Rates		
Electricity Rate	0.1002 $/kWh (Colorado EIA Statewide Average for Commercial Building Customers)	Same as Baseline
Natural Gas Rate	0.7648 $/therm (Colorado EIA Statewide Average for Commercial Building Customers)	Same as Baseline

System Assumptions

System Type	ASHRAE 90.1 2016 ECB	Permit Drawing Set
HVAC System Configuration		
General	System 2: VAV with reheat System 7: Four-pipe fan coil units	Energy recovery ventilators serving ventilation requirements and distributed 4-pipe fan coil units providing space heating and cooling
Air Handling Systems	System 2: VAV with chilled water cooling, hot-water fossil fuel boiler; enthalpy wheel with 50% effectiveness System 7: Four-pipe fan coil units with chilled water cooling and hot water heating; OA economizer Fan power same as proposed	Two ERVs (10,000 CFM and 4,700 CFM) with chilled water cooling, hot water heating, and sensible wheels (67% effectiveness) handling ventilation air Both variable volume Distributed 4 pipe fan coil units serving all main spaces Cycling fans Hot water unit heater in vestibules, stairwells, and restrooms
Chilled Water Loop	Water-cooled screw chiller with 44°F supply and 56°F return with kW/ton of 0.72; OA reset	Evap-cooled screw chiller with 44°F supply and 54°F return with effective EER of 12.85 (EER of 9.7 excluding evap pre-cool)
Condenser Water Loop	Open-circuit axial-fan cooling tower with variable-speed fan control, design temperature rise of 10°F; OA reset	N/A
Hot Water Loop	2 natural draft boilers with 180°F supply and 130°F return with OA reset	3 5,000 MBH condensing boilers (part of larger plant) with 150°F supply and 130°F return
Pumping	CHW and HW pumping power modeled same as proposed; hot water loop modeled as primary only Condenser water pumps modeled as 19 W/GPM	3 455 GPM primary heating loop pumps 2 250 GPM building secondary heating loop pumps 2 200 GPM chilled water pumps 3 635 GPM snowmelt secondary loop pumps
Snowmelt Loop	Same as proposed	Secondary loop off of hot water loop with 150°F supply and 130°F return serving snowmelt at Plaza and Gold Walk
Domestic Hot Water	Same as proposed	50 gallon electric water heater serving Promenade 120 gallon electric water heater serving Plaza

Schedules

The usage for these buildings can be broken down into 3 primary seasons: ski season, mud season, and summer season.

Season	Dates	Description
Ski Season	November 15th - April 15th	Highest usage for both Plaza and Promenade areas; ice rink and snowmelt all operational
Mud Season	April 16th - June 15th and September 1st - November 15th	Lowest usage, no food and beverage stands open in the Plaza
Summer Season	June 15th - December 1st	Promenade and Plaza occupied up to 60% capacity