Single Family Home Case Study | Eagle County, Colorado

Project Data

Project Location	Wolcott, CO
Climate Zone	6B
Placed in Service	2019
Primary Home Size (sf)	4,391 sf total 886 sf unconditioned 3,505 sf conditioned
ADU Size (sf)	2,400 sf total 600 sf unconditioned 1,800 sf conditioned
Floors (#)	3
Buildings (#)	2
Construction Type	New
Fuel-Type	All-Electric
Development Cost	Primary Home - $885,685 (2019) ADU - $465,304 (2019)

Overview

This case study highlights a passive solar home design in the Horse Mountain Ranch community of Wolcott, CO. Completed in 2019, this single family detached home with ADU features an all-electric design, implementing strategies for resiliency and sustainability. This home serves as a model for other mountain town developers, demonstrating ways high-end residential homes can be designed to help sustain the built environment.

Electrification Strategies and Features

Roof	R-49 spray foam in truss (U-0.021)
Exterior Walls	1.5” zip panel walls with 2” (R-10) spray foam in cavity + R-19 batt (U-0.038)
Foundation Insulation	2” (R-10) spray foam underslab (F-0.54)
Windows	Assembly: U-0.30
Lighting	LED lighting with controls
HVAC	Split DX Heat Pumps with ERV (10 deg F heat pump operation temperature)
DHW	Heat pump water heater
PV System	Primary Home - 8.4 kW ADU - 5 kW
EV Charger	Electric F150

This home is a masterclass in seamlessly integrating stunning design, energy efficient strategies, and ambitious sustainability goals into a single cohesive vision. The all-electric design features a split system heat pump with energy recovery to efficiently provide heating and cooling. By using electricity instead of fossil fuels, overall emissions are reduced and a healthier living environment is produced.

The heat pump produces heat until the outdoor air temperature is 10 deg F or lower, at which time an indoor electric coil takes over. This reduces the annual energy cost for the home. The ventilation is provided by energy recovery ventilation (ERV). This reduces both the heating demand and operating costs associated with conditioning outside air.

To supplement the split system heat pump, there is also a wood burning masonry heater that radiates heat into the home throughout the night. Located on the south side of the home, the heater was designed to absorb heat from solar gain and passively heat the home during cooler temperatures.

The home also utilizes a heat pump water heater (HPWH). HPWHs are highly efficient, operating at nearly three times the efficiency of conventional electric resistance water heaters.

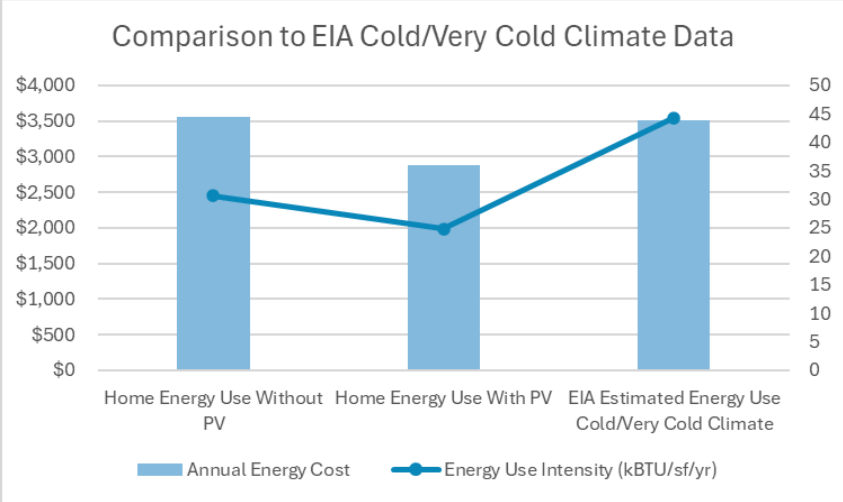
Successes

There are also several sustainability measures implemented at the site. There is an attached greenhouse for year round food production including lettuce, peppers, strawberries, cucumbers, and more. There are also large outdoor gardens, chickens, bees, and composting included on the site. Another interesting feature of the home is that it utilizes beetle kill wood siding meant to look like reclaimed wood. This provides a unique aesthetic, a lower first cost option, and an environmentally friendly way to utilize forest by-product.

Not only is this home designed to be very energy efficient, it also supports an electric vehicle which can further reduce the occupant's carbon footprint. This home exemplifies how single-family residences can dramatically reduce annual energy use, costs, and greenhouse gas emissions, as shown in the adjacent table. The data points shown are benchmarked against the median U.S. single-family household in a cold or very cold climate[1]. The Social Cost of Carbon is the estimated future dollar cost of the economic and social damages caused by carbon dioxide emissions.

	Home Energy Use Without PV	Home Energy Use With PV
Total Annual Energy Use (kBTU)	107,116	86,774
Total GHG Emissions (lbs CO2)	30,044	24,338
Total GHG Intensity (lbsCO2/sf/yr)	8.6	6.9
Social Cost of Carbon (2025)	$1,131	$916
Social Cost of Carbon (2050)	$1,581	$1,281

Holy Cross Electric Association, Inc. aims to lead a responsible transition toward achieving 100 percent clean energy by 2030 and are already averaging between 80-95%. This home is an excellent example of how to implement energy efficiency and sustainability strategies to strive toward a cleaner future.



[1] https://www.eia.gov/consumption/residential/data/2020/c&e/pdf/ce1.1.pdf