

Lower Bills, Better Grids: Heat Pump Benefits for Homes Heating with Electric Resistance

Key analysis assumptions

System rated efficiency

- Electric resistance space heat: 1.0 AFUE
- Air conditioner: 15.2 SEER2
- Air-source Heat Pump (ASHP): Ducted 16 SEER2, 9 HSPF2. Ductless 17 SEER2, 9.5 HSPF2.
- Electric resistance water heater: 0.93 UEF
- Heat pump water heater (HPWH): 3.45 UEF, 310% effective efficiency operating in efficiency mode

Hourly loads and system efficiency

- The most common types of single-family homes were grouped into different home archetypes based on the US Energy Information Administration's (EIA's) [Residential Energy Consumption \(RECS\)](#) 2020 consumption microdata. Key variables include building type, building year, space heating fuel and equipment, air conditioning type, and household income. The building stock share for each home archetype was determined per climate zone per state.
- A typical home's energy load profile by end use was taken from the National Renewable Energy Laboratory's (NREL) ResStock for the corresponding home archetype.
- AC and ASHP hourly efficiencies were estimated based on performance curves versus hourly TMY3 temperature data for each climate zone.
- Cold climate ASHP performance curves were based on an average subset of 100 common ASHPs listed in the Northeast Energy Efficiency Partnerships' Air Source Heat Pump (ASHP) database. These ASHPs were sized to meet nearly all heating load, with limited supplemental electric resistance.
- HPWH hourly efficiency was estimated based on a performance curve versus hourly ambient temperature surrounding the water heater based on the state's most common water heater location (e.g., living space, basement, garage, outside) and the climate zone. The HPWH performance curve was based on reported data from two common electric HPWH manufacturers as found in HPWHSim; this data was also used in CBECC-Res.

Energy rates

- Electric volumetric prices were calculated by subtracting utility fixed charge revenue (\$) from the [Energy Information Administration](#) (EIA)'s 2024 residential state-average total revenue (\$) and dividing by the residential sales (kWh)