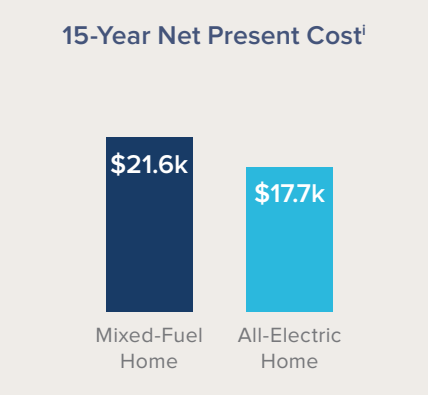
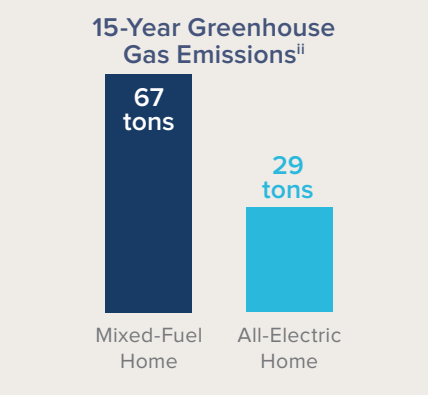
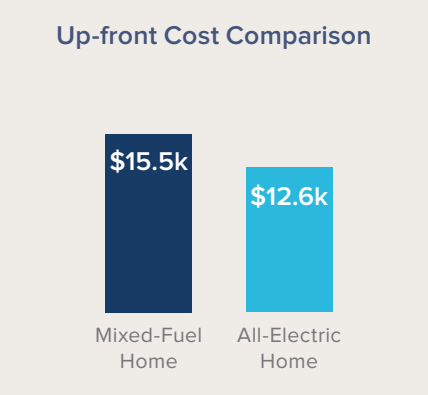
RESIDENTAL NEW CONSTRUCTION

# COLUMBUS: SINGLE-FAMILY HOMES

RMI analyzed the costs of a new all-electric home versus a new mixed-fuel home that relies on gas for cooking, space heating, and water heating. **In Columbus, the all-electric home saves $3,900 in net present costs and 38 tons of $CO_2$ emissions over a 15-year period.**




## Key Findings

The new all-electric home has a lower net present cost than the new mixed-fuel home, presenting **savings on both up-front costs and utility bills**.

- A mixed-fuel home (with gas furnace, water heater, air conditioning, and new gas connection costs) has a higher up-front cost than the all-electric home, which uses the heat pump system for both heating and cooling.
- The all-electric home has **6% lower** annual utility costs. There are significant energy savings with a heat pump space and water heater over corresponding gas appliances, even though electricity is significantly more expensive than gas per unit energy in Columbus.
- Carbon emissions from heating, water heating, and cooking are **57% lower** over the appliance lifetime in the all-electric home, due to more efficient appliances and increasingly low-carbon electricity.

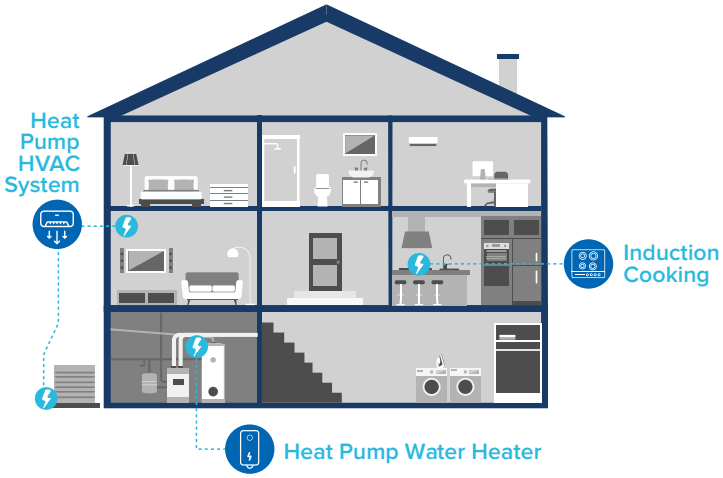
## Annual Energy Usage and Utility Bill Impacts[iii]

| | Mixed-Fuel | All-Electric | Difference |
|---|---|---|---|
| **Annual Electricity & Gas Costs[iv]** | $1,940 | $1,830 | -$110 (-6%) |
| **Electricity Usage (kWh)** | 10,930 | 16,420 | 5,490 (+50%) |
| **Gas Usage (kWh equiv.)** | 22,360 (760 therms) | n/a | -22,360 (-100%) |

*i. Net present cost calculation incorporates up-front costs and bill impacts, discount rate of 7%, and 15-year assumed equipment lifetime.*
*ii. $CO_2$ emissions are equipment lifetime projections and are conservative because these numbers do not include methane leakage. See calculation methodology.*
*iii. Results are rounded.*
*iv. Annual utility cost includes electricity and gas costs, where present. Standard 2020 residential tariffs were used.*

# METHODOLOGY DETAILS

RMI analyzed the economics of a new all-electric single-family home versus a mixed-fuel home that relies on gas for cooking, space heating, and water heating. The following summarizes key home equipment and appliance characteristics for the study.




## Electrification Scenario Equipment Comparison[iv]

| Equipment | Mixed-Fuel | All-Electric |
|---|---|---|
| Heating | Ducted central gas furnace (AFUE 95) | Ducted multi-zone air source heat pump (11 HSPF, SEER 19) |
| Cooling | Central air conditioner (SEER 14) | |
| Water Heating | Gas water heater 80 gallon storage (EF 0.68) | Hybrid electric heat pump water heater 80 gal storage (EF 1.6) |
| Cooking | Gas cooktop Gas oven | Induction cooktop Electric oven |

## Annual Operating Cost Energy Modeling Methodology

**Annual hourly energy modeling in EnergyPlus was conducted for each city using the following references:**

- Department of Energy Residential Prototype Building Model for a single-family detached house (2,400 sq ft) used for building massing.[i]
- ASHRAE Standard 90.2-2019 used as reference HVAC system performance.[ii] Local building codes used as reference for thermal envelope performance.
- Energy modeling results for each scenario calibrated to end-use breakdown, EUI, and gas/electricity fuel split with the latest available Residential Energy Consumption Survey data by climate region.[iii]

## New Customer Gas Connection

We assume an out-of-pocket cost of $2,100 for the gas connection of a new home, with scaling by a local construction cost factor. This estimate is conservative, as our research shows that the out-of-pocket cost range for a new customer gas connection per lot is $0 to $15k+. This cost varies widely depending on the extent of infrastructure upgrade required and the ratepayer-funded customer allowance from the utility in each location.

## Appliance Costs

RMI compiled appliance cost data from cost studies reflecting invoice analyses, contractor surveys, and professional estimates. Costs were then scaled by city using RSMeans Construction Cost Indices. HVAC equipment costs were scaled on a per-ton basis depending on the capacity requirements of each climate.

*i. DOE Residential Prototype*
*ii. Gas furnace and water heater equipment was specified at higher performance ratings than outlined in ASHRAE; efficiencies for that equipment were based on Energy Star specification to reflect consumer choice.*
*iii. EIA RECs Residential Energy Consumption Survey*
*iv. AFUE—Annual Fuel Utilization Efficiency; SEER—Seasonal Energy Efficiency Ratio; EF—Energy Factor; HSPF—Heating Seasonal Performance Factor*

## ABOUT ROCKY MOUNTAIN INSTITUTE

Rocky Mountain Institute (RMI)—an independent nonprofit founded in 1982—transforms global energy use to create a clean, prosperous, and secure low-carbon future. It engages businesses, communities, institutions, and entrepreneurs to accelerate the adoption of market-based solutions that cost-effectively shift from fossil fuels to efficiency and renewables. RMI has offices in Basalt and Boulder, Colorado; New York City; Oakland, California; Washington, D.C.; and Beijing.

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