ALL-ELECTRIC NEW HOMES & BUILDINGS IN COLORADO

A 2020-2021 BUILDER SURVEY OF COSTS, TECHNOLOGIES, AND TRENDS

All-electric new homes are a small but growing trend catching on across Colorado. Often marketed as "net-zero energy homes" rather than all-electric, these homes offer several notable benefits, including lower asthma rates, no risk of carbon monoxide poisoning or explosions from gas leaks, and a much smaller carbon footprint compared to homes that use gas or propane for heating, hot water, and cooking. In addition, the all-electric home's costs, comfort, and cooking performance can be the same or slightly better. We surveyed home builders from across Colorado, in particular searching out those that have built all-electric homes and buildings in the last year or so, to find out the state of the market. We uncovered several new examples from different parts of the state – including large master-planned developments, custom-built single-family homes, a multifamily complex, and a pre-k-12 rural school.

TOP SURVEY FINDINGS

- 1 Builders are planning and constructing larger, master-planned, all-electric communities in several parts of the state.
- 2. Costs, quality, and comfort can be comparable to mixed-fuel homes.
- 3. New all-electric buildings typically use air source or ground source heat pumps for both heating and cooling, heat pump water heaters, and induction stoves.
- 4. Builders are marketing all-electric homes with terms like "sustainable," "high-performance," and "net zero" more often than "all-electric" or details of the specific technologies.
- 5. Home buyers are seeking out all-electric homes, out of concerns for health, safety, and climate.
- 6. Utilities are increasingly supporting electrification through rebates and training programs.
- 7. Multifamily buildings including affordable multifamily housing and commercial buildings are also growing in popularity.

"All-electric homes are readily achievable now with very little, or even zero, increase in cost. As long as you are dedicated to high quality construction, there should be very little difference.

- PETER EWERS, EWERS ARCHITECTURE, GOLDEN, CO

TECHNOLOGIES AND BENEFITS

CLEANER AND SAFER HEATING, USING A THIRD OF THE ENERGY

All-electric homes usually feature efficient air source or ground source heat pumps, which provide both heating and cooling from the same unit. These systems use about one third of the energy of even the best gas or propane furnace plus AC. "Cold-climate" heat pumps have improved dramatically over the past several years and they now perform well yearround, even in the coldest counties of Colorado. Ground source heat pumps are more efficient than air source, but are also more expensive, and are mainly used for larger homes, multi-family homes, or a housing development.

ULTRA HIGH EFFICIENCY WATER HEATING

For hot water, all-electric homes generally rely on efficient heat pump water heaters, which are now available from most major retailers. They use only one fourth of the energy of their gas or propane counterparts. Like heat pumps, these typically have rebates available from the utility.

HIGH-PERFORMANCE STOVES WITH PRECISION CONTROLS – WITHOUT THE INDOOR AIR POLLUTION

And for cooking, induction cooktops/ranges are very efficient and deliver quicker and more precise cooking performance compared to gas. Glass-top radiant electric cooktops are also available, at a lower price and lower efficiency. The best part: no asthma-causing indoor air pollution.

SAFETY AND PROTECTION, INSIDE AND OUT

In addition, eliminating open flames and natural gas pipes from furnaces, water heaters, and stoves eliminates the risks of carbon monoxide poisoning or explosions. Using efficient heat pumps and heat pump water heaters rather than natural gas or propane also significantly reduces the home's carbon footprint — about the same amount as switching from a gasoline-powered car to an all-electric one.

WHY AND WHERE BUILDERS CHOOSE ALL-ELECTRIC

In our conversations and surveys, Colorado builders both big and small gave a host of reasons for choosing to build all electric:

- Consumer demand for net zero
- Low monthly utility bills
- Healthier air quality
- High cost of gas connections, piping, and monthly charges
- Simpler, low-maintenance mechanical systems
- Leading by example
- Aesthetics and high-end features (especially in the case of induction stoves)
- Future-proofed homes, avoiding obsolescence





COST COMPARISONS

Overall, an all-electric new home costs about the same to build as a mixed-fuel home with natural gas or propane for heating, hot water, and cooking (see table below). Since a heat pump provides both heating in the winter and cooling in the summer – all from one unit – its initial costs turn out to be comparable to a gas or propane furnace and a separate AC unit. Heat pump water heater and induction range cost slightly more than natural gas water heaters or ranges, but these costs are offset by savings from avoiding the natural gas connection and piping to the home. However, in our examples below, we found that the costs of an all-electric versus a similar mixed-fuel home are difficult to compare. In addition, heat pump costs vary considerably, mainly due to inconsistencies in contractor familiarity and skill with these systems.

Ongoing costs are just as important than upfront costs when evaluating the economics. Annual heating costs are about the same for both types of homes, despite the low costs of natural gas, due to the high efficiency of heat pumps as well as savings from avoiding the fixed natural gas charges on monthly bills. If we assume the electric home gets 75 percent of its electricity from on-site solar annually (a reasonable assumption for these homes), then the total annual heating costs shown below would be about 50-60% lower for the electric home.

ELECTRIFICATION COST COMPARISONS FOR NEW HOMES IN COLORADO

HVAC System Costs [1]	95% Efficient Gas Furnace & AC	95% Efficient Propane Furnace & AC	Cold-climate Heat Pump
Initial cost excluding ducts	\$15,000	\$15,500	\$16,000
Rebate from Colorado utilities [2]	\$350	\$0	\$1,800
Total cost after rebates	\$14,650	\$15,500	\$14,200
Annual heating costs [3]	\$437	\$1,567	\$588
Fixed natural gas charges	\$156	\$0	\$0
Total annual heating costs	\$593	\$1,567	\$588
ENERGY STAR Water Heater Costs	Gas Water	Propane Water	Heat Pump
	Heater	Heater	water Heater
Installed cost	\$1,500	\$1,600	\$2,500
Rebate from Colorado utilities [2]	\$50	\$0	\$350
Total cost after rebates	\$1,450	\$1,600	\$2,150
Annual heating costs	\$122	\$523	\$119
Stove/Range	Gas Stove	Propane Stove	Electric (Std, Induction)
Initial cost [4]	\$1,200	\$1,200	\$1,200-\$2,400
Infrastructure Costs	Gas Equipment	Propane	Electric
		Equipment	Equipment
Electrical modification	\$0	\$ 0	\$500
Gas connection & piping or propane tank	\$4,000	\$2,500	\$0
Totals	Gas Equipment	Propane	Electric
		Equipment	Equipment
Total equipment and infrastructure costs	\$21,300	\$20,800	\$17,370-\$18,450
Total annual heating costs	\$715	\$2,090	\$707

[1] The initial costs for the heating and hot water systems, gas connection, and electrical modifications are from "Electrification of Commercial and Residential Buildings," Group 14, November 2020, <u>https://www.communityenergyinc.com/wp-content/uploads/Building-Electrification-Study-Group14-2020-11.09.pdf</u>, p. 12. The heat pump costs are for a 4-ton cold-climate system with a heating capacity of 48,000 Btu/hr. The cold-climate heat pump assumes no backup, although electric strip heating could be added for \$300.Group 14 obtained its cost data from GB3 Energy Smart Homes, a residential contractor specializing in high efficiency equipment, and from HM Capital, a real estate development firm.
[2] Rebate amounts for a high-efficiency gas furnace and water heater are based on Black Hills Energy <u>new construction prescriptive path</u>. Rebate amounts for a cold-climate heat pump are based on a Colorado electric cooperative that is a member of Tri-State Generation and Transmission, Inc.

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ALL-ELECTRIC CONDOS, MULTI-FAMILY, AND COMMERCIAL BUILDINGS

L'AVENIR TOWNHOME-STYLE CONDOS

Nestled in a prime location in the heart of Old Town Fort Collins are the townhome-style condos, literally translating to "The Future." Each of the four residences includes two geothermal wells that are individually owned by each residence, and a ground source heat pump system that feeds into hybrid heating and cooling offering three zones per home. They also each include a geothermal-fed water heater, an "owned" solar photovoltaic (PV) system, additional storage options, energy recovery ventilation system, and EV charging prewire (along with the HOA providing an actual EV for the residents!) The condos were designed and built with state-of-the-art green building features to not only reach net zero, but to contribute back to the environment. Laurie Davis who together with Robert Davis developed and designed L'Avenir, explained "Let's design for the future. Let's make buildings that are not only beautiful, but are also healthy and regenerative."







WILLITS WORKFORCE HOUSING

Aspen Skiing Company's Willits Block 9 Workforce Housing in Basalt has 43 units for employees and community childcare workers to rent. According to Ryland French, Director of Facility Operations and Energy, Aspen Skiing Company chose all-electric because it wanted to "lead by example and inspire others to go high-efficiency and allelectric in cold climates at this scale." The building has cold climate air source heat pumps, cold climate heat pump water heaters, and electric ranges, plus solar and EV charging. The project is the first of several all-electric, high-performance, and sustainable buildings Aspen Skiing Company has under development, adding to the projects other developers have under construction in the area.

SIERRA GRANDE PK-12 SCHOOL

When the Sierra Grande School District in rural Blanca, Colorado needed a new school building to replace its previous old and outdated one, it laid out its important criteria: sustainable, energy efficient, and a very simple and reliable HVAC system, since it can be hard to get experienced HVAC techs in for maintenance. Construction is set to be completed in the summer of 2021, and the school is on track to be the most energy-efficient school in the state, all at no extra cost compared to a fossil-fueled school. The architect and electrical engineering team accomplished this by building the outer shell to Passive House principles (i.e. airtight with very good insulation) so they could minimize the heating system. A PV array will offset a portion of the electric load.



ALL-ELECTRIC MASTER-PLANNED COMMUNITIES

REVIVE PROPERTIES

Revive Properties, a few minutes from downtown Fort Collins, has 37 townhomes and 18 single family homes – all high-performance and all net zero. What's more, they're built with only a small additional cost of construction and priced similarly to nearby mixed-fuel properties (mid-\$250s to mid-\$500s). Solar PV is included as a 20-year prepaid lease, so the home buyer gets 20 years of renewable electricity at no extra cost, and energy bills are typically in the single digits or even negative. Heating comes from ground source heat pumps, and water heating is either also from the ground source heat pumps or from separate air source heat pump water heaters. As advice for other builders and developers. Sue McFaddin, a Development Consultant for Revive Homes, noted "You can get great savings by not running gas lines and you can get a great value for the land without gas easements." She also added, "All-electric makes a great deal of sense from both a development and environmental perspective. With home energy labeling beginning across the country, high efficiency homes will have higher market values and not building to zero will be building to obsolescence."

GEOS

Geos is a net zero development in Arvada with 15 singlefamily homes, 19 rowhomes, and 4 apartments in the first phase. Future builds will include another 250 net zero homes. Each home in the existing development was built all-electric at a price comparable to mixed-fuel homes, with ongoing monthly energy bills "in the single digits." Heating and cooling comes from ground source heat pumps for the single-family homes, and air source heat pump mini-splits for the rowhomes and apartments. Since the homes were built to be extra energy efficient (e.g. airtight construction with very good insulation), the heating systems only needed to be a quarter the size of typical system to still keep the homes comfortable and cozy. Heat pump water heaters, electric ranges, solar PV, and EV-ready outlets round out the all-electric features. Lead designer and developer Norbert Klebl points out three reasons why builders should be building all-electric: "Keeping natural gas out of homes makes them healthier and safer; heat pumps require less maintenance and are energy efficient; and new homes are built to last for many years and should use future technologies."



THRIVE VITALITY COLLECTION

Thrive Homes, Colorado's largest Zero Energy Ready home builder, is launching a new development of 39 all-electric and net zero homes in Denver's Central Park area. All-electric features include air source heat pumps, heat pump water heaters, and induction stoves, plus rooftop solar and EV-ready garages. According to Bill Rectanus, Thrive's VP of Operations, "Electricity is a better choice for the environment than gas, giving our homes a lower carbon footprint and maximizing the energy offset from the rooftop solar. Healthy indoor air is a key component of the Thrive brand. Burning anything in your house releases CO2 and particulate matter into the air you're breathing – and reducing the levels of those contaminants is essential to creating healthier indoor air. Finally, future code requirements are shifting to all-electric homes and the Vitality series is a way for us to build the product, vendor and supervisory resources to be ready."



NORTH VISTA HIGHLANDS

The North Vista Highlands outside of Pueblo is a planned community of all-electric and net zero single family homes, townhomes, multifamily buildings, and commercial properties across 1,060 acres, with the first 162 lots under construction now. Most homes will have mini-split heat pump systems, and some will have radiant in-floor systems with air-to water heat pumps. Why all-electric? Two main reasons, according to Rod Stambaugh, Sprout Tech Homes' President and Chairman: "First, these highly efficient homes with very low energy costs will cost less over the longer-term if you consider the total cost of home ownership. Secondly these homes provide much better indoor air quality, so they're healthier."



BASALT VISTA

Basalt Vista is an all-electric and net zero workforce housing community of 27 homes in the Roaring Fork Valley, designed to attract and retain teachers and other county workers in an area of otherwise high housing costs. The homes were priced at \$270,000-\$395,000 for two to four bedroom units. With a goal of keeping both mortgages and energy bills low for workforce residents, the development saved \$30,000-\$40,000 on new natural gas line connections plus eliminated monthly natural gas fixed charges – and instead uses PV arrays on each house plus coldclimate air source heat pumps, heat pump water heaters, and induction stoves. Basalt Vista's cold winter climate has served as a good proving ground that cold-climate heat pumps alone can measure up in all but our coldest and highest altitudes.



ALL-ELECTRIC SINGLE-FAMILY HOMES

SAMUELSON

In the mountains west of Golden is this uniquely angled, carefully engineered all-electric home. Heating comes from a ground source heat pump plus passive solar and a wood stove. The electric resistance water heater, while not as efficient as a heat pump water heater, garnered a \$1,000 utility rebate for a net cost of \$29, in part because it is grid connected and can help the utility save energy in congested times by heating the water at night. The house also took advantage of a \$9,300 federal tax credit for energy efficient home construction.



VAN DER RIDJT

Sitting on 20 mountain acres near Golden Gate Canyon State Park, the new Van Der Ridjt home had a net zero and all-electric goal from the start. The home uses an air source heat pump with ground floor radiant heating, a heat pump water heater, and an induction stove, plus ground-mounted solar and EV charging. Utility rebates brought the cost of these electric systems to the same range as their natural gas or propane equivalents. No natural gas bills, combined with solar and high efficiency, brings the energy bills down to only around \$20 a month.



ABOVE-CODE HOMES

Grand Junction is gaining another allelectric home, under construction this year by Above Code Homes LLC. The 3,900 square foot house will have an air source heat pump, a heat pump water heater, and an induction cooktop, plus rooftop solar and an EV-ready outlet. It'll also be built with ICF (insulating concrete forms) up to the trusses. "Electricity seems to be the future. There's a growing market for these types of homes," said Brian Schultz, president of Above-Code Homes.





SOUTHWEST ENERGY EFFICIENCY PROJECT

About SWEEP: The Southwest Energy Efficiency Project is a public interest organization dedicated to advancing energy efficiency, electrification, and clean transportation in Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming. For more information, visit www.swenergy.org

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For more information on each specific project profiled herein, see the separate report appendix at www.swenergy.org/publications/building

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