

HEATING-PATH DESIGN-FREEZE WORKSHEET

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This printable worksheet helps a homeowner compare four complete heating energy paths for a new U.S. single-family home before design freeze:

1. all-electric air-source heat pump; 2. air-source heat pump with electric resistance backup; 3. dual-fuel air-source heat pump with a natural-gas or propane furnace; 4. combustion furnace with separate cooling.

This is a planning worksheet, not an engineering design, inspection form, code document, utility approval, laboratory report or installation instruction. The project HVAC designer, electrical professional, builder, fuel contractor, serving utility and qualified installer must verify the final decision for the actual address and jurisdiction.

HOW TO USE IT

Use one common load and design condition for every candidate. Obtain an ACCA Manual J or equivalent load calculation and manufacturer performance data at the project's heating design temperature. The DOE-hosted sizing guide (<https://bsesc.energy.gov/sites/default/files/2024-10/Guide%20To%20Sizing%20%26%20Selecting%20Air-Source.pdf>) describes these inputs and presents both 100-115% of load without auxiliary heat and 75-85% of load with supplemental heat as possible cold-climate sizing strategies; those ranges are discussion points, not universal requirements. Evidence ID: doe-load-design-capacity and doe-supplemental-sizing.

Record the source document and the person who verified each entry. Leave a field blank when it is unknown. An unknown is a decision action, not a number to fill with a national average.

PROJECT INPUTS

PROJECT ADDRESS OR PARCEL

Value:

Unit/source:

Verified by/date:

STATE/COUNTY/CITY OR OTHER AHJ

Value:

Unit/source:

Verified by/date:

HVAC DESIGN METHOD/WEATHER SOURCE

Value:

Unit/source:

Verified by/date:

INDOOR HEATING DESIGN TEMPERATURE

Value:

Unit/source:

degF

Verified by/date:

OUTDOOR HEATING DESIGN TEMPERATURE

Value:

Unit/source:

degF

Verified by/date:

INDOOR COOLING DESIGN TEMPERATURE

Value:

Unit/source:

degF

Verified by/date:

OUTDOOR COOLING DESIGN CONDITION

Value:

Unit/source:

degF/humidity as applicable

Verified by/date:

TOTAL DESIGN HEATING LOAD

Value:

Unit/source:

Btu/h

Verified by/date:

TOTAL DESIGN COOLING LOAD

Value:

Unit/source:

Btu/h

Verified by/date:

ROOM/ZONE LOADS ATTACHED?

Value:

Unit/source:

yes/no

Verified by/date:

ENVELOPE ASSUMPTIONS FINAL?

Value:

Unit/source:

yes/no; note revision

Verified by/date:

VENTILATION/INFILTRATION ASSUMPTION

Value:

Unit/source:

cfm or method

Verified by/date:

DUCT LOCATION AND INSULATION

Value:

Unit/source:

Verified by/date:

ELECTRIC SERVICE

Value:

Unit/source:

V, phase, A

Verified by/date:

OTHER LARGE ELECTRIC LOADS

Value:

Unit/source:

kW/A and description

Verified by/date:

NATURAL GAS AVAILABLE?

Value:

Unit/source:

yes/no; utility record

Verified by/date:

PROPANE AVAILABLE?

Value:

Unit/source:

yes/no; supplier record

Verified by/date:

OUTAGE/RESILIENCE GOAL

Value:

Unit/source:

Verified by/date:

CONSTRUCTION/OCCUPANCY TIMING

Value:

Unit/source:

dates

Verified by/date:

CANDIDATE COMPARISON

EXACT PRIMARY MODEL

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

INDOOR UNIT/COIL/FURNACE MODEL

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

AHRI REFERENCE OR CERTIFICATION RECORD

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

REFRIGERANT AND COMPLIANCE BASIS

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

HEAT DELIVERED AT DESIGN TEMPERATURE (BTU/H)

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

HEAT LOAD AT DESIGN TEMPERATURE (BTU/H)

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

CAPACITY GAP (BTU/H)

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

HEAT DELIVERED AT COLDER POINT (BTU/H)

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

COP/INPUT/AFUE AND CITED OUTDOOR CONDITION

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

MINIMUM AND MAXIMUM CAPACITY

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

BACKUP TYPE AND CAPACITY

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

BACKUP TRIGGER OR SWITCHOVER

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

EXPECTED BACKUP HOURS OR MODELED FRACTION

All-electric HP:

BRICTALE / FIELD SHEET

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HP + electric backup:

Dual fuel:

Furnace + separate cooling:

MAXIMUM ELECTRICAL DEMAND

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

SERVICE UPGRADE REQUIRED?

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

FUEL CONNECTION/TANK/VENTING REQUIRED?

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

COOLING EQUIPMENT INCLUDED?

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

DUCT/DISTRIBUTION SCOPE

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

CONDENSATE/DEFROST SCOPE

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

EQUIPMENT SPACE AND SERVICE ACCESS

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

CAPITAL-COST ASSUMPTIONS

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

MODELED DELIVERED-HEAT COST

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

RATE/COP/BACKUP SENSITIVITY

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

MAINTENANCE/SERVICE PLAN

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

WARRANTY CONDITIONS

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

RESPONSIBLE VERIFIER

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

STATUS: PASS/CONDITIONAL/FAIL

All-electric HP:

HP + electric backup:

Dual fuel:

Furnace + separate cooling:

CAPACITY-GAP CALCULATION

Use the same condition for load and equipment data:

capacity gap = $\max(0, \text{design heating load} - \text{delivered primary capacity})$

Illustrative example: if the design load is 42,000 Btu/h and the heat pump delivers 34,000 Btu/h at that condition, the modeled gap is 8,000 Btu/h. Record how that gap is served; do not choose the remedy from the formula alone.

47degF

Load (Btu/h):

Primary delivered capacity (Btu/h):

Gap (Btu/h):

Backup/response:

Evidence ID or document:

PROJECT DESIGN TEMPERATURE

Load (Btu/h):

Primary delivered capacity (Btu/h):

Gap (Btu/h):

Backup/response:

Evidence ID or document:

COLDER PUBLISHED POINT

Load (Btu/h):

Primary delivered capacity (Btu/h):

Gap (Btu/h):

Backup/response:

Evidence ID or document:

OWNER-SELECTED STRESS POINT

Load (Btu/h):

Primary delivered capacity (Btu/h):

Gap (Btu/h):

Backup/response:

Evidence ID or document:

DELIVERED-HEAT COST FORMULAS

Use local rates and label all values as measured, quoted, rated or modeled.

For a heat pump:

$$\text{electric kWh} = \text{delivered Btu} / (\text{COP} \times 3,412 \text{ Btu/kWh})$$

$$\text{cost} = \text{electric kWh} \times \text{electric rate (\$/kWh)}$$

For electric resistance backup, use the designer's applicable input; a simple illustrative convention is COP 1.0.

For gas:

$$\text{fuel therms} = \text{delivered Btu} / (100,000 \text{ Btu/therm} \times \text{AFUE})$$

$$\text{cost} = \text{fuel therms} \times \text{gas rate (\$/therm)}$$

Add blower, control, fixed-service, demand, maintenance and other applicable costs separately. Do not use a natural-gas therm rate for propane.

COST INPUTS

ANNUAL DELIVERED SPACE-HEAT DEMAND

Value:

Unit:

million Btu

Source/assumption:

Verified by:

ELECTRICITY RATE

Value:

Unit:

\$/kWh

Source/assumption:

Verified by:

ELECTRICITY FIXED/DEMAND CHARGE

Value:

Unit:

\$/month or \$/kW

Source/assumption:

Verified by:

GAS RATE

Value:

Unit:

\$/therm

Source/assumption:

Verified by:

PROPANE RATE

Value:

Unit:

\$/gal or supplier unit

Source/assumption:

Verified by:

HEAT-PUMP COP OR INPUT BY TEMPERATURE

Value:

Unit:

Source/assumption:

exact model data

Verified by:

FURNACE AFUE AND BLOWER INPUT

Value:

Unit:

%, kW

Source/assumption:

exact model data

Verified by:

RESISTANCE BACKUP HOURS/FRACTION

Value:

Unit:

h/year or %

Source/assumption:

model/sensitivity

Verified by:

DUAL-FUEL SWITCHOVER

Value:

BRICTALE / FIELD SHEET

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Unit:

degF and logic

Source/assumption:

control document

Verified by:

MAINTENANCE/SERVICE ALLOWANCE

Value:

Unit:

\$/year or scenario

Source/assumption:

local scope

Verified by:

SENSITIVITY ROWS

Repeat the cost result with at least these changes:

ELECTRICITY RATE (\$/KWH)

Low case:

Base case:

High case:

Does the selected path change?:

GAS/PROPANE RATE

Low case:

Base case:

High case:

Does the selected path change?:

AVERAGE MODELED HEAT-PUMP COP

Low case:

Base case:

High case:

Does the selected path change?:

HEATING DESIGN TEMPERATURE

Low case:

Base case:

High case:

Does the selected path change?:

BACKUP HOURS OR FRACTION

Low case:

Base case:

High case:

Does the selected path change?:

ANNUAL HEAT DEMAND

Low case:

Base case:

High case:

Does the selected path change?:

VERIFICATION CHECKLIST

BEFORE DESIGN FREEZE

- ☐ Jurisdiction and AHJ identified; local requirements assigned to the responsible professional.
- ☐ Manual J or equivalent load record received, with envelope and ventilation assumptions.
- ☐ Heating and cooling design temperatures recorded with method/source.
- ☐ Exact model numbers, indoor/outdoor pairing and performance data received.
- ☐ Delivered capacity at design and colder conditions recorded.
- ☐ Capacity gap and backup treatment documented.
- ☐ Electrical service calculation includes compressor, blower, resistance stages and other large loads.
- ☐ Gas or propane availability, connection, pressure/tank and delivery scope documented where applicable.
- ☐ Combustion-air, venting, condensate and carbon-monoxide safety scope assigned where applicable.
- ☐ Outdoor-unit location, clearances, snow/ice, sound and service access reviewed.
- ☐ Ducts, returns, airflow, static-pressure assumptions and filters

documented.

- ☐ Control sequence includes switchover, lockouts, defrost, staging and sensor failure behavior.
- ☐ Refrigerant, component timing and federal compliance basis documented.
- ☐ AHRI or other applicable certification record checked.
- ☐ Capital-cost exclusions and operating-cost assumptions listed.
- ☐ Warranty, registration and service responsibility assigned.
- ☐ Commissioning tests and homeowner handover records listed in the contract.

BEFORE PROCUREMENT

- ☐ No unresolved hard prerequisite remains.
- ☐ Any substitution requires a rerun of capacity, pairing, service, compliance and warranty checks.
- ☐ Builder, HVAC designer, electrical professional and homeowner acknowledge the selected path.
- ☐ Construction drawings and scope include the selected system, not only the brand family.

AT COMMISSIONING AND HANDOVER

- ☐ Model and serial numbers match the approved submittal.
- ☐ Startup/commissioning report received.
- ☐ Airflow and pressure checks received where applicable.
- ☐ Heat-pump, resistance and furnace modes tested where applicable.
- ☐ Defrost, switchover, condensate and safety functions checked.
- ☐ Thermostat settings and installer parameters recorded.
- ☐ Manuals, filters, maintenance intervals, warranty and service contacts received.
- ☐ First-season observation log started.

SOURCE BASIS AND LIMITS

This worksheet is derived from current U.S. primary or program sources reviewed September 8, 2026. Keep this source/evidence key with a printed or reused copy so a reader can verify the factual inputs without opening the article:

DOE-LOAD-DESIGN-CAPACITY

Worksheet input or claim:

Manual J or equivalent load and manufacturer performance at design conditions

Source:

DOE cold-climate sizing guide (<https://bsesc.energy.gov/sites/default/files/2024-10/Guide%20To%20Sizing%20%26%20Selecting%20Air-Source.pdf>)

DOE-SUPPLEMENTAL-SIZING

Worksheet input or claim:

100-115% no-auxiliary and 75-85% with supplemental-heat example strategies

Source:

DOE cold-climate sizing guide (<https://bsesc.energy.gov/sites/default/files/2024-10/Guide%20To%20Sizing%20%26%20Selecting%20Air-Source.pdf>)

ENERGYSTAR-COLD-CLIMATE-PERFORMANCE

Worksheet input or claim:

Cold-climate heat-pump COP and low-temperature capacity screening

Source:

ENERGY STAR Version 6.2 criteria (https://www.energystar.gov/sites/default/files/2026-02/HP%20Version%206.2%20Specification%20Revised%20February%202026_0.pdf)

ENERGYSTAR-COP-DEFINITION

Worksheet input or claim:

COP definition and point-condition limitation

Source:

ENERGY STAR heat-pump criteria (https://www.energystar.gov/products/air_source_heat_pumps/key-product-criteria)

EPA-RESIDENTIAL-HFC-TABLE / EPA-NEW-SYSTEM-FAQ

Worksheet input or claim:

Federal refrigerant transition dates, GWP limit and new-system scope

Source:

EPA sector restrictions
(<https://www.epa.gov/hfcs/technology-transitions-hfc-restrictions-sector>);
EPA homeowner FAQ
(<https://www.epa.gov/hfcs/frequent-questions-phasedown-hydrofluorocarbons>)

AHRI-CERTIFIED-DIRECTORY

Worksheet input or claim:

AHRI model/reference search and certificate record

Source:

AHRI public-user directory guide (<https://licensee.ahridirectory.org/Content/Asset/PDFTemplate/DIRECTORY%20USER%20GUIDE%20-%20Public%20User%20-%20v2.1.pdf>)

DOE-HEAT-PUMP-COOLING-AND-CLIMATE / DOE-INSTALLATION-MAINTENANCE

Worksheet input or claim:

Heat-pump heating/cooling scope, climate, sizing, duct and maintenance cautions

Source:

DOE residential heat-pump guidance (<https://www.energy.gov/cmei/femp/purchasing-energy-efficient-residential-air-source-heat-pumps>)

ENERGYSTAR-FURNACE-AFUE-REGIONS

Worksheet input or claim:

AFUE definition and ENERGY STAR regional thresholds

Source:

ENERGY STAR furnace criteria
(https://www.energystar.gov/products/furnaces/key_product_criteria)

DOE-DIRECT-VENT-COMBUSTION

Worksheet input or claim:

Direct-vent combustion air, exhaust and backdrafting explanation

Source:

DOE direct-vent equipment guidance

(<https://bsesc.energy.gov/energy-basics/hvac-direct-vent-equipment>)

DOE-LOCAL-COST-ASSUMPTIONS

Worksheet input or claim:

Cost examples use explicit rates and assumptions; actual savings vary

Source:

DOE residential heat-pump guidance (<https://www.energy.gov/cmei/femp/purchasing-energy-efficient-residential-air-source-heat-pumps>)

These sources support planning inputs and screening questions, not a site-specific design, code interpretation, utility quote, laboratory result or installation approval. Verify them again if the project is delayed, the equipment changes or the federal, state, local, utility or manufacturer requirements change. The HVAC designer, electrical professional, builder, fuel contractor, serving utility and qualified installer remain responsible for the final address-specific package.