

ALL-ELECTRIC NEW HOMES AND BUILDINGS IN COLORADO:

APPENDIX

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

Note: For the full report, visit www.swenergy.org/publications/building

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

L'AVENIR TOWNHOMES

Location: Fort Collins, CO

Builder/Developer: Philgreen Construction / L'Avenir Development, LLC.

Architect: Davis Davis Architects

Heating/Cooling: 3.5-ton Geocomfort ground source heat pump per each individual residence

Heating/Cooling Cost Data: \$50,000 for each townhome, before subtracting a 30 percent tax credit

Why This Heating/Cooling System: It's a high-efficiency system that meets or exceeds energy goals for heating, cooling, and hot water

Water Heating: Side-arm from the ground source heat pump system

Water Heating Cost Data: Included in the cost of the heating system

Cooking: KitchenAid induction stove

Cooktop Cost Data: \$2,800 off-the-shelf, \$3,100 installed

Why This Cooktop: L'Avenir, by design, has no gas coming to the site and induction is faster, safer, cleaner, and more efficient than either gas or electric by a significant margin

Solar: 7.15 kW per residence

Storage: 9.3 kW per residence along with options for more

Why All-Electric: To procure Living Building Challenge certification and meet those goals/criteria means using only renewable resources onsite

Advice: Invest in battery back-up with fewer PV panels

Future Predictions: In utilizing economies of scale and the sharing of systems, the cost base will be minimized with other archetypes that would support renewable energy – resulting in a better-quality, more comfortable, and healthier living environment that truly regenerates with natural resources.

Website: www.lavenirliving.com

WILLITS WORKFORCE HOUSING

Location: Basalt, CO

Owner: Aspen Skiing Company

Architect: Lipkin Warner

General Contractor: Shaw Construction

Location: Basalt, CO

Development: Willits Workforce Housing

Size: 53,000 sq ft, 43 units for Aspen Skiing Company employees and community childcare workers to rent

Electric Utility: Holy Cross Energy

Heating/Cooling: ENERGY STAR-certified Armstrong air source heat pumps

Why This Heating/Cooling System: Best combination of performance, lifecycle cost, and emissions. The heat pump mode goes down to 0°F.

Heat Pump Cost Data: The heat pumps cost \$70,000 more than high efficiency gas boilers with split direct expansion cooling, but a utility rebated covered \$58,000 of that.

Water Heating: Eight Sanden CO2 heat pump water heaters installed on the roof; storage in building via eigh 120-gal tanks.

Why This Heating/Cooling System: Best combination of performance, lifecycle cost, and emissions. The heat pump mode goes down to -13°F.

Cooking: Electric ranges

Other state, local, or federal tax credits: \$100,000 from Community Office for Resource Efficiency (CORE) for electrification and solar

Solar PV: 86 kW DC

EV Charging: 3 x ChargePoint CT4000

Why All-Electric: To lead by example and inspire others to go high-efficiency all-electric in cold climate at this scale

Advice:

- Push your general contractor and engineer to understand modern electrification options
- Spend money on energy model to fully understand lifecycle costs
- Quality control of install and commissioning
- In working with trades, the more experience they have with heat pumps, the better

Future Plans: Another all-electric ski rental building in 2022

SIERRA GRANDE PK-12 SCHOOL

Location: Blanca, CO

Owner: Sierra Grande School District

Architect: Cuningham Group

General Contractor: FCI

Electrical Engineer: Branch Pattern

Size: 85,852 sq ft on a 20-acre site; 400 students

Total Construction Cost: \$42,554,000 (no added cost for all-electric)

Electric Utility: Xcel Energy

Heating/Cooling: Direct expansion cooling (DX) variable air volume (VAV) with electric reheat and energy recovery (no boiler, chiller, or perimeter heating)

Heating/Cooling Cost Data: The cost increases from the improved envelope are were offset by the cost decreases from the resulting simplified HVAC system

Water Heating: Electric resistance

Solar PV: 372 kW ground-mounted

Why All-Electric: Hard to get HVAC techs out in the San Louis Valley for maintenance, so they designed the school to Passive House standards and eliminated the heating system. Also: simple to operate, easy to maintain, extremely low utility bills, and a comfortable environment for learning

ALL-ELECTRIC MASTER-PLANNED COMMUNITIES

REVIVE

Location: Fort Collins, CO

Builder/Developer: Philgreen Construction, Seven Generations, Revive Properties LLC

Architect: Greg D. Fisher

Electric Utility: Fort Collins Utilities

Development Size: 37 duplex homes, 18 townhomes

Listing Price (single family/duplex): \$525,000/\$430,000+

Home Size (single family/duplex): 1800-2,500 sq ft

Heating/Cooling (single family/duplex): Ground source heat pump

Why This Heating/Cooling System: The homes have a very low energy demand, and the system has a very high coefficient of performance (COP) of 3.0.

Water Heating (duplex): Two-tank water heater system with a desuperheater.

Why This Water Heating System: It uses the ground source heat pump to preheat the water and is the most efficient, plus it uses no natural gas

Cooking (single family/duplex): Induction stoves and conventional electric ranges

Solar PV: Solar City / Tesla 8.5 kW

EV Charging: Pre-wired

Listing Price (townhome): \$254,000-450,000+

Home Size (townhome): 1,100-2,200 sq ft

Heating/Cooling (townhome): Ground source heat pump

Water Heating (townhome): Air Source Heat Pump

Cooking (townhome): Electric stove

Why This Cooktop (townhome): It doesn't use gas

Solar PV: Solar City / Tesla 5.5 kW

EV Charging: Pre-wired

Why All-Electric: To avoid putting in gas lines

Advice for Other Builders: You can get great savings by not running gas lines – and you can get a great value for the land without gas easements.

Future Predictions: 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. It is so much easier to do the basic first (good windows, air sealing and insulation) than trying to retrofit a home. After the efficiency measures, solar at developer prices is below grid-parity and just makes sense from a resilience and environmental perspective.

Website: www.revivefc.com

GEOS

Location: Arvada, CO

Builder/Developer: Cottonwood West Park; Cornerstone Homes; Peak Development; Laudick & Laudick Engineering, LLC

Electric Utility: Xcel Energy

Listing Price: \$450,000's to \$700,000's

Development Size: 15 single-family homes and cottages plus 15 rowhomes across 10 blocks in Phase 1; additional 250 homes and rowhomes under construction

Home Size: 1,500 to 2,500 sq ft

Heating/Cooling (single family): Controlled energy recovery ventilation from Build Equinox with air source heat pump (CERV); Bosch 1.5-ton geothermal heat pump, installed in the basement; small electric strip heaters for backup

Heating/Cooling Cost Data (single family): \$4,500 off-the-shelf, \$15,000 installed, minus a \$600 utility rebate and a 30 percent federal tax credit

Heating/Cooling (rowhome): CERV from Build Equinox as primary source; LG Carrier 2-ton 2-head mini-split air source heat pump; small electric strip heaters for backup

Heating/Cooling Cost Data (rowhome): \$3,000 off-the-shelf, \$6,000 installed, minus a \$600 utility rebate and a 30 percent federal tax credit

Why This Heating/Cooling System: This system has a 5-year payback on the upfront investment, and gas furnaces and water heaters produce too much CO₂ and other noxious gases in an airtight home

Water Heating: 50-gallon Bradford White heat pump water heater, installed in kitchen pantries to use cooling for food preservation and beverages

Why This Water Heating System: It saves energy by coupling with the geothermal heat pump, and is far more efficient than electric resistance

Cooking: Bosch standard electric resistance range

Cooktop Cost Data: \$1,750 off-the-shelf

Why This Cooktop: The increased cost of induction outweighed benefit of faster cook times

Solar PV: 6 kW

EV Charging: EV-Ready 240-volt outlets

Why All-Electric: Keeping natural gas out of homes makes them healthier and safer. Heat pumps require less maintenance and are energy efficient. Electricity costs with these technologies match current costs of natural gas. New homes are built to last for many years and should use future technologies.

Advice: Emphasize the health benefits of electric homes. Explain that natural gas will have to be replaced by electricity within the next 10 years. Fossil fuels will become more expensive while renewable electricity will drop in price.

Future Predictions: Tighter homes will make burning gas a more serious health hazard. Natural gas will be uneconomical and impractical, and will have to be replaced like wired phone lines, gasoline, and coal. Gas lines will be aging and replacing them will be too expensive.

Website: www.discovergeos.com

THRIVE VITALITY COLLECTION

Location: Denver, CO

Developer: Thrive Home Builders

Home Design: Vitality Collection

Electric Utility: Xcel Energy

Listing Price: \$700,000+

Size: 2,300-3,400 sq ft, 3-5 bedrooms, 39 production homes total

Heating/Cooling: Mitsubishi ENERGY STAR ducted mini-split air source heat pumps

Cooking: 36-inch Samsung induction cooktop

Solar PV: 7.8 kW SunStreet

Battery Storage: Yes

EV Charging: Pre-wired

Other Rebates or Incentives: Utility rebate for exceeding code by 10%

Why Electric: 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 system. 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 at home is essential to creating a healthier indoor air environment. 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.

Website: www.thrivehomebuilders.com

NORTH VISTA HIGHLANDS

Location: Pueblo, CO

Builder/Developer: Sprout Tech Homes

Status: First phase of 162 lots under construction

Development Size: 4,850 lots over 1,060 acres

Home Size: 1,800-2,600 sq ft for single-family homes, 2,400 sq ft for townhomes

Electric Utility: Black Hills

Heating/Cooling: Air source mini-splits or radiant in-floor systems with air-to-water heat pumps

Why Electric: Two main reasons: 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. And secondly these homes provide much better indoor air quality, so they're healthier.

Website: www.northvistahighlands.com

BASALT VISTA

Builder/developer: Habitat for Humanity Roaring Fork Valley

Development: Basalt Vista

Location: Basalt, CO

Electric Utility: Holy Cross

Size: 27 homes, each 1,150-1675 sq ft

Heating/Cooling: 4-ton Carrier air source heat pump

Heating/Cooling Cost Data: \$10,985 off-the-shelf, \$24,557 installed; approx. \$10,000 savings from not installing ducts

Water Heating: 50-gallon A.O. Smith heat pump water heater installed in vented closets or mechanical rooms

Water Heat Cost Data: \$1,370 off-the-shelf minus a \$450 utility rebate, \$1,300 installed

Cooking: Frigidaire induction cooktop

Cooktop Cost Data: \$900 off-the-shelf, \$1,000 installed

Solar PV: 11 kW

EV Charging: ChargePoint

Why All-Electric: Net zero goals

Advice: The mini split's outdoor unit must be installed somewhere where it is protected from snow and raised at least a foot off the ground, to help it avoid freezing up or not performing well

Website: www.habitatroaringfork.org/pages/basalt-vista

ALL-ELECTRIC SINGLE-FAMILY HOMES

SAMUELSON

Location: Golden, CO

General Contractor: Kinsman Construction

Architect: Ewers Architecture

Engineering: Christie and Chris Samuelson

Size: 1,900 sq ft

Electric Utility: United Power

Heating/Cooling: 4.4-ton EarthLinked ground source heat pump
Heating/Cooling Cost Data: \$20,700 installed including blower and ducts a \$3,250 utility rebate
Why This Heating/Cooling System: Lowest long-term cost, moderate up-front cost compared to other alternatives such as propane, air source heat pump, or wood pellets
Water Heating: 85 gallon grid-connected Marathon electric resistance tank
Water Heater Cost Data: \$1,029 off-the-shelf minus a \$1,000 utility incentive, for a total of \$29
Why This Water Heating System: Utility incentive, grid controlled off-peak rate
Cooking: LG Glass top electric resistance
Other Tax Credits: \$9,300 federal tax credit
Advice: Don't forget about passive solar

VAN DER RIDJT

Location: West of Golden, CO
Builder/Developer: DT Construct
Architect: Ewers Architecture
Size: 2,000 sq ft
Electric Utility: United Power
Heating/Cooling: 3-ton Chiltrix CX34 air source heat pump with ground-floor radiant floor heating.
Heating/Cooling Cost Data: \$32,455 installed, minus \$1,100 utility rebate (about \$1,000-\$2,000 more than a gas furnace)
Why This Heating/Cooling System: Efficiency and installation cost
Water Heating: 72-gallon Rheem hybrid heat-pump water heater installed in a utility room
Water Heating Cost Data: \$2,964 installed, minus \$370 utility rebate (about the same net costs as a natural gas tank water heater)
Why This Water Heater: Efficiency
Cooking: GE Profile induction and separate wall oven
Cooktop Cost Data: \$1,439 cooktop plus \$1,298 wall oven off-the-shelf
Why This Cooktop: Griddle function, aesthetics
Solar PV: Buglet 5.4 kW ground-mounted
Solar Tax Credit: \$5,829 (federal)
EV charging: 32-amp charger
Net Monthly Electric Bill: ~\$20
Why All-Electric: Desire to generate all energy to operate the home
Advice: Understand and explain to clients the benefit of heat pumps versus traditional inefficient heating. Understand passive solar gain and thermal bridging
Future Prediction: Gas connection becomes less common

ABOVE CODE HOMES

Location: Grand Junction, CO
Builder/Developer: Above Code Homes LLC
Status: Construction starting April 2021
Size: 3,900 sq ft
Electric Utility: Grand Valley Power
Heating/Cooling: Ducted 2-ton Mitsubishi air source heat pump
Heating/Cooling Cost Data: \$2,500 off-the-shelf, \$6,000 installed
Why This Heating/Cooling System: Comfort of mixing air with ducts in every room; lower costs compared to others; approximately the same cost as forced air gas furnace with standard AC
Water Heating: 82-gallon Rheem heat pump water heater in dedicated mechanical room

Water Heating Cost Data: \$2,000 off-the-shelf, \$4,000 installed (~\$1,200 more than gas water heater)

Why This Water Heating System: Cost, efficiency, and availability

Cooking: Bosch or GE Induction cooktop, double electric oven

Cooktop Cost Data: \$2,000 off-the-shelf, \$2,400 installed (~\$1,000 more than a gas stove)

Why This Cooktop: Induction cooktops are getting good reviews and gaining popularity, and they have healthier air quality compared to gas

Solar PV: 8 kW

EV charging: EV-ready

Why All-Electric: Electricity seems to be the future; growing market for these types of homes

Future Predictions: Codes will require at least prewiring for all appliances to be electric ready

L&D CONSTRUCTION

(Not included in main report)

Builder/developer: L&D Construction

Location: Denver, CO

Electric Utility: Xcel Energy

Gas Connection Avoided Cost: ~\$3,500

Heating/Cooling: Mitsubishi air source heat pump mini-split, 2-3 zone systems

Why This Heating/Cooling System: They are the best on the market. Great to work with.

Water Heating: 50-gallon grid-connected Rheem Performance Hybrid Electric heat pump, installed under the stairs

Cooktop: Induction

Solar PV: Yes, always engineer and design for solar – if not right away then in the future

EV Charging: Yes, required by city

Future Prediction: This will become more common

Website: www.ldconstructiondenver.com