Lower Bills, Cleaner Air: Heat Pump Benefits for Homes Relying on Delivered Fuels
Key analysis assumptions

Building stock

- The most common types of single-family homes were grouped into different home architypes based on the US Energy Information Administration's (EIA's) Residential Energy Consumption (RECS) 2020 consumption microdata. Key factors include building type, building year, space heating fuel source and equipment, air conditioning (AC) type, and household income. The building stock share for each home archetype was determined per climate zone per state.

Energy prices

- 2024 state-average electric and delivered fuel volumetric prices
- 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).

Rated efficiency

- The ASHP's efficiency, measured in HSPF2 and SEER2, was varied based on ducting and climate zone given common models in today's market. Ducted ASHPs had an HSPF2 of 8 and SEER2 of 17 in climate zones 1–4 and HSPF2 of 9 and SEER2 of 16 in climate zones 5 and above. Ductless ASHPs had an HSPF2 of 8.5 and SEER2 of 19 in climate zones 1–4 and HSPF2 of 9.5 and SEER2 of 18 in climate zones 5 and above.
- The traditional air conditioner's SEER2 was assumed to be the same as the ASHP.
- The HPWH's efficiency, measured in uniform energy factor (UEF), was 3.7 given common models in today's market.
- Traditional furnaces, boilers, and water heaters were Energy Star minimum efficiency.

Hourly efficiency

- 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 type, home size, and climate zone.
- 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. The supplemental electric resistance heating element then covered any unmet heating load.
- 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.
- The electric resistance element then covered any unmet water-heating load based on the hourly water-heating load profile.