ResStock Dataset 2024.1 Documentation

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Technical Report
NREL/TP-5500-88109
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National Renewable Energy Laboratory
15013 Denver West Parkway
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List of Acronyms

AC	air conditioner
ACH50	air changes per hour at 50 pascals
AFUE	annual fuel utilization efficiency
ASHP	air-source heat pump
CEF	combined energy factor
CEER	combined energy efficiency ratio
CFL	compact fluorescent lamp
COP	coefficient of performance
DOE	U.S. Department of Energy
EER	energy efficiency ratio
EF	energy factor
EIA	U.S. Energy Information Administration
ERV	energy recovery ventilator
HPWH	heat pump water heater
HSPF	heating seasonal performance factor
HVAC	heating, ventilating, and air conditioning
IECC	International Energy Conservation Code
MSHP	minisplit heat pump
NG	natural gas
NREL	National Renewable Energy Laboratory
PADD	Petroleum Administration for Defense Districts
PUMA	public use microdata area
QAQC	quality assurance/quality control
RECS	Residential Energy Consumption Survey
SEER	seasonal energy efficiency ratio
TMY	typical meteorological year
UEF	uniform energy factor
XPS	extruded polystyrene insulation

Executive Summary

Public ResStock™ datasets provide credible, relevant, and accessible information on energy use and related non-energy metrics to a variety of stakeholders in the residential buildings space. The current public datasets include baseline building characteristics, timeseries (15-minute) energy consumption, and timeseries carbon emissions for the baseline (existing) U.S. housing stock and the U.S. housing stock with 10 "what-if" energy measure packages applied.

This report documents a new public ResStock dataset to complement and build upon the existing public datasets. This dataset is specifically intended to be a resource for state and local decision-makers considering options for energy retrofits for their housing stock to reduce carbon emissions, energy use, and/or utility bills. These data consist of housing stock characteristics and modeled full-year energy consumption, carbon emission, energy bill, and energy burden data for the baseline U.S. housing stock as well as the U.S. housing stock with 260 "what-if" energy measure packages applied. These measure packages include measures related to the building envelope, appliances, pools and spas, lighting, water heating, and HVAC (including efficiency improvements and fuel switching with equipment at a range of performance levels) in a variety of combinations.

This report provides methodology information on the generation of this dataset and serves as a key part of the dataset's public documentation.

Table of Contents

List of Tables

1 The ResStock Tool

ResStock™ is a National Renewable Energy Laboratory (NREL)-developed residential building energy stock analysis tool. It has two main functions: generating a set of residential dwelling unit models to statistically represent the residential building stock of the contiguous United States,[1] and then modeling the energy consumption of those dwelling unit models. The modeling is performed using OpenStudio® and EnergyPlus®, flagship U.S. Department of Energy (DOE) energy modeling tools, through the BuildStockBatch workflow either on NREL's supercomputer, or on cloud computing resources. This energy modeling can either be done on the dwelling unit models as they are, representing the existing energy consumption, or in "what-if" technical potential scenarios, looking at potential changes to the models in the form of the application of measure packages—for example, replacing the lighting in every model that doesn't currently have light-emitting diode (LED) lighting with LEDs. The result is a dataset of dwelling unit models and their energy consumption that represents the variety of actual U.S. dwelling units in terms of geographic location and conditions (weather, etc.), dwelling unit characteristics (size, heating fuel, wall and attic insulation, etc.) and household characteristics (heating and cooling setpoints, occupied by owner vs. renter vs. nobody, household income, etc.).

ResStock generates these models from dependent probability distributions created from datasets such as the U.S. Energy Information Administration's (EIA) Residential Energy Consumption Survey (RECS) and U.S. Census data. For example, the version of ResStock used in this analysis has a probability distribution of window types for each dwelling unit model based on the ASHRAE/International Energy Conservation Code (IECC) 2004 climate zone, the dwelling unit type, the vintage, the income (federal poverty level), and whether the unit is owner- or renter-occupied. So if a particular dwelling unit model has already been assigned using upstream probability distributions to ASHRAE/IECC climate zone 5B, a federal poverty level of 300%–400%, a dwelling unit type of Single-Family Detached, and a vintage of 1980–1999, then there is a 25% chance it will be assigned a window type of "Single, Clear, Metal," an 18% chance it will be assigned a window type of "Double, Clear, Metal, Air," and so forth for other window types. This distribution of window types as a function of other dwelling unit and household characteristics is derived from RECS 2020 data. Many other distributions in ResStock are derived from other data sources; specific source information is contained in the housing characteristic files in the ResStock GitHub repository.[2]

Additional non-energy outputs are also possible from within ResStock if the appropriate inputs are provided. Key among these are emissions calculations, utility bill calculations, and measure package costs.

2 Motivation for Creation of This Dataset

The ResStock team publishes large, robust public datasets to meet the needs of a wide range of users and use cases. Our team has published two key datasets under this current paradigm—2021.1, also known as "End-Use Load Profiles," and 2022.1, also known as "End-Use Savings

[1] At the time of publication, ResStock does not include Alaska, Hawaii, or U.S. territories
[2] Available at: https://github.com/NREL/resstock/tree/fact_sheets_2023/project_national/housing_characteristics

Shapes Residential Round 1." The End-Use Load Profiles analysis (Wilson et al. 2022) is a timeseries dataset representing the existing building stock, whereas the End-Use Savings Shapes analysis (Present et al. 2022a) is a timeseries dataset that includes both the existing housing stock and 10 "what-if" scenarios of measure packages focused on the impact of electrifying a variety of end uses.[3] By including both timeseries and annual results, these datasets can be used to answer diverse questions not just about energy consumption and energy savings opportunities, but also to examine the temporal implications of building electricity use, valuable for short- and long-term planning by utilities, grid operators, public utility commissions, and state energy offices.

Following the publication of these datasets, we received feedback—particularly from states and communities—suggesting a near-term need for results from many more measure packages to support strategic planning and preparation for investments supported by the Inflation Reduction Act, Bipartisan Infrastructure Law, and other federal, state, and local investments in energy efficiency and decarbonization. These use cases do not generally require timeseries data, but do require sample sizes sufficient for smaller geographies. While we published analysis results for a wide range of measure packages in 2017[4] (Wilson et al. 2017), they were limited in detail and lack the significant calibration and feature expansions incorporated into ResStock since 2017. The interest in a very large number of measure packages with immediate needs that did not require timeseries data motivated the development of a dataset outside of the standard End-Use Savings Shapes publication cycle.

3 Methodology for Creation of This Dataset

3.1 Determining the Measure Packages for Inclusion

We developed a draft list of measure packages with the aim of including a wide range of technologies and performance levels, constrained principally by ResStock's modeling capabilities at that time. The measure packages were defined based on feedback on the 2021.1 and 2022.1 datasets and prior one-off analyses. The dominant themes from user feedback on the measure packages were a desire for an extensive array of combinations of heat pump measures with envelope measures, a need for variable-speed cold climate heat pump results at a "medium" performance level between those we had modeled in the 2022.1 dataset, and interest in heat pump water heaters (HPWHs) in combination with HVAC and envelope measures.

We reviewed the draft list with a range of ResStock dataset users including utilities, nonprofits, and government organizations, as well as several subject matter experts within NREL, and revised the list based on their input and subsequent identification of ResStock or data availability constraints.

3.2 Baseline Building Stock Representation

ResStock has a number of configuration options when generating a representation of the existing building stock. For the creation of this dataset we used the "develop" branch of the public

[3] https://resstock.nrel.gov/datasets
[4] https://resstock.nrel.gov/factsheets/

ResStock GitHub repository as of August 23, 2023—SHA 45178e1,[5] which represents the housing stock as it was in 2018, as nearly as possible based on the best available data sources. We used Typical Meteorological Year 3 (TMY3) weather data, selected after discussions with a range of users. And we used a sample size of 2.2 million dwelling unit models, roughly 1 model for every 60 dwelling units that actually exist in the contiguous United States. Each dwelling unit model has its own value for each of over 100 characteristics such as location, size, vintage, HVAC types, insulation and infiltration levels, number of occupants, thermostat setpoints, and appliances. Overall, each dwelling unit model is representative of a small subset of the dwelling units in the real housing stock—it is not modeling an "average," "typical," or "prototype" dwelling unit, nor is it modeling an individual actual dwelling unit. This creates a representation of the existing building stock that varies in similar ways to the actual building stock. The full list of models with their baseline characteristics is available as part of the dataset.[6] Find the full version of this branch of the ResStock GitHub repository using the repository tag "v3.1.1-2024.1."[7]

Based on a number of user requests, we added one characteristic not in the ResStock GitHub repository—a representative income for each dwelling unit, within each income bin. We used the weighted median of each income bin from the 2019 5-year American Community Survey's Public Use Microdata Sample dataset (Ruggles et al. 2022), separated by geography, household size, federal poverty level, renter/owner status, and building type. Including this characteristic in the dataset facilitates calculation of energy burden for occupied dwelling units, corresponding to the one-year energy bill as a percentage of household income for both baseline and non-baseline results.

3.3 Energy Consumption of Measure Packages

The energy consumption of the baseline (i.e., existing) building stock and of the building stock with measure packages applied are direct outputs of ResStock. ResStock simulates each measure package separately through OpenStudio and EnergyPlus, which means that impacts of energy consumption interactions between different measures in a package are included. For example, in a measure package with both envelope and HVAC components, the load on the HVAC will be impacted by the changes in the envelope, and these impacts will show in the energy, emissions, energy bill, and energy burden results. Each component of a measure is applied using if/then applicability logic to the same population of dwelling unit models that compose the baseline. The measures are applied to all eligible dwelling unit models based on the if/then applicability logic, with no consideration of existing equipment lifetime, consumer adoption, phased implementation, or other factors that could limit adoption; the results are thus equivalent to overnight technical potential.

In this analysis we include four types of site energy consumption: electricity, natural gas, propane, and fuel oil. Other fuel types, such as site consumption of wood or coal, are not included in any results. Roughly 3% of dwelling units included in the dataset have a baseline

[5] Full SHA: 45178e17f386fff4e24c48ebbdd9244b6afe3fb5
[6] The characteristics for each model are available in both .csv and .parquet database formats, and each model's respective simulation file in .xml format.
[7] https://github.com/NREL/resstock/releases/tag/v3.1.1-2024.1

primary heating fuel other than one of the four included, and less than 0.5% have a baseline water heating fuel other than one of the four included.

3.4 Emissions Reduction Associated With Measure Packages

ResStock can calculate avoided emissions associated with the measure packages when provided with appropriate emissions factors. For this dataset, we used carbon emissions factors intended to represent the one-year emissions reductions in the year 2030 that would result from each measure package. This is a different and more straightforward approach than we used in the 2022.1 dataset—our approach now does not require choosing or interpreting the implications of a start year, levelization period, or discount rate—which means the two sets of emissions results cannot be directly compared.

Given the uncertainty of future emissions from electricity consumption, we include three options for electric emissions results, all based on long-run marginal emissions factors from the Cambium 2022 (Gagnon et al. 2023) release, but using different NREL Standard Scenarios that represent potential futures of the electric grid—Low Renewable Energy (RE) Cost, Mid-Case, and High RE Cost. We used the Generation and Emissions Assessment geographic resolution from Cambium 2022. We averaged values from 2026, 2030, and 2035 to represent 2030 in order to mitigate any impacts of single-year anomalies from the underlying grid models. These emissions values represent the emissions impact of changes in electric load and are the most appropriate values available for representing the change in emissions that would result from differences in energy consumption in 2030 due to a measure package being implemented; they are not suitable for emissions inventory efforts (e.g., showing what portion of all emissions in 2030 would come from the residential building stock) (Present et al. 2022b; Ekvall 2019).

For site consumption of natural gas, propane, and fuel oil, we used values from Table 7.1.2(1) of draft PDS-01 of BSR/RESNET/ICCC 301 Addendum B, CO2 Index (RESNET 2022). These are 147.3 lb/MMBtu (228.5 kg/MWh) for natural gas, 177.8 lb/MMBtu (275.8 kg/MWh) for propane, and 195.9 lb/MMBtu (303.9 kg/MWh) for fuel oil.

All the emissions values used are carbon dioxide equivalent values, comprising both carbon dioxide and other greenhouse gas emissions, including methane leakage emissions.[8]

3.5 Energy Bill Savings Associated With Measure Packages

We used ResStock energy consumption results to calculate energy bills for each dwelling unit modeled—for both the baseline and every measure package. We based these on state-average volumetric costs from the EIA, with fixed customer costs from other sources also included for electricity and natural gas as detailed below.

Where possible, situationally specific energy rates should be used to calculate utility bills from the energy data provided in this dataset rather than using the provided values, as individual rates can differ within each state and rates may have structures such as tiers or time-of-use that are not included in the pre-computed values.

[8] The lrmer_co2e variable from Cambium 2022, which includes both combustion and precombustion impacts—see Section 6.2 of the Cambium documentation report (Gagnon et al. 2023).

3.5.1 Residential Electricity Bills

We downloaded data from NREL's Utility Rate Database in November 2021 (OpenEI 2021) to calculate the customer-weighted average fixed monthly electricity charge across all utilities in the database:

$$\frac{\sum Fixed\ electric\ charge\ *\ Number\ of\ customers}{\sum Number\ of\ customers}$$

This came out to approximately $10/customer/month, or $120/customer/year.

We downloaded EIA state average residential electricity data including total revenue (in thousands of dollars), total sales (in MWh), and total customers (quantity) for 2022 (EIA 2023). We then calculated the average variable electricity rate for each state as:

$$\frac{Total\ revenue - (Fixed\ cost * Number\ of\ customers)}{Total\ sales}$$

This resulted in a per-unit residential utility customer rate for each state that varied from $0.10/kWh in WA to $0.23/kWh in MA.

The full year electricity bill was then calculated for each modeled dwelling unit using its modeled electricity consumption and the variable electric rate calculated for each state, as:

$$\$120 + (Electricity\ consumption * Variable\ electric\ rate)$$

3.5.2 Residential Natural Gas Bills

For natural gas bill calculations, we used the American Gas Association's value of $11.25/customer/month (American Gas Association 2015) for the fixed portion of the utility bill (generally referred to as the "customer charge"). We downloaded 2022 EIA data by state on price, consumption, and number of customers,[9] then calculated the volumetric rate for each state as:

$$\frac{(Consumption * Price) - (Fixed\ cost * Number\ of\ customers)}{Total\ sales}$$

The results ranged from $0.49/therm in ID to $1.64/therm in FL.

The full year natural gas bill was then calculated for each modeled dwelling unit using its modeled natural gas consumption and the volumetric natural gas rate calculated for each state, as:

$$\$135 + (Natural\ gas\ consumption\ x\ Volumetric\ natural\ gas\ rate)$$

[9] For price, see EIA 2024a, for consumption see EIA 2024b, and for number of customers see EIA 2024c.

Dwelling unit models without natural gas consumption have no natural gas bill in our results, including no customer cost, whether in the baseline or because a measure package resulted in the elimination of all natural gas consumption.

3.5.3 Residential Propane and Residential Fuel Oil Bills

We downloaded weekly volumetric rate data from the 2021–2022 winter from EIA for residential fuel oil (EIA 2024d) and residential propane (EIA 2024e), and averaged the data over the available weeks. When state-level data were not available, we used data from the state's Petroleum Administration for Defense Districts (PADD) region. When PADD region data were not available, we used U.S. national average values. These values ranged from $1.79/gallon in ID to $4.50 in FL for propane and from $2.54 in NE to $3.31 in DE for fuel oil. We then calculated propane and fuel oil bills by multiplying the fuel consumption for each dwelling unit model by the volumetric rate for that fuel and state.

3.6 Quality Assurance and Quality Control

The specifics of the measure packages included in this dataset have been reviewed by subject matter experts at NREL and, when appropriate, at DOE and other national laboratories as well. The ResStock inputs and results have also been reviewed at multiple stages in the process according to our project Quality Control (QC) Plan.

- Each ResStock project input file was reviewed by multiple members of the team, focusing on correct application of measure packages based on previously agreed upon and documented what-if criteria.
- A "small" run of 100 national dwelling unit samples was then conducted and reviewed, focusing on the number of dwelling unit models having each measure package applied, the rough scale of energy savings (by fuel type and total), emissions savings, and bill savings for each measure package. Both aggregate values and distributions were reviewed. Any results or trends that could not be explained by the project team were escalated to subject matter experts or other team members as appropriate.
- A "medium" run of 30,000 national dwelling unit samples was then conducted and reviewed, focusing on similar quantities of interest as the small run, but with higher scrutiny and subsetting of results as appropriate—for example, by climate zone, baseline water heater type, dwelling unit type, or other dwelling unit characteristics. Any results or trends that could not be explained by the project team were escalated to subject matter experts or other team members as appropriate.
- The "full" run of 2,200,000 national dwelling unit samples was then conducted, and select quantities of interest (e.g., total energy use by fuel type, heating energy use by fuel type) were calculated and compared to the medium run results.
- The medium run results were loaded into dashboards using Tableau Public, which allowed for wider review of a smaller set of outputs from the project team, peer reviewers, and DOE.

This QAQC workflow allowed us to identify several unexpected values in the results, some of which have reasonable explanations within the workflow and some of which required revisions to ResStock, or to our input files, or resulted in plans for future ResStock improvements.

However, due to the size and complexity of the data and the number of ways it can be viewed, filtered, and aggregated, not every data point or possible aggregation of data was reviewed independently. Errors may exist and we encourage dataset users to contact us[10] should they encounter any problems.

4 Sample Sizes

The simulated dwelling units in this dataset are created via a quota-based sampling method based on probability distributions. This methodology allows reproducible output values when the number of simulated dwelling units is relatively high. For example, 10,000 distinct dwelling unit simulations sampled by ResStock's quota-based sampling method should have similar annual total energy outputs as a separate (i.e., a different random seed) sampling of 10,000 dwelling unit simulations. However, if the number of dwelling units being compared becomes relatively low (e.g., 100 dwelling units rather than 10,000 dwelling units), then there can be discrepancies in the simulations' respective outputs.

Extensive filtering in the 2024.1 dataset can result in low numbers of dwelling units that may not provide reliable results. When determining the impact of smaller sample sizes on the uncertainty of the results, users should estimate standard error for metrics of interest using the standard deviation divided by the square root of the number of samples/models.[11] As discussed in the EULP methodology report (Wilson et al. 2022; see Section 5.1.3), a general guideline is to use at least 1,000 samples to maintain approximately 15% or less sampling discrepancy for common quantities of interest.

Every state meets the 1,000 sample threshold easily when no further filtering is applied, due to the oversize nature of the sample in this dataset—2.2 million dwelling unit samples, whereas recent published ResStock datasets have used 550,000 samples. The 1,000 sample threshold is also met in the largest 439 counties (representing 71% of dwelling units in the contiguous U.S.), 160 census-designated cities, and 783 public use microdata areas (PUMAs). The average sample size in a PUMA is 941. Nevertheless, dataset subsets corresponding to sparsely populated areas or uncommon dwelling unit characteristics, or subsets with multiple filter criteria applied to the housing stock characteristics, may have relatively few samples available. In these cases, samples from similar locations can be grouped to increase the sample size until the needs of the particular analysis being performed are met.

As an example, if a user is interested in the mean change in annual electricity costs in a certain county under a potential new rate structure and 500 samples are available in that county, either additional samples should be included from similar counties or the costs should be calculated for all 500 samples and the standard deviation of those costs can be used to calculate the standard error of the mean change in annual electricity costs.

[10] ResStock@nrel.gov
[11] For more information, see the ResStock FAQ: https://resstock.nrel.gov/page/faq.

5 Measure Package Details

5.1 Measure Package Overview

The 2024.1 dataset includes 260 measure packages composed of 55 distinct measures. The distinct measures fall into five categories, described in Section 5.1.1–5.1.5. Section 5.1.6 provides context to modeling assumptions with heat pumps, and Section 5.1.7 addresses this dataset's use of the legacy efficiency metrics EER, SEER, and HSPF. Section 5.3 describes each individual measure package in detail, and the Appendix has a table of all measure packages.

5.1.1 Envelope

This dataset includes the following envelope measures.

ENERGY STAR Windows

Replace any less-efficient existing windows with windows that meet ENERGY STAR (v7)[12] criteria. This measure includes a 30% infiltration reduction for dwelling units with existing single-pane windows and 15% infiltration reduction for dwelling units with existing double-pane windows.

The window specifications used for the new windows vary by ENERGY STAR Climate Zone:[13]

- North-Central
  - U-factor: 0.25
  - SHGC: 0.40
- Northern
  - U-factor: 0.22
  - SHGC: 0.40
- South-Central
  - U-factor: 0.28
  - SHGC: 0.23
- Southern
  - U-factor: 0.32
  - SHGC: 0.23

Thin Triple Windows

Replace any less-efficient existing windows with thin triple-pane windows. This includes a 30% infiltration reduction for dwelling units with existing single-pane windows and 15% infiltration reduction for dwelling units with existing double-pane windows.

The window specifications used for the new windows vary by ENERGY STAR Climate Zone:

[12] ENERGY STAR v7 documentation for Residential Windows, Doors, and Skylights available at: https://www.energystar.gov/sites/default/files/asset/document/ES_Residential_WDS_V7_Final%20Specification%202022.pdf?_gl=1*69ynaq*_ga*MzEwMzEzODU4LjE3MDc0Mzk4NTc.*_ga_S0KJTVVLQ6*MTcwNzQzOTg1Ni4xLjAuMTcwNzQzOTg1Ni4wLjAuMA.

[13] A map of the climate zones is available at: https://www.energystar.gov/sites/default/files/asset/document/Promotional_Map_Only.pdf.

- North-Central + Northern
    - U-factor: 0.19
    - SHGC: 0.41
- South-Central + Southern
    - U-factor: 0.18
    - SHGC: 0.18

Attic Floor Insulation

Attic floor insulation increased to IECC-Residential 2021 levels for dwelling units with vented attics and any lower level of insulation.

ResStock currently uses the older (2004) IECC climate zone definitions. New climate zone definitions were released in 2021 (see Antonopoulos et al. 2022), but have not yet been incorporated into ResStock. As a result, this dataset models dwelling units in some counties with a higher insulation level than specified in IECC 2021. Specifically, dwelling units with lower attic insulation levels in counties that were redefined from IECC climate zone 2A to 1A received R-49 instead of the IECC 2021-specified R-30 attic insulation, and those in counties that were redefined from IECC climate zone 4 to 3 received R-60 instead of the IECC 2021 specified R-49.

General Air Sealing

A 30% whole-home reduction in infiltration (ACH50) for dwelling units with greater than 10 ACH50 in the baseline. This value is consistent with the median reduction documented in Walker et al. (2021).

Duct Sealing

Duct sealing to 10% leakage and R-8 duct insulation for any leakier or less-insulated ducts.

Drill-and-Fill Wall Insulation

Drill-and-fill wall insulation (R-13) for dwelling units with no wall insulation and wood stud walls.

Foundation Wall and Rim Joist Insulation, With Sealing of Crawlspace Vents

Add R-10 interior insulation to foundation walls and rim joists in conditioned basements and crawlspaces; seal crawlspace vents.

Exterior Continuous Wall Insulation

1” exterior insulation extruded polystyrene (XPS) (R-5/in.) for wood or concrete masonry unit (CMU) walls with existing total insulation of less than R-19.

IECC 2021 Air Sealing

Improve dwelling unit’s infiltration to IECC 2021 air sealing requirements—5 ACH50 for climate zones 1A, 2A, and 2B, and 3 ACH50 for the remaining climate zones.

Counties that were in IECC climate zone 4 in the 2004 IECC climate zone definitions receive 3 ACH50 rather than 5 ACH50, even if they are in climate zone 3 in the 2021 IECC.

Roof Insulation

R-30 insulation for less-insulated finished attics and cathedral ceilings.

Improved Ventilation

Energy recovery ventilator (ERV) ventilation is added to dwelling units in climate zones 4A, 4B, 4C, 5A, 5B, 6A, 6B, 7A, and 7B if existing infiltration is above 3 ACH50. Exhaust-only ventilation is added to dwelling units in climate zones 1A, 2A, and 2B if existing infiltration is above 5 ACH50. Exhaust-only ventilation is for climate zones 3A, 3B, and 3C for dwelling units with greater than 3 ACH50. All climate zones are based on the 2004 IECC definitions.

These measures were grouped into envelope-only measure packages as shown in Table 1.

Table 1. Envelope-Only Measure Packages

Measure Package Number	Measure Package Name, Full	Measures Included
2.01	Windows, Thin Triple	• Thin Triple Windows
2.02	Windows, ENERGY STAR	• ENERGY STAR Windows
2.03	Envelope, Light Touch	• Attic Floor Insulation • General Air Sealing
2.04	Envelope, Intermediate	• Attic Floor Insulation • General Air Sealing • Duct Sealing • Drill-and-Fill Wall Insulation • Foundation Wall and Rim Joist Insulation, With Sealing of Crawlspace Vents
2.05	Envelope, Advanced	• Attic Floor Insulation • Duct Sealing • Drill-and-Fill Wall Insulation • Foundation Wall and Rim Joist Insulation, With Sealing of Crawlspace Vents • ENERGY STAR Windows • Exterior Continuous Wall Insulation • IECC 2021 Air Sealing • Improved Ventilation

The Light Touch, Intermediate, and Advanced envelope measure packages were also included in cross-system packages as described in Table 6 and Table 7.

5.1.2 Appliances, Pools, and Lighting

The dataset includes the following measures of efficient appliances, LED lighting, and electrification of gas dryers and gas ranges/ovens, as well as electrification of pool and spa heating.

Refrigerator, ENERGY STAR

Refrigerator, ENERGY STAR (v5.1),[14] with energy factor (EF) 19.9 replaces any lower-rated refrigerator, for both primary and secondary refrigerators.

Clothes Washer, ENERGY STAR

Clothes washer, ENERGY STAR (v8.1),[15] rated 123 kWh/year annual energy use replaces any lower-rated clothes washer.

Dishwasher, ENERGY STAR

Dishwasher, ENERGY STAR (v7.0)[16] rated 240 kWh/year annual energy use replaces any lower-rated dishwasher.

Clothes Dryer, Electric, ENERGY STAR

High-efficiency ENERGY STAR (v1.1)[17] electric clothes dryer, combined energy factor (CEF) 3.93, replaces any less-efficient electric clothes dryer.

Clothes Dryer, Electric, ENERGY STAR, Replaces Non-Electric Clothes Dryer

High-efficiency ENERGY STAR (v1.1)[17] electric clothes dryer, CEF 3.93, replaces any non-electric clothes dryer.

Clothes Dryer, Natural Gas, ENERGY STAR

High-efficiency ENERGY STAR (v1.1)[17] natural gas clothes dryer, CEF 3.48, replaces any less-efficient natural gas clothes dryer.

Range and Oven, Electric, Induction, Replaces Non-Electric Range and Oven

Induction range and electric oven replaces existing non-electric range and oven. The induction range and electric oven measure will use 9% less energy annually compared to a conventional resistance electric range and electric oven when all other characteristics are the same (e.g., same number of bedrooms and range/oven usage multiplier). This relationship is built in to ResStock and based on the RESNET standard.[18]

Range and Oven, Electric, Resistance, Replaces Non-Electric Range and Oven

Conventional electric resistance range and oven replaces existing non-electric range and oven.

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[14] ENERGY STAR v5.1 documentation for Consumer Refrigeration Products available at: https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Version%205.1%20Consumer%20Refrigeration%20Products%20Final%20Specification_0.pdf

[15] ENERGY STAR v8.1 documentation for Clothes Washers available at: https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Version%208.1%20Clothes%20Washer%20Final%20Specification%20-%20Partner%20Commitments%20and%20Eligibility%20Criteria.pdf

[16] ENERGY STAR v7 documentation for Residential Dishwashers available at: https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Version%207.0%20Residential%20Dishwasher%20Final%20Specification.pdf

[17] ENERGY STAR v1.1 documentation for Clothes Dryers available at: https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Final%20Version%201.1%20Clothes%20Dryers%20Specification%20-%20Program%20Commitment%20Criteria%20and%20Eligibility%20Criteria_0.pdf

[18] RESNET standard available at https://codes.iccsafe.org/content/RESNET3012019P1.

Pool Heaters, Electric, Replaces Natural Gas Pool Heaters

Electric resistance pool heater replaces existing natural gas pool heater.

Hot Tub Heaters, Electric, Replaces Natural Gas Spa Heaters

Electric resistance spa heater replaces existing natural gas spa heater.

Universal LED Lighting

LED lighting (90 lumens/Watt, or lm/W) replaces existing incandescent or compact fluorescent lamp (CFL) lighting. This measure replaces interior, exterior, and garage lighting.

These measures were grouped into the appliance, pool, and lighting measure packages as shown in Table 2.

Table 2. Appliance, Pool, and Lighting Measure Packages

Measure Package Number	Measure Package Name, Full	Measures Included
3.01	Appliances, ENERGY STAR	• Refrigerator, ENERGY STAR • Clothes Washer, ENERGY STAR • Dishwasher, ENERGY STAR • Clothes Dryer, Electric, ENERGY STAR • Clothes Dryer, Natural Gas, ENERGY STAR
3.02	Dryer, Electric, Replaces Non-Electric	• Clothes Dryer, Electric, ENERGY STAR, Replaces Non-Electric Dryer
3.03	Cooking, Electric, Induction, Replaces Non-Electric	• Induction Range and Oven, Replaces Non-Electric Range and Oven
3.04	Cooking, Electric, Conventional, Replaces Non-Electric	• Conventional Range and Oven, Replaces Non-Electric Range and Oven
3.05	Pool Heaters, Electric, Replaces Natural Gas	• Pool Heater, Electric
3.06	Spa Heaters, Electric, Replaces Natural Gas	• Spa Heater, Electric
3.07	Lighting, Universal LEDs	• Universal LED Lighting

The Appliances, ENERGY STAR measure package was also included in cross-system packages as described in Table 6 and Table 7.

5.1.3 Traditional Cooling and Heating

This dataset includes the following measures consisting of non-heat pump cooling and heating with efficiency levels above those in the replacement HVAC and water heating measures (see Section 5.1.4).

Room AC for Universal Cooling

Add room AC (12.0 energy efficiency ratio [EER]) for partial space conditioning to dwelling units without cooling and without ducts.

Partial conditioning levels were calculated from ResStock's distribution of baseline partial conditioning in dwelling units with room ACs, which in turn comes from RECS 2009 (EIA 2013) and correlated to dwelling units' floor area bins outlined below:

- 27% conditioned for dwelling units with floor areas of 4000+ ft^2
- 36% conditioned for dwelling units with floor areas between 2500 and 3999 ft^2
- 37% conditioned for dwelling units with floor areas between 1500 and 2499 ft^2
- 52 % conditioned for dwelling units with floor areas between 0 and 1499 ft^2

Central AC for Universal Cooling

Add central AC to dwelling units without cooling and with ducts,[19] efficiency level of 15 SEER (seasonal EER) for southern states[20] and 14 SEER for northern states.[21,22]

This approach was also used for dwelling units with shared HVAC systems, despite ResStock limitations with the HVAC duct specifications in dwelling units with shared systems for heating and/or cooling.

ENERGY STAR Room AC

Replacing less-efficient existing room ACs with ENERGY STAR (v5.0)[23] room ACs of EER 12.0, retaining portion of dwelling unit conditioned.

ENERGY STAR Central AC

Replaces less-efficient existing central ACs with ENERGY STAR (v6.1)[24] central ACs of SEER 15.2.

Heat Pump Water Heater (HPWH)

Replace less-efficient existing water heaters with a HPWH with a uniform energy factor (UEF) between 3.35 and 3.45, determined by the size of the water heater (50 gal, 66 gal, or 80 gal), which is determined in turn by the number of bedrooms in the dwelling unit.

Note that dwelling units in the baseline that have a water heating fuel designated as "Other Fuel" do not have their baseline water heater energy consumption included in this dataset. However, these dwelling units will receive a HPWH in this measure, meaning their water heater energy consumption will be included in the measure package results.

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[19] Standard ResStock practice is to model all central ACs as conditioning the entire heated living space. Room ACs are typically modeled as providing partial space conditioning.
[20] Southern states: CA, NV, AZ, NM, OK, TX, AR, LA, KY, TN, MS, AL, GA, FL, SC, NC, VA, DC, MD, DE
[21] Northern states: WA, OR, MT, ID, WY, UT, CO, NC, SD, NE, KS, MN, IA, MO, WI, IL, MI, IN, OH, WV, PA, NJ, NY, CT, RI, MA, VT, NH, ME
[22] Note that these values are slightly lower than the replacement level values in Section 5.1.4. These measures were run before the performance levels for Replacement Cooling were finalized.
[23] ENERGY STAR v5 documentation for Room Air Conditioners available at: https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Version%205.0%20Room%20Air%20Conditioners%20Specification%20and%20Partner%20Commitments.pdf
[24] ENERGY STAR v6.1 documentation for Central Air Conditioner and Heat Pump Equipment available at: https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Version%206.1%20CACHP%20Final%20Specification%20and%20Partner%20Commitments%20%28Rev.%20January%20%202022%29_0.pdf

96% AFUE Natural Gas Furnace

Replace existing furnaces with a 96% annual fuel utilization efficiency (AFUE) natural gas furnace for dwelling units with any existing natural gas usage and a lower-efficiency furnace using natural gas, propane, or fuel oil.

96% AFUE Natural Gas Boiler

Replace existing boiler with a 96% AFUE natural gas boiler for dwelling units with any existing natural gas (NG) usage and a lower-efficiency boiler using natural gas, propane, or fuel oil.

These measures were grouped into the traditional HVAC measure packages as shown in Table 3.

Table 3. Traditional HVAC Measure Packages

Measure Package Number	Measure Package Name, Full	Measures Included
4.01	Cooling, for All Homes Without Cooling	• Room AC for Universal Cooling • Central AC for Universal Cooling
4.02	Cooling, ENERGY STAR Room AC	• EER 12.0 Room AC
4.03	Cooling, ENERGY STAR Central AC	• SEER 15.2 Central AC
4.04	Water Heating, HPWH for All	• HPWH
4.05	Furnace, 96% AFUE NG, Replaces NG Furnace	• 96% AFUE Natural Gas Furnace
4.06	Furnace, 96% AFUE NG, Replaces Propane Furnace if NG Available	• 96% AFUE Natural Gas Furnace
4.07	Furnace, 96% AFUE NG, Replaces Fuel Oil Furnace if NG Available	• 96% AFUE Natural Gas Furnace
4.08	Boiler, 96% AFUE NG, Replaces NG Boiler	• 96% AFUE Natural Gas Boiler
4.09	Boiler, 96% AFUE NG, Replaces Propane Boiler if NG Available	• 96% AFUE Natural Gas Boiler
4.10	Boiler, 96% AFUE NG, Replaces Fuel Oil Boiler if NG Available	• 96% AFUE Natural Gas Boiler

5.1.4 Replacement HVAC and Water Heating

This category of measure packages represents replacing existing cooling, heating, and water heating with the minimum-performing replacement available, as may typically be done at equipment end of life or failure. The performance levels modeled are meant to approximately represent the lowest-performing options available within federal standards. These measure packages can be used to calculate energy, emissions, and energy bill impacts of other measures "at end of life" or "at intended replacement" by comparing the results of two measure packages, rather than a measure package versus baseline.

84% AFUE Natural Gas Boiler

Replace existing boiler with an 84% AFUE natural gas boiler for dwelling units with a lower-efficiency boiler using natural gas.

86% AFUE Fuel Oil Boiler

Replace existing boiler with an 86% AFUE fuel oil boiler for dwelling units with a lower-efficiency boiler using fuel oil.

80% AFUE Natural Gas Furnace

Replace existing furnace with an 80% AFUE natural gas furnace for dwelling units with a lower-efficiency furnace using natural gas.

83% AFUE Fuel Oil Furnace

Replace existing furnace with an 83% AFUE fuel oil furnace for dwelling units with a lower-efficiency furnace using fuel oil.

80% AFUE Propane Furnace

Replace existing furnace with an 80% AFUE propane furnace for dwelling units with a lower-efficiency furnace using propane.

Ducted ASHP SEER 15.05, 8.82 HSPF

Replace existing ducted ASHP with a SEER 15.05, 8.82 HSPF ducted ASHP for dwelling units with a lower-efficiency HSPF (for replacement heating) or SEER (for replacement cooling)

Non-Ducted MSHP SEER 14.5, 8.33 HSPF

Replace existing non-ducted MSHP with a SEER 14.5, 8.33 HSPF non-ducted MSHP for dwelling units with a lower-efficiency HSPF (for replacement heating) or SEER (for replacement cooling). Note: the federal minimum SEER rating for a non-ducted heat pump is 14.3. ResStock's baseline building stock does not have any dwellings with MSHPs with a SEER lower than 14.5.

Central AC, SEER 15.05 for Southern States

Replace existing central AC with a SEER 15.05 central AC for dwelling units with a lower-efficiency SEER and within the southern region for federal minimum standards.[25]

Central AC, SEER 14.11 for Northern States

Replace existing central AC with a SEER 14.11 central AC for dwelling units with a lower-efficiency SEER and within the northern region for federal minimum standards.[26]

Room AC, EER 10.9

Replace existing room AC with an EER 10.9 room AC for dwelling units with a lower-efficiency EER.

Electric Storage Water Heater, 0.9307 UEF

Replace existing electric storage water heater with a 0.9307 UEF electric storage tank for dwelling units with a lower-efficiency UEF and 1–3 bedrooms. Note: volume is determined by a sizing algorithm within ResStock.

[25] Southern states: CA, NV, AZ, NM, OK, TX, AR, LA, KY, TN, MS, AL, GA, FL, SC, NC, VA, DC, MD, DE
[26] Northern states: WA, OR, MT, ID, WY, UT, CO, NC, SD, NE, KS, MN, IA, MO, WI, IL, MI, IN, OH, WV, PA, NJ, NY, CT, RI, MA, VT, NH, ME

Electric Heat Pump Water Heater, 66 gallons, 3.35 UEF

Replace existing non-tankless electric water heater with a 3.35 UEF 66 gallon electric heat pump water heater for dwelling units with a lower-efficiency UEF and 4 bedrooms.

Electric Heat Pump Water Heater, 80 gallons, 3.45 UEF

Replace existing non-tankless electric water heater with a 3.45 UEF 80 gallon electric heat pump water heater for dwelling units with a lower-efficiency UEF and 5 bedrooms.

Natural Gas Storage Water Heater, 0.6483 UEF

Replace existing natural gas storage water heater with a 0.6583 UEF natural gas storage tank for dwelling units with a lower-efficiency UEF. Note: volume is determined by a sizing algorithm within ResStock.

Fuel Oil Storage Water Heater, 0.6078 UEF

Replace existing fuel oil storage water heater with a 0.6078 UEF fuel oil storage tank for dwelling units with a lower-efficiency UEF. Note: volume is determined by a sizing algorithm within ResStock.

These measures were grouped into the minimum HVAC and water heating measure packages as shown in Table 4.

Table 4. Minimum HVAC and Water Heating Measure Packages

Measure Package Number	Measure Package Name, Full	Measures Included
1.01	Heating, Replacement	• 84% AFUE Natural Gas Boiler • 86% AFUE Fuel Oil Boiler • 80% AFUE Natural Gas Furnace • 83% AFUE Fuel Oil Furnace • 80% AFUE Propane Furnace • Ducted ASHP SEER 15.05, 8.82 HSPF • Non-Ducted MSHP SEER 14.5, 8.33 HSPF
1.02	Cooling, Replacement	• Central AC, SEER 15.05 for Southern States • Central AC, SEER 14.11 for Northern States • Room AC, EER 10.9 • Ducted ASHP SEER 15.05, 8.82 HSPF • Non-Ducted MSHP SEER 14.5, 8.33 HSPF
1.03	Heating & Cooling, Replacement	• 84% AFUE Natural Gas Boiler • 86% AFUE Fuel Oil Boiler • 80% AFUE Natural Gas Furnace • 83% AFUE Fuel Oil Furnace • 80% AFUE Propane Furnace • Ducted ASHP SEER 15.05, 8.82 HSPF • Non-Ducted MSHP SEER 14.5, 8.33 HSPF • Central AC, SEER 15.05 for Southern States • Central AC, SEER 14.11 for Northern States • Room AC, EER 10.9
1.04	Water Heating, Replacement	• Electric Storage Water Heater, 0.9307 UEF • Electric Heat Pump Water Heater, 66 Gallons, 3.35 UEF • Electric Heat Pump Water Heater, 80 Gallons, 3.45 UEF • Natural Gas Storage Water Heater, 0.6483 UEF • Fuel Oil Storage Water Heater, 0.6078 UEF
1.05	Heating, Cooling, & Water Heating, Replacement	• 84% AFUE Natural Gas Boiler • 86% AFUE Fuel Oil Boiler • 80% AFUE Natural Gas Furnace • 83% AFUE Fuel Oil Furnace • 80% AFUE Propane Furnace • Ducted ASHP SEER 15.05, 8.82 HSPF • Non-Ducted MSHP SEER 14.5, 8.33 HSPF • Central AC, SEER 15.05 for Southern States • Central AC, SEER 14.11 for Northern States • Room AC, EER 10.9 • Electric Storage Water Heater, 0.9307 UEF • Electric Heat Pump Water Heater, 66 Gallons, 3.35 UEF • Electric Heat Pump Water Heater, 80 Gallons, 3.45 UEF • Natural Gas Storage Water Heater, 0.6483 UEF • Fuel Oil Storage Water Heater, 0.6078 UEF

5.1.5 Heat Pumps

Heat pumps in the 2024.1 dataset[27] span three different efficiency levels, two different backup heating methods, and vary for dwelling units with ducts and without ducts. Table 5 describes each of these heat pump model configurations, complete with compressor speed and capacity retention information. ENERGY STAR refers to v6.1.[28] Dwelling units that receive variable speed heat pumps have setpoint offsets removed. Because of ResStock limitations with the HVAC duct specifications in dwelling units that share their HVAC systems with other dwelling units for heating and/or cooling, this dataset does not include heat pump measures for such systems. For important information on how these heat pumps are modeled, see Section 5.1.6, Notes on Heat Pump Modeling. For measure package numbers for specific modeled heat pump measure packages, see Table 6.

[27] Excluding replacement level heat pumps described in section 5.1.4

[28] Documentation for v6.1 for Central Air Conditioner and Heat Pump Equipment available at: https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Version%206.1%20CACHP%20Final%20Specification%20and%20Partner%20Commitments%20%28Rev.%20January%20%202022%29.pdf

Table 5. The Twelve Heat Pump Configurations Included in this Dataset[29]

Heat Pump	Type	SEER	HSPF	Capacity Retention at 5°F	Existing HVAC Ducts?	Backup Heat Type	Sized Using	Compressor Speed
ENERGY STAR	Ducted ASHP[30]	16	9.2	40%	Yes	Electric	ACCA S/J	Single speed
ENERGY STAR	Ductless MSHP	16	9.2	40%	No	Electric	Max load	Variable speed
ENERGY STAR	Ducted ASHP	16	9.2	40%	Yes	Existing	ACCA S/J	Single speed
ENERGY STAR	Ductless MSHP	16	9.2	40%	No	Existing	Max load	Variable speed
ENERGY STAR cc	Ducted ASHP	16	9.5	70%	Yes	Electric	Max load	Variable speed
ENERGY STAR cc	Ductless MSHP	16	9.5	70%	No	Electric	Max load	Variable speed
ENERGY STAR cc	Ducted ASHP	16	9.5	70%	Yes	Existing	ACCA S/J	Variable speed
ENERGY STAR cc	Ductless MSHP	16	9.5	70%	No	Existing	Max load	Variable speed
Higher Efficiency	Ducted ASHP	20	11	90%	Yes	Electric	Max load	Variable speed
Higher Efficiency	Ductless MSHP	20	11	90%	No	Electric	Max load	Variable speed
Higher Efficiency	Ducted ASHP	20	11	90%	Yes	Existing	Max load	Variable speed
Higher Efficiency	Ductless MSHP	20	11	90%	No	Existing	Max load	Variable speed

5.1.6 Notes on Heat Pump Modeling

Heat pumps are included in many measure packages in this dataset. All modeled heat pumps have supplemental backup heating available. For some measure packages, this supplemental backup heating is electric resistance and for others the existing fuel-fired system is retained as the backup heating source. For heat pumps with the existing fuel-fired system retained as backup, the heat pump compressor will be locked out below 5°F and the backup system will be locked out above 40°F. Below 5°F, the backup system will be solely responsible for meeting the dwelling unit's setpoint. Above 40°F, the heat pump system will be solely responsible for meeting the dwelling unit's setpoint. The backup system will turn on when the heat pump cannot meet the full heating load and the outdoor temperature is between 5°F and 40°F.

Each heat pump efficiency level included in the dataset—referred to as ENERGY STAR, ENERGY STAR Cold Climate (cc), and Higher Efficiency—has a specific capacity retention fraction as shown in Table 5. The capacity retention fraction is the percentage of the rated size of the heat pump that can be utilized at an outdoor ambient temperature of 5°F. When modeling heat pumps, we specify the HSPF and capacity retention at the beginning of the simulation. Because these two variables are fixed at the beginning of the simulation, there is an inverse

[29] Excluding replacement level heat pumps described in Section 5.1.4.
[30] Note that throughout this documentation, "ASHP" refers to a central, ducted air-source heat pump, as opposed to a minisplit. All heat pumps in the analysis are air-source heat pumps as opposed to ground- or water-source.

relationship between capacity retention fraction and the coefficient of performance (COP). Therefore, the modeled heat pumps with higher capacity retention fractions will have a lower COP at cold temperatures than the ENERGY STAR heat pumps. The key tradeoff is that higher capacity retention fractions lower the necessary size for heat pumps in cold climates.

The key specifications used for each heat pump modeled in this dataset are shown in Table 6. The size of the heat pump is calculated using either ACCA Manuals J and S,[31] or the maximum load between the design cooling and heating load of the dwelling unit (i.e., "Max Load"). ACCA Manual S primarily sizes heat pumps using the cooling load, with allowed oversizing factors. For higher heating loads, a 15% oversizing allowance applies when the heat pump is single-stage (e.g., the ENERGY STAR Ducted ASHP with electric or existing fuel-fired backup). A +1 ton allowance applies if in a cold, dry climate. A 30% oversizing allowance applies to variable speed heat pumps (e.g., the ENERGY STAR cc Ducted ASHP with existing fuel-fired backup modeled for this dataset).

Because the heat pumps in this dataset's measure packages represent retrofits to existing dwelling units, there is a limitation in our modeling methodology surrounding duct size. In reality, duct sizes will not change when a heat pump retrofit is installed unless the owner also replaces their ducts. In ResStock, this interaction between duct size and maximum airflow rate is not accounted for, and ducts will be resized to meet the heat pump's requirements automatically.

For heat pumps utilizing the existing system as backup, it is possible that an actual heat pump retrofit would utilize the existing fuel-fired system's fan to distribute conditioned air if it is a single or two speed heat pump. In our results, it is instead assumed that the system's fan to distribute conditioned air is newly sized with the heat pump.

The heating and cooling efficiency ratings for this dataset's heat pumps are in SEER and HSPF. Section 5.1.7 provides references for converting SEER and HSPF to SEER2 and HSPF2, respectively.

5.1.7 ResStock's Usage of Legacy Efficiency Ratings

ResStock's default inputs for HVAC equipment utilize several legacy metrics for non-fossil fuel efficiency ratings: SEER, HSPF, and EER. Newer metrics have been developed—SEER2, HSPF2, and CEER (combined energy efficiency ratio). These newer metrics are how current HVAC equipment is rated and how efficiency standards are set.

Because ResStock still uses the older metrics, HVAC measure package efficiency levels in this report are detailed in SEER, HSPF, and EER. The ResStock team used the following conversion information for making comparisons between this report's non-fossil fuel HVAC efficiency ratings and the newer metrics of SEER2, HSPF2, and CEER:

- Ductless heat pump systems
    - SEER2/SEER = 1.00
    - HSPF2/HSPF = 0.90

[31] We used the 2016 version of Manual J (8th edition) and the 2014 version of Manual S (2nd edition).

- Ducted heat pump systems[32] and central air conditioners
  - SEER2/SEER = 0.95
  - HSPF2/HSPF = 0.85
- Window air conditioners[33]
  - CEER = EER/1.01

5.2 Measure Package Combinations

5.2.1 Measure Packages with Heat Pumps for Space Heating

This dataset includes results for every heat pump shown in Table 5 modeled as a stand-alone retrofit, for every combination of ducted vs. ductless HVAC and baseline heating fuel, as well as in combination with the three envelope measure packages. It also includes certain heat pump configurations modeled together with HPWHs and HPWHs and envelope together. Table 6 serves as a guide to all measure packages in this dataset that include heat pumps for space heating. The first three columns of the table can be used to match up the heat pump modeled with the modeling details in Table 5.

[32] Adapted from the "ducted split system" in https://www.resnet.us/wp-content/uploads/FS_Adndm71fSEER2_webpost.pdf

[33] See: https://github.com/NREL/OpenStudio-HPXML/blob/master/HPXMLtoOpenStudio/resources/hvac.rb#L2740-L2743 and http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BB6A57FC0-6376-4401-92BD-D66EC1930DCF%7D

Table 6. Measure Packages That Include Heat Pumps for Space Heating, by Measure Package Number

Heat Pump	Type	Backup Heat Type	Existing Heating Fuel	Stand Alone	+ Envelope, Light Touch	+ Envelope, Intermediate	+ Envelope, Advanced	+ HPWH	+ HPWH + Envelope, Light Touch
				Measure Package Number					
ENERGY STAR	Ducted ASHP	Electric	Electricity	5.01	7.01	8.01	9.01		15.01
ENERGY STAR	Ductless MSHP	Electric	Electricity	5.13	7.13	8.13	9.13		15.05
ENERGY STAR cc	Ducted ASHP	Electric	Electricity	5.05	7.05	8.05	9.05	13.01	15.09
ENERGY STAR cc	Ductless MSHP	Electric	Electricity	5.17	7.17	8.17	9.17	13.05	15.13
Higher Efficiency	Ducted ASHP	Electric	Electricity	5.09	7.09	8.09	9.09		
Higher Efficiency	Ductless MSHP	Electric	Electricity	5.21	7.21	8.21	9.21		
ENERGY STAR	Ducted ASHP	Electric	Natural Gas	5.02	7.02	8.02	9.02		15.03
ENERGY STAR	Ductless MSHP	Electric	Natural Gas	5.14	7.14	8.14	9.14		15.07
ENERGY STAR	Ducted ASHP	Existing	Natural Gas	6.01	10.01	11.01	12.01		15.17
ENERGY STAR	Ductless MSHP	Existing	Natural Gas	6.10	10.10	11.10	12.10		15.20
ENERGY STAR cc	Ducted ASHP	Electric	Natural Gas	5.06	7.06	8.06	9.06	13.02	15.11
ENERGY STAR cc	Ductless MSHP	Electric	Natural Gas	5.18	7.18	8.18	9.18	13.06	15.15
ENERGY STAR cc	Ducted ASHP	Existing	Natural Gas	6.04	10.04	11.04	12.04	13.09	15.23
ENERGY STAR cc	Ductless MSHP	Existing	Natural Gas	6.13	10.13	11.13	12.13	13.12	15.26
Higher Efficiency	Ducted ASHP	Electric	Natural Gas	5.10	7.10	8.10	9.10		
Higher Efficiency	Ductless MSHP	Electric	Natural Gas	5.22	7.22	8.22	9.22		

Heat Pump	Type	Backup Heat Type	Existing Heating Fuel	Stand Alone	+ Envelope, Light Touch	+ Envelope, Intermediate	+ Envelope, Advanced	+ HPWH	+ HPWH + Envelope, Light Touch
Higher Efficiency	Ducted ASHP	Existing	Natural Gas	6.07	10.07	11.07	12.07		
Higher Efficiency	Ductless MSHP	Existing	Natural Gas	6.15	10.15	11.15	12.15		
ENERGY STAR	Ducted ASHP	Electric	Propane	5.03	7.03	8.03	9.03		15.02
ENERGY STAR	Ductless MSHP	Electric	Propane	5.15	7.15	8.15	9.15		15.06
ENERGY STAR	Ducted ASHP	Existing	Propane	6.02	10.02	11.02	12.02		15.18
ENERGY STAR	Ductless MSHP	Existing	Propane	6.11	10.11	11.11	12.11		15.21
ENERGY STAR cc	Ducted ASHP	Electric	Propane	5.07	7.07	8.07	9.07	13.03	15.10
ENERGY STAR cc	Ductless MSHP	Electric	Propane	5.19	7.19	8.19	9.19	13.07	15.14
ENERGY STAR cc	Ducted ASHP	Existing	Propane	6.05	10.05	11.05	12.05	13.10	15.24
ENERGY STAR cc	Ductless MSHP	Existing	Propane	6.14	10.14	11.14	12.14	13.13	15.27
Higher Efficiency	Ducted ASHP	Electric	Propane	5.11	7.11	8.11	9.11		
Higher Efficiency	Ductless MSHP	Electric	Propane	5.23	7.23	8.23	9.23		
Higher Efficiency	Ducted ASHP	Existing	Propane	6.08	10.08	11.08	12.08		
Higher Efficiency	Ductless MSHP	Existing	Propane	6.17	10.17	11.17	12.17		
ENERGY STAR	Ducted ASHP	Electric	Fuel Oil	5.04	7.04	8.04	9.04		15.04
ENERGY STAR	Ductless MSHP	Electric	Fuel Oil	5.16	7.16	8.16	9.16		15.08
ENERGY STAR	Ducted ASHP	Existing	Fuel Oil	6.03	10.03	11.03	12.03		15.19

Heat Pump	Type	Backup Heat Type	Existing Heating Fuel	Stand Alone	+ Envelope, Light Touch	+ Envelope, Intermediate	+ Envelope, Advanced	+ HPWH	+ HPWH + Envelope, Light Touch
ENERGY STAR	Ductless MSHP	Existing	Fuel Oil	6.12	10.12	11.12	12.12		15.22
ENERGY STAR cc	Ducted ASHP	Electric	Fuel Oil	5.08	7.08	8.08	9.08	13.04	15.12
ENERGY STAR cc	Ductless MSHP	Electric	Fuel Oil	5.20	7.20	8.20	9.20	13.08	15.16
ENERGY STAR cc	Ducted ASHP	Existing	Fuel Oil	6.06	10.06	11.06	12.06	13.11	15.25
ENERGY STAR cc	Ductless MSHP	Existing	Fuel Oil	6.14	10.14	11.14	12.14	13.14	15.28
Higher Efficiency	Ducted ASHP	Electric	Fuel Oil	5.12	7.12	8.12	9.12		
Higher Efficiency	Ductless MSHP	Electric	Fuel Oil	5.24	7.24	8.24	9.24		
Higher Efficiency	Ducted ASHP	Existing	Fuel Oil	6.09	10.09	11.09	12.09		
Higher Efficiency	Ductless MSHP	Existing	Fuel Oil	6.18	10.18	11.18	12.18		

5.2.2 Measure Packages Without Heat Pumps for Space Heating

This dataset also includes measure packages that do not include heat pumps for space heating, as shown in Table 7.

Table 7. Measure Packages That Do Not Include Heat Pumps for Space Heating

Measure Package Number	HVAC	Water Heating	Envelope	Existing Heating Fuel[34]
13.15		HPWH	Light Touch	Any
13.16		HPWH	Intermediate	Any
13.17		HPWH	Advanced	Any
13.18	96% AFUE NG Furnace	HPWH		Any
13.19	96% AFUE NG Boiler	HPWH		Any
14.01	96% AFUE NG Furnace		Light Touch	Natural Gas
14.02	96% AFUE NG Furnace		Light Touch	Propane
14.03	96% AFUE NG Furnace		Light Touch	Fuel Oil
14.04	96% AFUE NG Boiler		Light Touch	Natural Gas
14.05	96% AFUE NG Boiler		Light Touch	Propane
14.06	96% AFUE NG Boiler		Light Touch	Fuel Oil
14.07	96% AFUE NG Furnace		Intermediate	Natural Gas
14.08	96% AFUE NG Furnace		Intermediate	Propane
14.09	96% AFUE NG Furnace		Intermediate	Fuel Oil
14.10	96% AFUE NG Boiler		Intermediate	Natural Gas
14.11	96% AFUE NG Boiler		Intermediate	Propane
14.12	96% AFUE NG Boiler		Intermediate	Fuel Oil
14.13	96% AFUE NG Furnace		Advanced	Natural Gas
14.14	96% AFUE NG Furnace		Advanced	Propane
14.15	96% AFUE NG Furnace		Advanced	Fuel Oil
14.16	96% AFUE NG Boiler		Advanced	Natural Gas
14.17	96% AFUE NG Boiler		Advanced	Propane
14.18	96% AFUE NG Boiler		Advanced	Fuel Oil

[34] Packages that include natural gas furnaces or natural gas boilers are only applicable to dwelling units with nonzero natural gas consumption in the baseline.

5.3 Details of Each Measure Package

Measure Category 1: Replacement Heating, Cooling, and Water Heating Systems

Measure Package 1.01: Heating, Replacement

Summary

- Meant to generally represent the minimum level that is compliant with federal standards for various heating systems.

Technical Description

- Boilers, applies to dwelling units with less-efficient systems of same fuel type:
  - Gas-fired: 84% AFUE
  - Oil-fired: 86% AFUE
- Furnaces, applies to dwelling units with less-efficient systems of same fuel type:
  - Gas-fired:80% AFUE
  - Oil-fired: 83% AFUE
  - Propane-fired: 80% AFUE
- Heat Pump, applies to dwelling units with less-efficient heat pump systems:
  - ASHPs: 15.05 SEER, 8.82 HSPF
  - MSHPs: 14.5 SEER, 8.33 HSPF

Measure Package 1.02: Cooling, Replacement

Summary

- Meant to generally represent the minimum level that is compliant with federal standards for various cooling systems.

Technical Description

- Central AC systems, applies to dwelling units with less-efficient central AC systems:
  - U.S. South[35]: 15.05 SEER
  - U.S. North[36]: 14.11 SEER
- Room AC systems, applies to dwelling units with less-efficient room AC systems:
  - 10.9 EER
- Heat Pump, applies to dwelling units with less-efficient heat pump systems:
  - ASHPs: 15.05 SEER, 8.82 HSPF
  - MSHPs: 14.5 SEER, 8.33 HSPF

Measure Package 1.03: Heating & Cooling, Replacement

Summary

- Meant to generally represent the minimum level that is compliant with federal standards for various cooling and heating systems.

Technical Description

- Central AC systems, applies to dwelling units with less-efficient central AC systems:

[35] South states: CA, NV, AZ, NM, OK, TX, AR, LA, KY, TN, MS, AL, GA, FL, SC, NC, VA, MD, DC, DE, HI
[36] North states: WA, OR, ID, MT, WY, UT, CO, ND, SD, NE, KS, MO, IA, MN, WI, IL, IN, MI, OH, WV, PA, NJ, NY, CT, RI, MA, VT, NH, ME, AK
source: https://www.eia.gov/todayinenergy/detail.php?id=40232

    - U.S. South: 15.05 SEER
    - U.S. North: 14.11 SEER
- Room AC systems, applies to dwelling units with less-efficient room AC systems:
    - 10.9 EER
- Boilers, applies to dwelling units with less-efficient systems of same fuel type:
    - Gas-fired: 84% AFUE
    - Oil-fired: 86% AFUE
- Furnaces, applies to dwelling units with less-efficient systems of same fuel type:
    - Gas-fired:80% AFUE
    - Oil-fired: 83% AFUE
    - Propane-fired: 80% AFUE
- Heat Pump, applies to dwelling units with less-efficient heat pump systems:
    - ASHPs: 15.05 SEER, 8.82 HSPF
    - MSHPs: 14.5 SEER, 8.33 HSPF

Measure Package 1.04: Water Heating, Replacement

Summary

– Meant to generally represent the minimum level that is compliant with federal standards for various water heating systems.

Technical Description

- Electric, applies to water heaters with less efficiency of the same volume type:
    - 1-3 bedrooms: UEF = 0.9307; electric storage tank
    - 4 bedrooms: UEF = 3.35, 66 gallon HPWH
    - 5 bedrooms: UEF = 3.45 80 gallon HPWH
- Gas Storage, applies to water heaters with less efficiency of the same type:
    - UEF = 0.6483
- Oil Storage, applies to water heaters with less efficiency of the same type:
    - UEF = 0.6078

Measure Package 1.05: Heating, Cooling, & Water Heating, Replacement

Summary

– Meant to generally represent the minimum level that is compliant with federal standards for various cooling, heating, and water heating systems.

Technical Description

- Water Heating:
    - Electric, applies to water heaters with less efficiency of the same volume type:
        - 1-3 bedrooms: UEF = 0.9307; electric storage tank
        - 4 bedrooms: UEF = 3.35, 66 gallon HPWH
        - 5 bedrooms: UEF = 3.45 80 gallon HPWH
    - Gas Storage, applies to water heaters with less efficiency of the same type:
        - UEF = 0.6483
    - Oil Storage, applies to water heaters with less efficiency of the same type:
        - UEF = 0.6078
- Heating and Cooling Systems:

- Central AC systems, applies to dwelling units with less-efficient central AC systems:
  - U.S. South: 15.05 SEER
  - U.S. North: 14.11 SEER
- Room AC systems, applies to dwelling units with less-efficient room AC systems:
  - 10.9 EER
- Boilers, applies to dwelling units with less-efficient systems of same fuel type:
  - Gas-fired: 84% AFUE
  - Oil-fired: 86% AFUE
- Furnaces, applies to dwelling units with less-efficient systems of same fuel type:
  - Gas-fired:80% AFUE
  - Oil-fired: 83% AFUE
  - Propane-fired: 80% AFUE
- Heat Pump, applies to dwelling units with less-efficient heat pump systems:
  - ASHPs: 15.05 SEER, 8.82 HSPF
  - MSHPs: 14.5 SEER, 8.33 HSPF

Measure Category 2: Envelopes

Measure Package 2.01: Windows, Thin Triple

Summary

– Replace existing windows with thin triple windows for any less-efficient windows.

Technical Description

- Infiltration reduction, applies only to dwelling units with a window upgrade and constructed before 2000:
  - 30% whole-home reduction in ACH50
    - Applies to dwelling units with single paned windows
  - 15% whole-home reduction in ACH50
    - Applies to dwelling units with double paned windows
- Windows
  - Triple, Thin, Northern
    - Applies to ENERGY STAR Northern climate zone
    - Applies to dwelling units with window U-Factor more than 0.20
    - U-factor: 0.19
    - SHGC: 0.41
  - Triple, Thin, North-Central
    - Applies to ENERGY STAR North-Central climate zone
    - Applies to dwelling units with window U-Factor more than 0.20
    - U-factor: 0.19
    - SHGC: 0.41
  - Triple, Thin, South-Central
    - Applies to ENERGY STAR South-Central climate zone
    - Applies to dwelling units with window U-Factor more than 0.20
    - U-factor: 0.18
    - SHGC: 0.18
  - Triple, Thin, Southern

        - Applies to ENERGY STAR Southern climate zone
        - Applies to dwelling units with window U-Factor more than 0.20
        - U-factor: 0.18
        - SHGC: 0.18

Measure Package 2.02: Windows, ENERGY STAR

Summary

– Replace existing windows with ENERGY STAR windows for any less-efficient windows.

Technical Description

- Infiltration reduction, applies only to dwelling units with a windows upgrade and constructed before 2000:
    - 30% whole-home reduction in ACH50
        - Applies to dwelling units with single paned windows
    - 15% whole-home reduction in ACH50
        - Applies to dwelling units with double paned windows
- Windows
    - ENERGY STAR, Northern
        - Applies to ENERGY STAR Northern climate zone
        - Applies to dwelling units with window U-Factor more than 0.22
        - U-factor: 0.22
        - SHGC: 0.40
    - ENERGY STAR, North-Central
        - Applies to ENERGY STAR North-Central climate zone
        - Applies to dwelling units with window U-Factor more than 0.25
        - U-factor: 0.25
        - SHGC: 0.40
    - ENERGY STAR, South-Central
        - Applies to ENERGY STAR South-Central climate zone
        - Applies to dwelling units with window U-Factor more than 0.28
        - U-factor: 0.28
        - SHGC 0.23
    - ENERGY STAR, Southern
        - Applies to ENERGY STAR Southern climate zone
        - Applies to dwelling units with window U-Factor more than 0.32
        - U-factor: 0.32
        - SHGC: 0.23

Measure Package 2.03: Envelope, Light Touch

Summary

– Attic floor insulation up to IECC-Residential 2021 levels (using IECC 2004 climate zones) for dwelling units with vented attics and lower-performing insulation

– General air sealing: 30% total reduction in ACH50 for dwelling units with greater than 10 ACH50.

Technical Description

- Attic floor insulation, applies only to dwelling units with vented attics
  - R-30
    - Applies to IECC 2004 CZ 1A
    - Applies to dwelling units without insulation or with insulation less than R-30
  - R-49
    - Applies to IECC 2004 CZ 2A, 2B, 3A, 3B, 3C
    - Applies to dwelling units without insulation or with insulation less than R-49
  - R-60
    - Applies to IECC 2004 CZ 4A, 4B, 4C, 5A, 5B, 6A, 6B, 7A, 7B
    - Applies to dwelling units without insulation or with insulation less than R-60
- Air leakage reduction
  - 30% whole-home reduction in ACH50
    - Applies to all dwelling units with greater than 10 ACH50 infiltration.

Measure Package 2.04: Envelope, Intermediate

Summary

- Everything in Measure Package 2.03
- Duct sealing to 10% leakage, R-8 insulation
- Drill-and-fill insulation (R-13) for dwelling units with no insulation and wood stud walls
- Add R-10 interior insulation to foundation walls and rim joists in conditioned basements and crawlspaces; seal crawlspace vents.

Technical Description

- Duct sealing
  - 10% Leakage, R-8
    - Applies to all dwelling units with leakier and/or less-insulated ducts located in unconditioned space
- Drill-and-fill wall insulation
  - R-13 insulation with wood stud walls
    - Applies to dwelling units with uninsulated wood stud walls
- Foundation wall insulation and rim joist insulation
  - R-10 interior insulation for foundation walls
    - Applies to dwelling units without foundation wall insulation
  - R-10 exterior insulation for rim joists
    - Applies to dwelling units with unvented crawlspaces, vented crawlspaces, or heated basements
- Seal vented crawlspaces
    - Applies to single-family detached, single-family attached, and bottom-floor multifamily dwelling units with a foundation type of vented crawlspace.

Measure Package 2.05: Envelope, Advanced

Summary

- Everything in Measure Package 2.02 *except* for infiltration reduction
- Everything in Measure Package 2.04 *except* for general air sealing
- 1” exterior insulation XPS (R-5/in) for wall insulation of less than R-19
- Insulate finished attics and cathedral ceilings to R-30

- Air seal to IECC 2021 requirements (applied using IECC 2004 climate zones)
- ERV ventilation for climate zones 4A, 4B, 4C, 5A, 5B, 6A, 6B, 7A, and 7B
- Exhaust ventilation for climate zones 1A, 2A, 2B, 3A, 3B, and 3C.

Technical Description

- Measure Package 2.02 except for infiltration reduction
- Measure Package 2.04 except for general air sealing
- Insulation sheathing
  - R-5
    - Applies to dwelling units with wall insulation of less than R-19
- Insulate finished attics and cathedral ceilings
  - R-30 roof assembly insulation
    - Applies to single-family detached, single-family attached, and top-level multifamily dwelling units
    - Applies to dwelling units without roof insulation or with roof insulation less than R-30
    - Applies to dwelling units with finished attics or cathedral ceilings
- Air leakage
  - 3 ACH50
    - Applies to all dwelling units with infiltration higher than 3 ACH50 and are located in IECC 2004 climate zones 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 6A, 6B, 7A, and 7B
  - 5 ACH50
    - Applies to all dwelling units with infiltration higher than 5 ACH50 and are located in IECC 2004 climate zones 1A, 2A, and 2B
- Mechanical ventilation
  - ERV, 72%
    - Applies to all dwelling units with no mechanical ventilation and infiltration above 3 ACH50
    - Applies to IECC 2004 climate zones 4A, 4B, 4C, 5A, 5B, 6A, 6B, 7A, and 7B
  - Exhaust
    - Applies to all dwelling units with no mechanical ventilation
    - Applies to IECC 2004 climate zones 1A, 2A, 2B and infiltration above 5 ACH50
    - Applies to IECC 2004 climate zones 3A, 3B, and 3C and infiltration above 3 ACH50

Measure Category 3: Appliances, Pools and Spas, and Lighting

Measure Package 3.01: Appliances, ENERGY STAR

Summary

- Replace refrigerators, clothes washers, dishwashers, and clothes dryers with ENERGY STAR appliances for any less-efficient appliances while maintaining existing fuel type.

Technical Description

- Refrigerator

    - EF 19.9
        - Applies to dwelling units with refrigerator less than EF 19.9
- Extra refrigerator
    - EF 19.9
        - Applies to dwelling units with extra refrigerator less than EF 19.9
- Clothes washer
    - ENERGY STAR; Integrated Modified Energy Factor (IMEF) = 2.07; 123 kWh/yr rated performance
        - Applies to dwelling units with lower-rated clothes washer
- Dishwasher
    - 240 kWh/yr rated performance
        - Applies to dwelling units with dishwasher whose rating is above 240 kWh/yr
- Clothes dryer
    - Electric, ENERGY STAR; CEF = 3.93
        - Applies to dwelling units with electric clothes dryer[37]
    - Natural gas, ENERGY STAR; CEF = 3.48
        - Applies to dwelling units with gas clothes dryer.

Measure Package 3.02: Dryer, Electric, Replaces Non-Electric

Summary

– Replace existing non-electric dryer with ENERGY STAR electric dryer

Technical Description

- Clothes dryer
    - Electric, ENERGY STAR; CEF = 3.93
        - Applies to dwelling units with gas or propane dryer.

Measure Package 3.03: Cooking, Electric, Induction, Replaces Non-Electric

Summary

– Replace existing non-electric range and oven with electric induction range and oven.

Technical Description

- Cooking range
    - Electric, Induction
        - Applies to dwelling units with a gas or propane cooking range.

Measure Package 3.04: Cooking, Electric, Conventional, Replaces Non-Electric

Summary

– Replace existing non-electric range and oven with conventional electric resistance range and oven.

Technical Description

- Cooking range
    - Electric, Conventional Induction
        - Applies to dwelling units with a gas or propane cooking range.

[37] All clothes dryers in the baseline models are lower-performing than their respective option in this measure package

Measure Package 3.05: Pool Heaters, Electric, Replaces Natural Gas

Summary

– Replace existing natural gas pool heater with an electric resistance pool heater.

Technical Description

- Pool heater
  - Electric, resistance
    - Applies to dwelling units with a natural gas pool heater.

Measure Package 3.06: Spa Heaters, Electric, Replaces Natural Gas

Summary

– Replace natural gas spa heater with an electric resistance spa heater

Technical Description

- Hot tub or spa heater
  - Electric, resistance
    - Applies to dwelling units with a natural gas hot tub or spa heater.

Measure Package 3.07: Lighting, Universal LEDs

Summary

– Replaces existing incandescent or CFL lighting with LED lighting.

Technical Description

- Lighting
  - 100% LED, 90 lm/W
    - Applies to dwelling units with lighting but not fully using LED lighting.

Measure Category 4: Universal Cooling, Water Heaters, and Gasification

Measure Package 4.01: Cooling, for all Homes without Cooling

Summary

– Add room ACs for dwelling units without cooling and without HVAC ducts. Portion of space conditioned based on the floor area of the building, using the distributions in baseline ResStock modeled dwelling units which are in turn based on RECS 2009 (EIA 2013).

– Add central ACs that generally represent the minimum level that is compliant with federal standards for dwelling units without cooling and with HVAC ducts. Entire space is conditioned.

Technical Description

- HVAC Cooling System, applies only to dwelling units without cooling
  - Room AC, EER 12.0
    - Applies to dwelling units without HVAC ducts
  - AC, SEER 15
    - Applies to dwelling units with HVAC ducts and in U.S. South
  - AC, SEER 14
    - Applies to dwelling units with HVAC ducts and in U.S. North

- HVAC Cooling Partial Space Conditioning, applies only to dwelling units without cooling
  - 27% Conditioned
    - Applies to dwelling units that add room AC
    - Applies to dwelling units with floor area larger than 3999 ft^2
  - 36% Conditioned
    - Applies to dwelling units that add room AC
    - Applies to dwelling units that floor area is within 2500-3999 ft^2
  - 37% Conditioned
    - Applies to dwelling units that add room AC
    - Applies to dwelling units that floor area is within 1500-2499 ft^2
  - 52% Conditioned
    - Applies to dwelling units that add room AC
    - Applies to dwelling units with floor area less than 1500 ft^2
  - 100% Conditioned
    - Applies to dwelling units that add central AC.

Measure Package 4.02: Cooling, ENERGY STAR Room AC

Summary

– Replace less-efficient existing room ACs with ENERGY STAR room ACs.

Technical Description

- HVAC Cooling System
  - Room AC, EER 12.0
    - Applies to dwelling units with Room AC less than EER 12.0.

Measure Package 4.03: Cooling, ENERGY STAR Central AC

Summary

– Replace less-efficient existing central ACs with ENERGY STAR central ACs

Technical Description

- HVAC Cooling System
  - AC, SEER 15.2
    - Applies to dwelling units with central AC less than SEER 15.2.

Measure Package 4.04: Water Heating, HPWH for All

Summary

– Replace existing non-electric water heater or existing less-efficient electric water heater with a HPWH UEF 3.35-3.45.

Technical Description

- Water Heater System
  - Electric Heat Pump, 50 gal, 3.45 UEF
    - Applies to dwelling units that have 3 or fewer bedrooms and a non-electric water heater or less-efficient electric water heater
  - Electric Heat Pump, 66 gal, 3.35 UEF

        - Applies to dwelling units that have 4 bedrooms and a non-electric water heater or less-efficient electric water heater
    - Electric Heat Pump, 80 gal, 3.45 UEF
        - Applies to dwelling units that have 5 or more bedrooms and a non-electric water heater or less-efficient electric water heater

Measure Package 4.05: Furnace, 96% AFUE NG, Replaces NG Furnace

Summary

– Replace existing natural gas furnace with high-efficiency natural gas furnace for dwelling units with less-efficient natural gas furnace.

Technical Description

- HVAC Heating System
    - Natural gas furnace, 96% AFUE
        - Applies to dwelling units with natural gas fuel furnace where the efficiency is less than 96% AFUE.

Measure Package 4.06: Furnace, 96% AFUE NG, Replaces Propane Furnace if NG Available

Summary

– Replace existing propane furnace with high-efficiency natural gas furnace for dwelling units with natural gas hookup.

Technical Description

- HVAC Heating System
    - Natural gas furnace, 96% AFUE
        - Applies to dwelling units with propane fuel furnace *and* any natural gas usage.

Measure Package 4.07: Furnace, 96% AFUE NG, Replaces Fuel Oil Furnace if NG Available

Summary

– Replace existing fuel oil furnace with high-efficiency natural gas furnace for dwelling units with natural gas hookup.

Technical Description

- HVAC Heating System
    - Natural gas furnace, 96% AFUE
        - Applies to dwelling units with fuel oil fuel furnace *and* any natural gas usage.

Measure Package 4.08: Boiler, 96% AFUE NG, Replaces NG Boiler

Summary

– Replace existing natural gas boiler with high-efficiency natural gas boiler for dwelling units with less-efficient natural gas boiler.

Technical Description

- HVAC Heating System
    - Natural gas boiler, 96% AFUE

        - Applies to dwelling units with natural gas fuel boiler and the efficiency is less than 96% AFUE.

Measure Package 4.09: Boiler, 96% AFUE NG, Replaces Propane Boiler if NG Available

Summary

– Replace existing propane boiler with high-efficiency natural gas boiler for dwelling units with natural gas hookup.

Technical Description

- HVAC Heating System
    - Natural gas boiler, 96% AFUE
        - Applies to dwelling units with propane fuel boiler *and* any natural gas usage.

Measure Package 4.10: Boiler, 96% AFUE NG, Replaces Fuel Oil Boiler if NG Available

Summary

– Replace existing fuel oil boiler with high-efficiency natural gas boiler for dwelling units with natural gas hookup.

Technical Description

- HVAC Heating System
    - Natural gas boiler, 96% AFUE
        - Applies to dwelling units with fuel oil fuel boiler *and* any natural gas usage.

Measure Category 5: Heat pumps With Electric Backup

Measure Package 5.01: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Elec Heating

Summary

All dwelling units with central HVAC ducts, existing electric heating, and no shared HVAC system receive a ducted ASHP (SEER 16, 9.2 HSPF) w/ electric backup heating, sized with ACCA Manual S/J.

Technical Description

- Centrally ducted single speed heat pump SEER 16, 9.2 HSPF
    - Apply to dwelling units:
        - With ducts
        - Electric heating
        - No heat pump *or* a less-efficient heat pump (SEER < 16, HSPF < 9.2)
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 50% @ 5°F
    - Single-stage.

Measure Package 5.02: ASHP, ENREGY STAR Ducted, Elec Backup, if Existing NG Heating

Summary

- All dwelling units with central HVAC ducts, existing natural gas heating, and no shared HVAC system receive a ducted ASHP (SEER 16, 9.2 HSPF) w/ electric backup heating, sized with ACCA Manual S/J.

Technical Description

- Centrally ducted single speed heat pump SEER 16, 9.2 HSPF
    - Apply to dwelling units:
        - With ducts
        - Natural gas heating
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 50% @ 5°F
    - Single-stage.

Measure Package 5.03: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Propane Heating

Summary

- All dwelling units with central HVAC ducts, existing propane heating, and no shared HVAC system receive a ducted ASHP (SEER 16, 9.2 HSPF) w/ electric backup heating, sized with ACCA Manual S/J.

Technical Description

- Centrally ducted single speed heat pump SEER 16, 9.2 HSPF
    - Apply to dwelling units:
        - With ducts
        - Propane heating
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 50% @ 5°F
    - Single-stage.

Measure Package 5.04: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Fuel Oil Heating

Summary

- All dwelling units with central HVAC ducts, existing fuel oil heating, and no shared HVAC system receive a ducted ASHP (SEER 16, 9.2 HSPF) w/ electric backup heating, sized with ACCA Manual S/J.

Technical Description

- Centrally ducted single speed heat pump SEER 16, 9.2 HSPF
    - Apply to dwelling units:

        - With ducts
        - Fuel oil heating
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 50% @ 5°F
    - Single-stage.

Measure Package 5.05: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Elec Heating

Summary

- All dwelling units with central HVAC ducts, existing electric heating, and no shared HVAC system receive a ducted cold climate ASHP (SEER 16, HSPF 9.5) w/ electric backup heating, sized to max load.

Technical Description

- Centrally ducted variable speed heat pump SEER 16, 9.5 HSPF
    - Apply to dwelling units:
        - With ducts
        - Electricity heating
        - No heat pump *or* a less-efficient heat pump (SEER < 16, HSPF < 9.5)
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 70% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.06: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing NG Heating

Summary

- All dwelling units with central HVAC ducts, existing natural gas heating, and no shared HVAC system receive a ducted cold climate ASHP (SEER 16, HSPF 9.5) w/ electric backup heating, sized to max load.

Technical Description

- Centrally ducted variable speed heat pump SEER 16, 9.5 HSPF
    - Apply to dwelling units:
        - With ducts
        - Natural gas heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 70% @ 5°F
    - Variable speed

- Any existing setpoint offsets are removed

Measure Package 5.07: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Propane Heating

Summary

- All dwelling units with central HVAC ducts, existing propane heating, and no shared HVAC system receive a ducted cold climate ASHP (SEER 16, HSPF 9.5) w/ electric backup heating, sized to max load.

Technical Description

- Centrally ducted variable speed heat pump SEER 16, 9.5 HSPF
    - Apply to dwelling units:
        - With ducts
        - Propane heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 70% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.08: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating

Summary

- All dwelling units with central HVAC ducts, existing fuel oil heating, and no shared HVAC system receive a ducted cold climate ASHP (SEER 16, HSPF 9.5) w/ electric backup heating, sized to max load.

Technical Description

- Centrally ducted variable speed heat pump SEER 16, 9.5 HSPF
    - Apply to dwelling units:
        - With ducts
        - Fuel oil heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 70% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.09: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Elec Heating

Summary

- All dwelling units with central HVAC ducts, existing electric heating, and no shared HVAC system receive a ducted ASHP (SEER 20, HSPF 11) w/ electric backup heating, sized to max load.

Technical Description

- Centrally ducted variable speed heat pump SEER 20, 11 HSPF
    - Apply to dwelling units:
        - With ducts
        - Electricity heating
        - No heat pump *or* a less-efficient heat pump (SEER < 20, HSPF < 11)
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.10: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing NG Heating

Summary

- All dwelling units with central HVAC ducts, existing natural gas heating, and no shared HVAC system receive a ducted ASHP (SEER 20, HSPF 11) w/ electric backup heating, sized to max load.

Technical Description

- Centrally ducted variable speed heat pump SEER 20, 11 HSPF
    - Apply to dwelling units:
        - With ducts
        - Natural gas heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.11: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Propane Heating

Summary

- All dwelling units with central HVAC ducts, existing propane heating, and no shared HVAC system receive a ducted ASHP (SEER 20, HSPF 11) w/ electric backup heating, sized to max load

Technical Description

- Centrally ducted variable speed heat pump SEER 20, 11 HSPF
    - Apply to dwelling units:

            - With ducts
            - Propane heating
            - No existing shared HVAC system
        - Sized to maximum design load (heating or cooling)
        - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
        - Capacity retention of 90% @ 5°F
        - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.12: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating

Summary

- All dwelling units with central HVAC ducts, existing fuel oil heating, and no shared HVAC system receive a ducted ASHP (SEER 20, HSPF 11) w/ electric backup heating, sized to max load.

Technical Description

- Centrally ducted variable speed heat pump SEER 20, 11 HSPF
    - Apply to dwelling:
        - With ducts
        - Fuel oil heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.13: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Elec Heating

Summary

- All dwelling units without HVAC ducts, with less-efficient existing electric heating, and without a shared HVAC system receive a ductless MSHP (SEER 16, HSPF 9.2) w/ electric backup heating, sized to max load.

Technical Description

- Ductless variable speed heat pump SEER 16, 9.2 HSPF
    - Apply to dwelling units:
        - Without ducts
        - Electricity heating
        - No heat pump *or* a less-efficient heat pump (SEER < 16, HSPF < 9.2)
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load

    - Capacity retention of 50% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.14: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing NG Heating

Summary

- All dwelling units without HVAC ducts, with existing natural gas heating, and without a shared HVAC system receive a ductless MSHP (SEER 16, HSPF 9.2) w/ electric backup heating, sized to max load

Technical Description

- Ductless variable speed heat pump SEER 16, 9.2 HSPF
    - Apply to dwelling units:
        - Without ducts
        - Natural gas heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 50% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.15: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Propane Heating

Summary

- All dwelling units without ducts, with existing propane heating, and without a shared HVAC system receive a ductless MSHP (SEER 16, HSPF 9.2) w/ electric backup heating, sized to max load.

Technical Description

- Ductless variable speed heat pump SEER 16, 9.2 HSPF
    - Apply to dwelling units:
        - Without ducts
        - Propane heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 50% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.16: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Fuel Oil Heating

Summary

- All dwelling units without ducts, with existing fuel oil heating, and without a shared HVAC system receive a ductless MSHP (SEER 16, HSPF 9.2) w/ electric backup heating, sized to max load.

Technical Description

- Ductless variable speed heat pump SEER 16, 9.2 HSPF
    - Apply to dwelling units:
        - Without ducts
        - Fuel oil heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 50% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.17: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Elec Heating

Summary

- All dwelling units without ducts, with less-efficient existing electric heating, and without a shared HVAC system receive a ductless MSHP (SEER 16, HSPF 9.5) w/ electric backup heating, sized to max load.

Technical Description

- Ductless variable speed heat pump SEER 16, 9.5 HSPF
    - Apply to dwelling units:
        - Without ducts
        - Electricity heating
        - No heat pump *or* a less-efficient heat pump (SEER < 16, HSPF < 9.5)
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 70% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.18: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing NG Heating

Summary

- All dwelling units without ducts and existing natural gas heating receive a ductless MSHP (SEER 16, HSPF 9.5) w/ electric backup heating, sized to max load
- Does not apply to dwelling units with shared systems due to limitations with ResStock

Technical Description

- Ductless single speed heat pump SEER 16, 9.5 HSPF
    - Apply to dwelling units:

        - Without ducts
        - Natural gas heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 70% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.19: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Propane Heating

Summary

All dwelling units without ducts, with existing propane heating, and without a shared HVAC system receive a ductless MSHP (SEER 16, HSPF 9.5) w/ electric backup heating, sized to max load.

Technical Description

- Ductless variable speed heat pump SEER 16, 9.5 HSPF
    - Apply to dwelling units:
        - Without ducts
        - Propane heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 70% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.20: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating

Summary

- All dwelling units without ducts, with existing fuel oil heating, and without a shared HVAC system receive a ductless MSHP (SEER 16, HSPF 9.5) w/ electric backup heating, sized to max load.

Technical Description

- Ductless variable speed heat pump SEER 16, 9.5 HSPF
    - Apply to dwelling units:
        - Without ducts
        - Fuel oil heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 70% @ 5°F

    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.21: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Elec Heating

Summary

- All dwelling units without ducts, with less-efficient existing electric heating, and without a shared HVAC system receive a ductless MSHP (SEER 20, HSPF 11) w/ electric backup heating, sized to max load.

Technical Description

- Ductless variable speed heat pump SEER 20, 11 HSPF
    - Apply to dwelling units:
        - Without ducts
        - Electricity heating
        - No heat pump *or* a less-efficient heat pump (SEER < 20, HSPF < 11)
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.22: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing NG Heating

Summary

- All dwelling units without ducts, with existing natural gas heating, and without a shared HVAC system receive a ductless MSHP (SEER 20, HSPF 11) w/ electric backup heating, sized to max load.

Technical Description

- Ductless variable speed heat pump SEER 20, 11 HSPF
    - Apply to dwelling units:
        - Without ducts
        - Natural gas heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.23: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Propane Heating

Summary

- All dwelling units without ducts, with existing propane heating, and without a shared HVAC system receive a ductless MSHP (SEER 20, HSPF 11) w/ electric backup heating, sized to max load
- Does not apply to dwelling units with shared systems due to limitations with ResStock

Technical Description

- Ductless variable speed heat pump SEER 20, 11 HSPF
    - Apply to dwelling units:
        - Without ducts
        - Propane heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 5.24: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating

Summary

All dwelling units without ducts, with existing fuel oil heating, and without a shared HVAC system receive a ductless MSHP (SEER 20, HSPF 11) w/ electric backup heating, sized to max load

Technical Description

- Ductless variable speed heat pump SEER 20, 11 HSPF
    - Apply to dwelling units:
        - Without ducts
        - Fuel oil heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by electric resistance, active when the heat pump cannot meet the load
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Category 6: Heat Pumps With Existing System as Backup

Measure Package 6.01: ASHP, ENERGY STAR Ducted, Existing NG Backup

Summary

- Applies only to dwelling units with natural gas primary heating in baseline
- Applies only to dwelling units with HVAC ducts
- All applicable dwelling units receive the ENERGY STAR ASHP (SEER 16, 9.2 HSPF) sized with ACCA Manual S/J
- Existing heating retained as backup

- Does not apply to dwelling units with shared systems

Technical Description

- Centrally ducted single speed heat pump SEER 16, 9.2 HSPF with existing heating system as independent backup
    - Apply to dwelling units:
        - With ducts
        - Existing non-ducted, natural gas heating
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J
    - Backup heat provided by existing heating, active when the heat pump cannot meet the load
    - Capacity retention of 50% @ 5°F
    - Single-stage
- Centrally ducted single speed heat pump SEER 16, 9.2 HSPF with existing heating system sharing ducts
    - Apply to dwelling units:
        - With ducts
        - Existing ducted, natural gas heating
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J
    - Backup heat provided by existing heating:
        - Backup heating is locked out over an outdoor ambient temperature of 40°F
        - Heat pump compressor heating is locked out below an outdoor ambient temperature of 5°F
        - Heating load is met by cycling between the two heating systems within this temperature band
    - Capacity retention of 50% @ 5°F
    - Single-stage

Measure Package 6.02: ASHP, ENERGY STAR Ducted, Existing Propane Backup

Summary

- Applies only to dwelling units with propane primary heating in baseline
- Applies only to dwelling units with HVAC ducts
- All applicable dwelling units receive the ENERGY STAR ASHP (SEER 16, 9.2 HSPF) sized with ACCA Manual S/J
- Existing heating retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Centrally ducted single speed heat pump SEER 16, 9.2 HSPF with existing heating system as independent backup
    - Apply to dwelling units:
        - With ducts
        - Existing non-ducted, propane heating
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J

    - Backup heat provided by existing heating, active when the heat pump cannot meet the load
    - Capacity retention of 50% @ 5°F
    - Single-stage
- Centrally ducted single speed heat pump SEER 16, 9.2 HSPF with existing heating system sharing ducts
    - Apply to dwelling units:
        - With ducts
        - Existing ducted, propane heating
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J
    - Backup heat provided by existing heating:
        - Backup heating is locked out over an outdoor ambient temperature of 40°F
        - Heat pump compressor heating is locked out below an outdoor ambient temperature of 5°F
        - Heating load is met by cycling between the two heating systems within this temperature band
    - Capacity retention of 50% @ 5°F
    - Single-stage

Measure Package 6.03: ASHP, ENERGY STAR Ducted, Existing Fuel Oil Backup

Summary

- Applies only to dwelling units with fuel oil primary heating in baseline
- Applies only to dwelling units with HVAC ducts
- All applicable dwelling units receive the ENERGY STAR ASHP (SEER 16, 9.2 HSPF) sized with ACCA Manual S/J
- Existing heating retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Centrally ducted single speed heat pump SEER 16, 9.2 HSPF with existing heating system as independent backup
    - Apply to dwelling units:
        - With ducts
        - Existing non-ducted, fuel oil heating
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J
    - Backup heat provided by existing heating, active when the heat pump cannot meet the load
    - Capacity retention of 50% @ 5°F
    - Single-stage
- Centrally ducted single speed heat pump SEER 16, 9.2 HSPF with existing heating system sharing ducts
    - Apply to dwelling units:
        - With ducts
        - Existing ducted, fuel oil heating
        - No existing shared HVAC system

    - Sized to ACCA Manual S/J
    - Backup heat provided by existing heating:
        - Backup heating is locked out over an outdoor ambient temperature of 40°F
        - Heat pump compressor heating is locked out below an outdoor ambient temperature of 5°F
        - Heating load is met by cycling between the two heating systems within this temperature band
    - Capacity retention of 50% @ 5°F
    - Single-stage

Measure Package 6.04: ASHP, ENERGY STAR Cold Climate Ducted, Existing NG Backup

Summary

- Applies only to dwelling units with natural gas primary heating in baseline
- Applies only to dwelling units with HVAC ducts
- All applicable dwelling units receive the ENERGY STAR ASHP (SEER 16, 9.5 HSPF) sized with ACCA Manual S/J
- Existing heating retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Centrally ducted variable speed heat pump SEER 16, 9.5 HSPF with existing heating system as independent backup
    - Apply to dwelling units:
        - With ducts
        - Existing non-ducted, natural gas heating
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J
    - Backup heat provided by existing heating, active when the heat pump cannot meet the load
    - Capacity retention of 70% @ 5°F
    - Variable speed
- Centrally ducted variable speed heat pump SEER 16, 9.5 HSPF with existing heating system sharing ducts
    - Apply to dwelling units:
        - With ducts
        - Existing ducted, natural gas heating
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J
    - Backup heat provided by existing heating:
        - Backup heating is locked out over an outdoor ambient temperature of 40°F
        - Heat pump compressor heating is locked out below an outdoor ambient temperature of 5°F
        - Heating load is met by cycling between the two heating systems within this temperature band
    - Capacity retention of 70% @ 5°F
    - Variable speed

- Any existing setpoint offsets are removed

Measure Package 6.05: ASHP, ENERGY STAR Cold Climate Ducted, Existing Propane Backup

Summary

- Applies only to dwelling units with propane primary heating in baseline
- Applies only to dwelling units with HVAC ducts
- All applicable dwelling units receive the ENERGY STAR ASHP (SEER 16, 9.5 HSPF) sized with ACCA Manual S/J
- Existing heating retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Centrally ducted variable speed heat pump SEER 16, 9.5 HSPF with existing heating system as independent backup
    - Apply to dwelling units:
        - With ducts
        - Existing non-ducted, propane heating
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J
    - Backup heat provided by existing heating, active when the heat pump cannot meet the load
    - Capacity retention of 70% @ 5°F
    - Variable speed
- Centrally ducted variable speed heat pump SEER 16, 9.5 HSPF with existing heating system sharing ducts
    - Apply to dwelling units:
        - With ducts
        - Existing ducted, propane heating
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J
    - Backup heat provided by existing heating:
        - Backup heating is locked out over an outdoor ambient temperature of 40°F
        - Heat pump compressor heating is locked out below an outdoor ambient temperature of 5°F
        - Heating load is met by cycling between the two heating systems within this temperature band
    - Capacity retention of 70% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 6.06: ASHP, ENERGY STAR Cold Climate Ducted, Existing Fuel Oil Backup

Summary

- Applies only to dwelling units with fuel oil primary heating in baseline
- Applies only to dwelling units with HVAC ducts

- All applicable dwelling units receive the ENERGY STAR ASHP (SEER 16, 9.5 HSPF) sized with ACCA Manual S/J
- Existing heating retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Centrally ducted variable speed heat pump SEER 16, 9.5 HSPF with existing heating system as independent backup
    - Apply to dwelling units:
        - With ducts
        - Existing non-ducted, fuel oil heating
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J
    - Backup heat provided by existing heating, active when the heat pump cannot meet the load
    - Capacity retention of 70% @ 5°F
    - Variable speed
- Centrally ducted variable speed heat pump SEER 16, 9.5 HSPF with existing heating system sharing ducts
    - Apply to dwelling units:
        - With ducts
        - Existing ducted, fuel oil heating
        - No existing shared HVAC system
    - Sized to ACCA Manual S/J
    - Backup heat provided by existing heating:
        - Backup heating is locked out over an outdoor ambient temperature of 40°F
        - Heat pump compressor heating is locked out below an outdoor ambient temperature of 5°F
        - Heating load is met by cycling between the two heating systems within this temperature band
    - Capacity retention of 70% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 6.07: ***ASHP, Higher Efficiency Cold Climate Ducted, Existing NG Backup***

Summary

- Applies only to dwelling units with natural gas primary heating in baseline
- Applies only to dwelling units with HVAC ducts
- All applicable dwelling units receive the ENERGY STAR ASHP (SEER 20, 11 HSPF) sized to max load
- Existing heating retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Centrally ducted variable speed heat pump SEER 20, 11 HSPF with existing heating system as independent backup

    - Apply to dwelling units:
        - With ducts
        - Existing non-ducted, natural gas heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by existing heating, active when the heat pump cannot meet the load
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Centrally ducted variable speed heat pump SEER 20, 11 HSPF with existing heating system sharing ducts
    - Apply to dwelling units:
        - With ducts
        - Existing ducted, natural gas heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by existing heating:
        - Backup heating is locked out over an outdoor ambient temperature of 40°F
        - Heat pump compressor heating is locked out below an outdoor ambient temperature of 5°F
        - Heating load is met by cycling between the two heating systems within this temperature band
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 6.08: ***ASHP, Higher Efficiency Cold Climate Ducted, Existing Propane Backup***

Summary

- Applies only to dwelling units with propane primary heating in baseline
- Applies only to dwelling units with HVAC ducts
- All applicable dwelling units receive the ENERGY STAR ASHP (SEER 20, 11 HSPF) sized to max load
- Existing heating retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Centrally ducted variable speed heat pump SEER 20, 11 HSPF with existing heating system as independent backup
    - Apply to dwelling units:
        - With ducts
        - Existing non-ducted, propane heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by existing heating, active when the heat pump cannot meet the load
    - Capacity retention of 90% @ 5°F

    - Variable speed
- Centrally ducted variable speed heat pump SEER 20, 11 HSPF with existing heating system sharing ducts
    - Apply to dwelling units:
        - With ducts
        - Existing ducted, propane heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by existing heating:
        - Backup heating is locked out over an outdoor ambient temperature of 40°F
        - Heat pump compressor heating is locked out below an outdoor ambient temperature of 5°F
        - Heating load is met by cycling between the two heating systems within this temperature band
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 6.09: ***ASHP, Higher Efficiency Cold Climate Ducted, Existing Fuel Oil Backup***

Summary

- Applies only to dwelling units with fuel oil primary heating in baseline
- Applies only to dwelling units with HVAC ducts
- All applicable dwelling units receive the ENERGY STAR ASHP (SEER 20, 11 HSPF) sized to max load
- Existing heating retained as backup
- Does not apply to dwelling units with shared systems due to limitations with ResStock

Technical Description

- Centrally ducted variable speed heat pump SEER 20, 11 HSPF with existing heating system as independent backup
    - Apply to dwelling units:
        - With ducts
        - Existing non-ducted, fuel oil heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Backup heat provided by existing heating, active when the heat pump cannot meet the load
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Centrally ducted variable speed heat pump SEER 20, 11 HSPF with existing heating system sharing ducts
    - Apply to dwelling units:
        - With ducts
        - Existing ducted, fuel oil heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)

    - Backup heat provided by existing heating:
        - Backup heating is locked out over an outdoor ambient temperature of 40°F
        - Heat pump compressor heating is locked out below an outdoor ambient temperature of 5°F
        - Heating load is met by cycling between the two heating systems within this temperature band
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 6.10: MSHP, ENERGY STAR Ductless, Existing NG Backup

Summary

- Applies only to dwelling units with natural gas primary heating in baseline
- Applies only to dwelling units without HVAC ducts
- All applicable dwelling units receive a ductless MSHP (SEER 16, HSPF 9.2) sized to max load
- Existing heating system retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Ductless variable speed heat pump SEER 16, 9.2 HSPF, with existing heating as independent backup
    - Apply to dwelling units:
        - Without ducts
        - Existing non-ducted, natural gas heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Existing heating retained as backup, active when the heat pump cannot meet the load
    - Capacity retention of 50% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 6.11: MSHP, ENERGY STAR Ductless, Existing Propane Backup

Summary

- Applies only to dwelling units with propane primary heating in baseline
- Applies only to dwelling units without HVAC ducts
- All applicable dwelling units receive a ductless MSHP (SEER 16, HSPF 9.2) sized to max load
- Existing heating system retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Ductless variable speed heat pump SEER 16, 9.2 HSPF, with existing heating as independent backup
    - Apply to dwelling units:
        - Without ducts

        - Existing non-ducted, propane heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Existing heating retained as backup, active when the heat pump cannot meet the load
    - Capacity retention of 50% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 6.12: MSHP, ENERGY STAR Ductless, Existing Fuel Oil Backup

Summary

- Applies only to dwelling units with fuel oil primary heating in baseline
- Applies only to dwelling units without HVAC ducts
- All applicable dwelling units receive a ductless MSHP (SEER 16, HSPF 9.2) sized to max load
- Existing heating system retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Ductless variable speed heat pump SEER 16, 9.2 HSPF, with existing heating as independent backup
    - Apply to dwelling units:
        - Without ducts
        - Existing non-ducted, fuel oil heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Existing heating retained as backup, active when the heat pump cannot meet the load
    - Capacity retention of 50% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 6.13: MSHP, ENERGY STAR Cold Climate Ductless, Existing NG Backup

Summary

- Applies only to dwelling units with natural gas primary heating in baseline
- Applies only to dwelling units without HVAC ducts
- All applicable dwelling units receive a ductless MSHP (SEER 16, HSPF 9.5) sized to max load
- Existing heating system retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Ductless variable speed heat pump SEER 16, 9.5 HSPF, with existing heating as independent backup
    - Apply to dwelling units:
        - Without ducts

        - Existing non-ducted, natural gas heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Existing heating retained as backup, active when the heat pump cannot meet the load
    - Capacity retention of 70% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 6.14: ***MSHP, ENERGY STAR Cold Climate Ductless, Existing Propane Backup***

Summary

- Applies only to dwelling units with propane primary heating in baseline
- Applies only to dwelling units without HVAC ducts
- All applicable dwelling units receive a ductless MSHP (SEER 16, HSPF 9.5) sized to max load
- Existing heating system retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Ductless variable speed heat pump SEER 16, 9.5 HSPF, with existing heating as independent backup
    - Apply to dwelling units:
        - Without ducts
        - Existing non-ducted, propane heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Existing heating retained as backup, active when the heat pump cannot meet the load
    - Capacity retention of 70% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 6.15: ***MSHP, ENERGY STAR Cold Climate Ductless, Existing Fuel Oil Backup***

Summary

- Applies only to dwelling units with fuel oil primary heating in baseline
- Applies only to dwelling units without HVAC ducts
- All applicable dwelling units receive a ductless MSHP (SEER 16, HSPF 9.5) sized to max load
- Existing heating system retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Ductless variable speed heat pump SEER 16, 9.5 HSPF, with existing heating as independent backup
    - Apply to dwelling units:

            - Without ducts
            - Existing non-ducted, fuel oil heating
            - No existing shared HVAC system
        - Sized to maximum design load (heating or cooling)
        - Existing heating retained as backup, active when the heat pump cannot meet the load
        - Capacity retention of 70% @ 5°F
        - Variable speed
- Any existing setpoint offsets are removed

Measure Package 6.16: ***MSHP, Higher Efficiency Cold Climate Ductless, Existing NG Backup***

Summary

- Applies only to dwelling units with natural gas primary heating in baseline
- Applies only to dwelling units without HVAC ducts
- All applicable dwelling units receive a ductless MSHP (SEER 20, HSPF 11) sized to max load
- Existing heating system retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Ductless variable speed heat pump SEER 20, 11 HSPF, with existing heating as independent backup
    - Apply to dwelling units:
        - Without ducts
        - Existing non-ducted, natural gas heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Existing heating retained as backup, active when the heat pump cannot meet the load
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 6.17: MSHP, Higher Efficiency Cold Climate Ductless, Existing Propane Backup

Summary

- Applies only to dwelling units with propane primary heating in baseline
- Applies only to dwelling units without HVAC ducts
- All applicable dwelling units receive a ductless MSHP (SEER 20, HSPF 11) sized to max load
- Existing heating system retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Ductless variable speed heat pump SEER 20, 11 HSPF, with existing heating as independent backup

    - Apply to dwelling units:
        - Without ducts
        - Existing non-ducted, propane heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Existing heating retained as backup, active when the heat pump cannot meet the load
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Package 6.18: MSHP, Higher Efficiency Cold Climate Ductless, Existing Fuel Oil Backup

Summary

- Applies only to dwelling units with fuel oil primary heating in baseline
- Applies only to dwelling units without HVAC ducts
- All applicable dwelling units receive a ductless MSHP (SEER 20, HSPF 11) sized to max load
- Existing heating system retained as backup
- Does not apply to dwelling units with shared systems

Technical Description

- Ductless variable speed heat pump SEER 20, 11 HSPF, with existing heating as independent backup
    - Apply to dwelling units:
        - Without ducts
        - Existing non-ducted, fuel oil heating
        - No existing shared HVAC system
    - Sized to maximum design load (heating or cooling)
    - Existing heating retained as backup, active when the heat pump cannot meet the load
    - Capacity retention of 90% @ 5°F
    - Variable speed
- Any existing setpoint offsets are removed

Measure Category 7: Heat Pumps With Electric Backup and Light Touch Envelope

Measure Package 7.01: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Elec Heating + Envelope, Light Touch

Summary

- **5.01**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.02: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing NG Heating + Envelope, Light Touch

Summary

- **5.02**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.03: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Propane Heating + Envelope, Light Touch

Summary

- **5.03**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.04: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Light Touch

Summary

- **5.04**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.05: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Elec Heating + Envelope, Light Touch

Summary

- **5.05**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.06: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing NG Heating + Envelope, Light Touch

Summary

- **5.06**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.07: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Propane Heating + Envelope, Light Touch

Summary

- **5.07**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.08: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Light Touch

Summary

- **5.08**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.09: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Elec Heating + Envelope, Light Touch

Summary

- **5.09**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.10: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing NG Heating + Envelope, Light Touch

Summary

- **5.10**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.11: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Propane Heating + Envelope, Light Touch

Summary

- **5.11**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.12: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Light Touch

Summary

- **5.12**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.13: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Elec Heating + Envelope, Light Touch

Summary

- **5.13**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.14: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing NG Heating + Envelope, Light Touch

Summary

- **5.14**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.15: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Propane Heating + Envelope, Light Touch

Summary

- **5.15**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.16: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Light Touch

Summary

- **5.16**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.17: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Elec Heating + Envelope, Light Touch

Summary

- **5.17**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.18: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing NG Heating + Envelope, Light Touch

Summary

- **5.18**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.19: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Propane Heating + Envelope, Light Touch

Summary

- **5.19**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.20: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Light Touch

Summary

- **5.20**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.21: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Elec Heating + Envelope, Light Touch

Summary

- **5.21**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.22: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing NG Heating + Envelope, Light Touch

Summary

- **5.22**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.23: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Propane Heating + Envelope, Light Touch

Summary

- **5.23**, and if it applies, then anything from **2.03** that is applicable

Measure Package 7.24: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Light Touch

Summary

- **5.24**, and if it applies, then anything from **2.03** that is applicable

Measure Category 8: Heat Pumps With Electric Backup and Intermediate Envelope

Measure Package 8.01: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Elec Heating + Envelope, Intermediate

Summary

- **5.01**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.02: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing NG Heating + Envelope, Intermediate

Summary

- **5.02**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.03: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Propane Heating + Envelope, Intermediate

Summary

- **5.03**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.04: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Intermediate

Summary

- **5.04**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.05: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Elec Heating + Envelope, Intermediate

Summary

- **5.05**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.06: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing NG Heating + Envelope, Intermediate

Summary

- **5.06**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.07: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Propane Heating + Envelope, Intermediate

Summary

- **5.07**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.08: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Intermediate

Summary

- **5.08**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.09: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Elec Heating + Envelope, Intermediate

Summary

- **5.09**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.10: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing NG Heating + Envelope, Intermediate

Summary

- **5.10**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.11: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Propane Heating + Envelope, Intermediate

Summary

- **5.11**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.12: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Intermediate

Summary

- **5.12**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.13: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Elec Heating + Envelope, Intermediate

Summary

- **5.13**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.14: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing NG Heating + Envelope, Intermediate

Summary

- **5.14**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.15: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Propane Heating + Envelope, Intermediate

Summary

- **5.15**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.16: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Intermediate

Summary

- **5.16**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.17: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Elec Heating + Envelope, Intermediate

Summary

- **5.17**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.18: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing NG Heating + Envelope, Intermediate

Summary

- **5.18**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.19: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Propane Heating + Envelope, Intermediate

Summary

- **5.19**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.20: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Intermediate

Summary

- **5.20**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.21: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Elec Heating + Envelope, Intermediate

Summary

- **5.21**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.22: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing NG Heating + Envelope, Intermediate

Summary

- **5.22**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.23: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Propane Heating + Envelope, Intermediate

Summary

- **5.23**, and if it applies, then anything from **2.04** that is applicable

Measure Package 8.24: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Intermediate

Summary

- **5.24**, and if it applies, then anything from **2.04** that is applicable

Measure Category 9: Heat Pumps With Electric Backup and Advanced Envelope

Measure Package 9.01: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Elec Heating + Envelope, Advanced

Summary

- **5.01**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.02: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing NG Heating + Envelope, Advanced

Summary

- **5.02**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.03: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Propane Heating + Envelope, Advanced

Summary

- **5.03**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.04: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Advanced

Summary

- **5.04**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.05: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Elec Heating + Envelope, Advanced

Summary

- **5.05**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.06: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing NG Heating + Envelope, Advanced

Summary

- **5.06**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.07: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Propane Heating + Envelope, Advanced

Summary

- **5.07**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.08: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Advanced

Summary

- **5.08**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.09: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Elec Heating + Envelope, Advanced

Summary

- **5.09**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.10: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing NG Heating + Envelope, Advanced

Summary

- **5.10**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.11: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Propane Heating + Envelope, Advanced

Summary

- **5.11**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.12: ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Advanced

Summary

- **5.12**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.13: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Elec Heating + Envelope, Advanced

Summary

- **5.13**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.14: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing NG Heating + Envelope, Advanced

Summary

- **5.14**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.15: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Propane Heating + Envelope, Advanced

Summary

- **5.15**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.16: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Advanced

Summary

- **5.16**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.17: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Elec Heating + Envelope, Advanced

Summary

- **5.17**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.18: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing NG Heating + Envelope, Advanced

Summary

- **5.18**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.19: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Propane Heating + Envelope, Advanced

Summary

- **5.19**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.20: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Advanced

Summary

- **5.20**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.21: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Elec Heating + Envelope, Advanced

Summary

- **5.21**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.22: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing NG Heating + Envelope, Advanced

Summary

- **5.22**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.23: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Propane Heating + Envelope, Advanced

Summary

- **5.23**, and if it applies, then anything from **2.05** that is applicable

Measure Package 9.24: MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Advanced

Summary

- **5.24**, and if it applies, then anything from **2.05** that is applicable

Measure Category 10: Heat Pumps With Existing Backup and Light Touch Envelope

Measure Package 10.01: ASHP, ENERGY STAR Ducted, Existing NG Backup + Envelope, Light Touch

Summary

- **6.01**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.02: ASHP, ENERGY STAR Ducted, Existing Propane Backup + Envelope, Light Touch

Summary

- **6.02**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.03: ASHP, ENERGY STAR Ducted, Existing Fuel Oil Backup + Envelope, Light Touch

Summary

- **6.03**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.04: ASHP, ENERGY STAR Cold Climate Ducted, Existing NG Backup + Envelope, Light Touch

Summary

- **6.04**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.05: ASHP, ENERGY STAR Cold Climate Ducted, Existing Propane Backup + Envelope, Light Touch

Summary

- **6.05**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.06: ASHP, ENERGY STAR Cold Climate Ducted, Existing Fuel Oil Backup + Envelope, Light Touch

Summary

- **6.06**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.07: ASHP, Higher Efficiency Cold Climate Ducted, Existing NG Backup + Envelope, Light Touch

Summary

- **6.07**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.08: ASHP, Higher Efficiency Cold Climate Ducted, Existing Propane Backup + Envelope, Light Touch

Summary

- **6.08**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.09: ASHP, Higher Efficiency Cold Climate Ducted, Existing Fuel Oil Backup + Envelope, Light Touch

Summary

- **6.09**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.10: MSHP, ENERGY STAR Ductless, Existing NG Backup + Envelope, Light Touch

Summary

- **6.10**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.11: MSHP, ENERGY STAR Ductless, Existing Propane Backup + Envelope, Light Touch

Summary

- **6.11**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.12: MSHP, ENERGY STAR Ductless, Existing Fuel Oil Backup + Envelope, Light Touch

Summary

- **6.12**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.13: MSHP, ENERGY STAR Cold Climate Ductless, Existing NG Backup + Envelope, Light Touch

Summary

- **6.13**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.14: MSHP, ENERGY STAR Cold Climate Ductless, Existing Propane Backup + Envelope, Light Touch

Summary

- **6.14**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.15: MSHP, ENERGY STAR Cold Climate Ductless, Existing Fuel Oil Backup + Envelope, Light Touch

Summary

- **6.15**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.16: MSHP, Higher Efficiency Cold Climate Ductless, Existing NG Backup + Envelope, Light Touch

Summary

- **6.16**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.17: MSHP, Higher Efficiency Cold Climate Ductless, Existing Propane Backup + Envelope, Light Touch

Summary

- **6.17**, and if it applies, then anything from **2.03** that is applicable

Measure Package 10.18: MSHP, Higher Efficiency Cold Climate Ductless, Existing Fuel Oil Backup + Envelope, Light Touch

Summary

- **6.18**, and if it applies, then anything from **2.03** that is applicable

Measure Category 11: Heat Pumps With Existing Backup and Intermediate Envelope

Measure Package 11.01: ASHP, ENERGY STAR Ducted, Existing NG Backup + Envelope, Intermediate

Summary

- **6.01**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.02: ASHP, ENERGY STAR Ducted, Existing Propane Backup + Envelope, Intermediate

Summary

- **6.02**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.03: ASHP, ENERGY STAR Ducted, Existing Fuel Oil Backup + Envelope, Intermediate

Summary

- **6.03**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.04: ASHP, ENERGY STAR Cold Climate Ducted, Existing NG Backup + Envelope, Intermediate

Summary

- **6.04**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.05: ASHP, ENERGY STAR Cold Climate Ducted, Existing Propane Backup + Envelope, Intermediate

Summary

- **6.05**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.06: ASHP, ENERGY STAR Cold Climate Ducted, Existing Fuel Oil Backup + Envelope, Intermediate

Summary

- **6.06**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.07: ASHP, Higher Efficiency Cold Climate Ducted, Existing NG Backup + Envelope, Intermediate

Summary

- **6.07**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.08: ASHP, Higher Efficiency Cold Climate Ducted, Existing Propane Backup + Envelope, Intermediate

Summary

- **6.08**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.09: ASHP, Higher Efficiency Cold Climate Ducted, Existing Fuel Oil Backup + Envelope, Intermediate

Summary

- **6.09**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.10: MSHP, ENERGY STAR Ductless, Existing NG Backup + Envelope, Intermediate

Summary

- **6.10**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.11: MSHP, ENERGY STAR Ductless, Existing Propane Backup + Envelope, Intermediate

Summary

- **6.11**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.12: MSHP, ENERGY STAR Ductless, Existing Fuel Oil Backup + Envelope, Intermediate

Summary

- **6.12**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.13: MSHP, ENERGY STAR Cold Climate Ductless, Existing NG Backup + Envelope, Intermediate

Summary

- **6.13**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.14: MSHP, ENERGY STAR Cold Climate Ductless, Existing Propane Backup + Envelope, Intermediate

Summary

- **6.14**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.15: MSHP, ENERGY STAR Cold Climate Ductless, Existing Fuel Oil Backup + Envelope, Intermediate

Summary

- **6.15**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.16: MSHP, Higher Efficiency Cold Climate Ductless, Existing NG Backup + Envelope, Intermediate

Summary

- **6.16**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.17: MSHP, Higher Efficiency Cold Climate Ductless, Existing Propane Backup + Envelope, Intermediate

Summary

- **6.17**, and if it applies, then anything from **2.04** that is applicable

Measure Package 11.18: MSHP, Higher Efficiency Cold Climate Ductless, Existing Fuel Oil Backup + Envelope, Intermediate

Summary

- **6.18**, and if it applies, then anything from **2.04** that is applicable

Measure Category 12: Heat Pumps With Electric Backup and Advanced Envelope

Measure Package 12.01: ASHP, ENERGY STAR Ducted, Existing NG Backup + Envelope, Advanced

Summary

- **6.01**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.02: ASHP, ENERGY STAR Ducted, Existing Propane Backup + Envelope, Advanced

Summary

- **6.02**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.03: ASHP, ENERGY STAR Ducted, Existing Fuel Oil Backup + Envelope, Advanced

Summary

- **6.03**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.04: ASHP, ENERGY STAR Cold Climate Ducted, Existing NG Backup + Envelope, Advanced

Summary

- **6.04**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.05: ASHP, ENERGY STAR Cold Climate Ducted, Existing Propane Backup + Envelope, Advanced

Summary

- **6.05**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.06: ASHP, ENERGY STAR Cold Climate Ducted, Existing Fuel Oil Backup + Envelope, Advanced

Summary

- **6.06**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.07: ASHP, Higher Efficiency Cold Climate Ducted, Existing NG Backup + Envelope, Advanced

Summary

- **6.07**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.08: ASHP, Higher Efficiency Cold Climate Ducted, Existing Propane Backup + Envelope, Advanced

Summary

- **6.08**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.09: ASHP, Higher Efficiency Cold Climate Ducted, Existing Fuel Oil Backup + Envelope, Advanced

Summary

- **6.09**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.10: MSHP, ENERGY STAR Ductless, Existing NG Backup + Envelope, Advanced

Summary

- **6.10**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.11: MSHP, ENERGY STAR Ductless, Existing Propane Backup + Envelope, Advanced

Summary

- **6.11**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.12: MSHP, ENERGY STAR Ductless, Existing Fuel Oil Backup + Envelope, Advanced

Summary

- **6.12**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.13: MSHP, ENERGY STAR Cold Climate Ductless, Existing NG Backup + Envelope, Advanced

Summary

- **6.13**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.14: MSHP, ENERGY STAR Cold Climate Ductless, Existing Propane Backup + Envelope, Advanced

Summary

- **6.14**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.15: MSHP, ENERGY STAR Cold Climate Ductless, Existing Fuel Oil Backup + Envelope, Advanced

Summary

- **6.15**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.16: MSHP, Higher Efficiency Cold Climate Ductless, Existing NG Backup + Envelope, Advanced

Summary

- **6.16**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.17: MSHP, Higher Efficiency Cold Climate Ductless, Existing Propane Backup + Envelope, Advanced

Summary

- **6.17**, and if it applies, then anything from **2.05** that is applicable

Measure Package 12.18: MSHP, Higher Efficiency Cold Climate Ductless, Existing Fuel Oil Backup + Envelope, Advanced

Summary

- **6.18**, and if it applies, then anything from **2.05** that is applicable

Measure Category 13: HPWH + Measure Packages

Measure Package 13.01: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Elec Heating + HPWH

Summary

- **5.05**, and if it applies, then anything from **4.04** that is applicable

Measure Package 13.02: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing NG Heating + HPWH

Summary

- **5.06**, and if it applies, then anything from **4.04** that is applicable

Measure Package 13.03: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Propane Heating + HPWH

Summary

- **5.07**, and if it applies, then anything from **4.04** that is applicable

Measure Package 13.04: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + HPWH

Summary

- **5.08**, and if it applies, then anything from **4.04** that is applicable

Measure Package 13.05: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Elec Heating + HPWH

Summary

- **5.17**, and if it applies, then anything from **4.04** that is applicable

Measure Package 13.06: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing NG Heating + HPWH

Summary

- **5.18**, and if it applies, then anything from **4.04** that is applicable

Measure Package 13.07: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Propane Heating + HPWH

Summary

- **5.19**, and if it applies, then anything from **4.04** that is applicable

Measure Package 13.08: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + HPWH

Summary

- **5.20**, and if it applies, then anything from **4.04** that is applicable

Measure Package 13.09: ASHP, ENERGY STAR Cold Climate Ducted, Existing NG Backup + HPWH

Summary

- **6.04**, and if it applies, then anything from **4.04** that is applicable

Measure Package 13.10: ASHP, ENERGY STAR Cold Climate Ducted, Existing Propane Backup + HPWH

Summary

- **6.05**, and if it applies, then anything from **4.04** that is applicable

Measure Package 13.11: ASHP, ENERGY STAR Cold Climate Ducted, Existing Fuel Oil Backup + HPWH

Summary

- **6.06**, and if it applies, then anything from **4.04** that is applicable

Measure Package 13.12: MSHP, ENERGY STAR Cold Climate Ductless, Existing NG Backup + HPWH

Summary

- **6.13**, and if it applies, then anything from **4.04** that is applicable

Measure Package 13.13: MSHP, ENERGY STAR Cold Climate Ductless, Existing Propane Backup + HPWH

Summary

- **6.14**, and if it applies, then anything from **4.04** that is applicable

Measure Package 13.14: MSHP, ENERGY STAR Cold Climate Ductless, Existing Fuel Oil Backup + HPWH

Summary

- **6.15**, and if it applies, then anything from **4.04** that is applicable

Measure Package 13.15: HPWH + Light Touch Envelope

Summary

- **4.04**, and if it applies, then anything from **2.03** that is applicable

Measure Package 13.16: HPWH + Intermediate Envelope

Summary

- **4.04**, and if it applies, then anything from **2.04** that is applicable

Measure Package 13.17: HPWH + Advanced Envelope

Summary

- **4.04**, and if it applies, then anything from **2.05** that is applicable

Measure Package 13.18: HPWH + 96% AFUE natural gas furnace

Summary

- Anything from **4.05**, **4.06**, or **4.07** that applies, if anything does then anything from **4.04** that is applicable

Measure Package 13.19: HPWH + 96% AFUE natural gas boiler

Summary

- Anything from **4.08**, **4.09**, or **4.10** that applies, if anything does then anything from **4.04** that is applicable

Measure Category 14: Furnace or Boiler w/ Envelope Packages

Measure Package 14.01: Furnace, 96% AFUE NG, Replaces NG Furnace + Envelope, Light Touch

Summary

- **4.05**, and if it applies, then anything from **2.03** that is applicable

Measure Package 14.02: Furnace, 96% AFUE NG, Replaces Propane Furnace if NG Available + Envelope, Light Touch

Summary

- **4.06**, and if it applies, then anything from **2.03** that is applicable

Measure Package 14.03: Furnace, 96% AFUE NG, Replaces Fuel Oil Furnace if NG Available + Envelope, Light Touch

Summary

- **4.07**, and if it applies, then anything from **2.03** that is applicable

Measure Package 14.04: Boiler, 96% AFUE NG, Replaces NG Boiler + Envelope, Light Touch

Summary

- **4.08**, and if it applies, then anything from **2.03** that is applicable

Measure Package 14.05: Boiler, 96% AFUE NG, Replaces Propane Boiler if NG Available + Envelope, Light Touch

Summary

- **4.09**, and if it applies, then anything from **2.03** that is applicable

Measure Package 14.06: Boiler, 96% AFUE NG, Replaces Fuel Oil Boiler if NG Available + Envelope, Light Touch

Summary

- **4.10**, and if it applies, then anything from **2.03** that is applicable

Measure Package 14.07: Furnace, 96% AFUE NG, Replaces NG Furnace + Envelope, Intermediate

Summary

- **4.05**, and if it applies, then anything from **2.04** that is applicable

Measure Package 14.08: Furnace, 96% AFUE NG, Replaces Propane Furnace if NG Available + Envelope, Intermediate

Summary

- **4.06**, and if it applies, then anything from **2.04** that is applicable

Measure Package 14.09: Furnace, 96% AFUE NG, Replaces Fuel Oil Furnace if NG Available + Envelope, Intermediate

Summary

- **4.07**, and if it applies, then anything from **2.04** that is applicable

Measure Package 14.10: Boiler, 96% AFUE NG, Replaces NG Boiler + Envelope, Intermediate

Summary

- **4.08**, and if it applies, then anything from **2.04** that is applicable

Measure Package 14.11: Boiler, 96% AFUE NG, Replaces Propane Boiler if NG Available + Envelope, Intermediate

Summary

- **4.09**, and if it applies, then anything from **2.04** that is applicable

Measure Package 14.12: Boiler, 96% AFUE NG, Replaces Fuel Oil Boiler if NG Available + Envelope, Intermediate

Summary

- **4.10**, and if it applies, then anything from **2.04** that is applicable

Measure Package 14.13: Furnace, 96% AFUE NG, Replaces NG Furnace + Envelope, Advanced

Summary

- **4.05**, and if it applies, then anything from **2.05** that is applicable

Measure Package 14.14: Furnace, 96% AFUE NG, Replaces Propane Furnace if NG Available + Envelope, Advanced

Summary

- **4.06**, and if it applies, then anything from **2.05** that is applicable

Measure Package 14.15: Furnace, 96% AFUE NG, Replaces Fuel Oil Furnace if NG Available + Envelope, Advanced

Summary

- **4.07**, and if it applies, then anything from **2.05** that is applicable

Measure Package 14.16: Boiler, 96% AFUE NG, Replaces NG Boiler + Envelope, Advanced

Summary

- **4.08**, and if it applies, then anything from **2.05** that is applicable

Measure Package 14.17: Boiler, 96% AFUE NG, Replaces Propane Boiler if NG Available + Envelope, Advanced

Summary

- **4.09**, and if it applies, then anything from **2.05** that is applicable

Measure Package 14.18: Boiler, 96% AFUE NG, Replaces Fuel Oil Boiler if NG Available + Envelope, Advanced

Summary

- **4.10**, and if it applies, then anything from **2.05** that is applicable

Measure Category 15: Home Upgrade

Measure Package 15.01: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Elec Heating + HPWH + Envelope, Light Touch

Summary

- **5.01**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.02: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Propane Heating + HPWH + Envelope, Light Touch

Summary

- **5.03**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.03: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing NG Heating + HPWH + Envelope, Light Touch

Summary

- **5.02,** and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.04: ASHP, ENERGY STAR Ducted, Elec Backup, if Existing Fuel Oil Heating + HPWH + Envelope, Light Touch

Summary

- **5.04**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.05: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Elec Heating + HPWH + Envelope, Light Touch

Summary

- **5.13**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.06: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Propane Heating + HPWH + Envelope, Light Touch

Summary

- **5.15**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.07: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing NG Heating + HPWH + Envelope, Light Touch

Summary

- **5.14**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.08: MSHP, ENERGY STAR Ductless, Elec Backup, if Existing Fuel Oil Heating + HPWH + Envelope, Light Touch

Summary

- **5.16**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.09: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Elec Heating + HPWH + Envelope, Light Touch

Summary

- **5.05**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.10: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Propane Heating + HPWH + Envelope, Light Touch

Summary

- **5.07**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.11: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing NG Heating + HPWH + Envelope, Light Touch

Summary

- **5.06**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.12: ASHP, ENERGY STAR Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + HPWH + Envelope, Light Touch

Summary

- **5.08**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.13: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Elec Heating + HPWH + Envelope, Light Touch

Summary

- **5.17**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.14: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Propane Heating + HPWH + Envelope, Light Touch

Summary

- **5.19**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.15: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing NG Heating + HPWH + Envelope, Light Touch

Summary

- **5.18**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.16: MSHP, ENERGY STAR Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + HPWH + Envelope, Light Touch

Summary

- **5.20**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.17: ASHP, ENERGY STAR Ducted, Existing NG Backup + HPWH + Envelope, Light Touch

Summary

- **6.01**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.18: ASHP, ENERGY STAR Ducted, Existing Propane Backup + HPWH + Envelope, Light Touch

Summary

- **6.02**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.19: ASHP, ENERGY STAR Ducted, Existing Fuel Oil Backup + HPWH + Envelope, Light Touch

Summary

- **6.03**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.20: MSHP, ENERGY STAR Ductless, Existing NG Backup + HPWH + Envelope, Light Touch

Summary

- **6.10**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.21: MSHP, ENERGY STAR Ductless, Existing Propane Backup + HPWH + Envelope, Light Touch

Summary

- **6.11**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.22: MSHP, ENERGY STAR Ductless, Existing Fuel Oil Backup + HPWH + Envelope, Light Touch

Summary

- **6.12**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.23: ASHP, ENERGY STAR Cold Climate Ducted, Existing NG Backup + HPWH + Envelope, Light Touch

Summary

- **6.04**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.24: ASHP, ENERGY STAR Cold Climate Ducted, Existing Propane Backup + HPWH + Envelope, Light Touch

Summary

- **6.05**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.25: ASHP, ENERGY STAR Cold Climate Ducted, Existing Fuel Oil Backup + HPWH + Envelope, Light Touch

Summary

- **6.06**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.26: MSHP, ENERGY STAR Cold Climate Ductless, Existing NG Backup + HPWH + Envelope, Light Touch

Summary

- **6.13**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.27: MSHP, ENERGY STAR Cold Climate Ductless, Existing Propane Backup + HPWH + Envelope, Light Touch

Summary

- **6.14**, and if it applies, then anything from **4.04** and **2.03** that is applicable

Measure Package 15.28: MSHP, ENERGY STAR Cold Climate Ductless, Existing Fuel Oil Backup + HPWH + Envelope, Light Touch

Summary

- **6.15**, and if it applies, then anything from **4.04** and **2.03** that is applicable

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Appendix

Measure Package Index

Measure Package	Measure Package Name, Full	Category	Envelope Measure Category	HVAC Measure Category	Appliance Measure Category	Approximate Applicability Rate of Measure Package to National Dataset Sample
Baseline	Baseline	Baseline	None	None	None	100%
1.01	Heating, Replacement	Replacement Heating, Cooling, and Water Heating	None	Heating, Replacement	None	59%
1.02	Cooling, Replacement	Replacement Heating, Cooling, and Water Heating	None	Cooling, Replacement	None	66%
1.03	Heating & Cooling, Replacement	Replacement Heating, Cooling, and Water Heating	None	Heating & Cooling, Replacement	None	81%
1.04	Water Heating, Replacement	Replacement Heating, Cooling, and Water Heating	None	None	Water Heating, Replacement	86%
1.05	Heating, Cooling, & Water Heating, Replacement	Replacement Heating, Cooling, and Water Heating	None	Heating & Cooling, Replacement	Water Heating, Replacement	97%
2.01	Windows, Thin Triple	Envelopes	Windows, Thin Triple	None	None	98%
2.02	Windows, EnergyStar	Envelopes	Windows, EnergyStar	None	None	>99%
2.03	Envelope, Light Touch	Envelopes	Envelope, Light Touch	None	None	82%
2.04	Envelope, Intermediate	Envelopes	Envelope, Intermediate	None	None	91%

2.05	Envelope, Advanced	Envelopes	Envelope, Advanced	None	None	67%
3.01	Appliances, EnergySTAR	Appliances; Pools; Lighting	None	None	Appliances, EnergyStar	97%
3.02	Dryer, Electric, Replaces Non-Electric	Appliances; Pools; Lighting	None	None	Dryer, Electric	17%
3.03	Cooking, Electric, Induction, Replaces Non-Electric	Appliances; Pools; Lighting	None	None	Cooking, Electric, Induction, for Non-Elec	38%
3.04	Cooking, Electric, Conventional, Replaces Non-Electric	Appliances; Pools; Lighting	None	None	Cooking, Electric, Conventional, for Non-Elec	38%
3.05	Pool Heaters, Electric, Replaces Natural Gas	Appliances; Pools; Lighting	None	None	Pool Heaters, Electric	1%
3.06	Spa Heaters, Electric, Replaces Natural Gas	Appliances; Pools; Lighting	None	None	Spa Heaters, Electric	1%
3.07	Lighting, Universal LEDs	Appliances; Pools; Lighting	None	None	Lighting, Universal LEDs	73%
4.01	Cooling, for all Homes without Cooling	Furnace; Boiler; Air Conditioner; HPWH	None	Cooling, Universal	None	10%
4.02	Cooling, EnergySTAR Room AC	Furnace; Boiler; Air Conditioner; HPWH	None	Cooling, Room AC, ES	None	12%
4.03	Cooling, EnergySTAR Central AC	Furnace; Boiler; Air Conditioner; HPWH	None	Cooling, Central AC, ES	None	50%
4.04	Water Heating, HPWH for All	Furnace; Boiler; Air Conditioner; HPWH	None	Furnace/Boiler, 96%	HPWH	>99%
4.05	Furnace, 96% AFUE NG, Replaces NG Furnace	Furnace; Boiler; Air Conditioner; HPWH	None	Furnace/Boiler, 96%	None	42%
4.06	Furnace, 96% AFUE NG, Replaces Propane Furnace if NG Available	Furnace; Boiler; Air Conditioner; HPWH	None	Furnace/Boiler, 96%	None	<1%

4.07	Furnace, 96% AFUE NG, Replaces Fuel Oil Furnace if NG Available	Furnace; Boiler; Air Conditioner; HPWH	None	Furnace/Boiler, 96%	None	<1%
4.08	Boiler, 96% AFUE NG, Replaces NG Boiler	Furnace; Boiler; Air Conditioner; HPWH	None	Furnace/Boiler, 96%	None	3%
4.09	Boiler, 96% AFUE NG, Replaces Propane Boiler if NG Available	Furnace; Boiler; Air Conditioner; HPWH	None	Furnace/Boiler, 96%	None	<1%
4.10	Boiler, 96% AFUE NG, Replaces Fuel Oil Boiler if NG Available	Furnace; Boiler; Air Conditioner; HPWH	None	Furnace/Boiler, 96%	None	<1%
5.01	ASHP, EnergySTAR Ducted, Elec Backup, if Existing Elec Heating	Heat Pump, Electric Backup	None	HP, ES, Elec BU	None	30%
5.02	ASHP, EnergySTAR Ducted, Elec Backup, if Existing NG Heating	Heat Pump, Electric Backup	None	HP, ES, Elec BU	None	44%
5.03	ASHP, EnergySTAR Ducted, Elec Backup, if Existing Propane Heating	Heat Pump, Electric Backup	None	HP, ES, Elec BU	None	2%
5.04	ASHP, EnergySTAR Ducted, Elec Backup, if Existing Fuel Oil Heating	Heat Pump, Electric Backup	None	HP, ES, Elec BU	None	3%
5.05	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Elec Heating	Heat Pump, Electric Backup	None	HP, ES-CC, Elec BU	None	30%
5.06	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing NG Heating	Heat Pump, Electric Backup	None	HP, ES-CC, Elec BU	None	44%
5.07	ASHP, EnergySTAR Cold Climate Ducted, Elec	Heat Pump, Electric Backup	None	HP, ES-CC, Elec BU	None	2%

	Backup, if Existing Propane Heating					
5.08	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating	Heat Pump, Electric Backup	None	HP, ES-CC, Elec BU	None	3%
5.09	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Elec Heating	Heat Pump, Electric Backup	None	HP, HE-CC, Elec BU	None	30%
5.10	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing NG Heating	Heat Pump, Electric Backup	None	HP, HE-CC, Elec BU	None	44%
5.11	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Propane Heating	Heat Pump, Electric Backup	None	HP, HE-CC, Elec BU	None	2%
5.12	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating	Heat Pump, Electric Backup	None	HP, HE-CC, Elec BU	None	3%
5.13	MSHP, EnergySTAR Ductless, Elec Backup, if Existing Elec Heating	Heat Pump, Electric Backup	None	HP, ES, Elec BU	None	9%
5.14	MSHP, EnergySTAR Ductless, Elec Backup, if Existing NG Heating	Heat Pump, Electric Backup	None	HP, ES, Elec BU	None	9%
5.15	MSHP, EnergySTAR Ductless, Elec Backup, if Existing Propane Heating	Heat Pump, Electric Backup	None	HP, ES, Elec BU	None	<1%
5.16	MSHP, EnergySTAR Ductless, Elec Backup, if Existing Fuel Oil Heating	Heat Pump, Electric Backup	None	HP, ES, Elec BU	None	2%

5.17	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Elec Heating	Heat Pump, Electric Backup	None	HP, ES-CC, Elec BU	None	9%
5.18	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing NG Heating	Heat Pump, Electric Backup	None	HP, ES-CC, Elec BU	None	9%
5.19	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Propane Heating	Heat Pump, Electric Backup	None	HP, ES-CC, Elec BU	None	<1%
5.20	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating	Heat Pump, Electric Backup	None	HP, ES-CC, Elec BU	None	2%
5.21	MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Elec Heating	Heat Pump, Electric Backup	None	HP, HE-CC, Elec BU	None	9%
5.22	MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing NG Heating	Heat Pump, Electric Backup	None	HP, HE-CC, Elec BU	None	9%
5.23	MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Propane Heating	Heat Pump, Electric Backup	None	HP, HE-CC, Elec BU	None	<1%
5.24	MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating	Heat Pump, Electric Backup	None	HP, HE-CC, Elec BU	None	2%

6.01	ASHP, EnergySTAR Ducted, Existing NG Backup	Heat Pump, Existing Heating Backup	None	HP, ES, Existing BU	None	43%
6.02	ASHP, EnergySTAR Ducted, Existing Propane Backup	Heat Pump, Existing Heating Backup	None	HP, ES, Existing BU	None	2%
6.03	ASHP, EnergySTAR Ducted, Existing Fuel Oil Backup	Heat Pump, Existing Heating Backup	None	HP, ES, Existing BU	None	3%
6.04	ASHP, EnergySTAR Cold Climate Ducted, Existing NG Backup	Heat Pump, Existing Heating Backup	None	HP, ES-CC, Existing BU	None	43%
6.05	ASHP, EnergySTAR Cold Climate Ducted, Existing Propane Backup	Heat Pump, Existing Heating Backup	None	HP, ES-CC, Existing BU	None	2%
6.06	ASHP, EnergySTAR Cold Climate Ducted, Existing Fuel Oil Backup	Heat Pump, Existing Heating Backup	None	HP, ES-CC, Existing BU	None	3%
6.07	ASHP, Higher Efficiency Cold Climate Ducted, Existing NG Backup	Heat Pump, Existing Heating Backup	None	HP, HE-CC, Existing BU	None	43%
6.08	ASHP, Higher Efficiency Cold Climate Ducted, Existing Propane Backup	Heat Pump, Existing Heating Backup	None	HP, HE-CC, Existing BU	None	2%
6.09	ASHP, Higher Efficiency Cold Climate Ducted, Existing Fuel Oil Backup	Heat Pump, Existing Heating Backup	None	HP, HE-CC, Existing BU	None	3%
6.10	MSHP, EnergySTAR Ductless, Existing NG Backup	Heat Pump, Existing Heating Backup	None	HP, ES, Existing BU	None	5%
6.11	MSHP, EnergySTAR Ductless, Existing Propane Backup	Heat Pump, Existing Heating Backup	None	HP, ES, Existing BU	None	<1%

6.12	MSHP, EnergySTAR Ductless, Existing Fuel Oil Backup	Heat Pump, Existing Heating Backup	None	HP, ES, Existing BU	None	1%
6.13	MSHP, EnergySTAR Cold Climate Ductless, Existing NG Backup	Heat Pump, Existing Heating Backup	None	HP, ES-CC, Existing BU	None	5%
6.14	MSHP, EnergySTAR Cold Climate Ductless, Existing Propane Backup	Heat Pump, Existing Heating Backup	None	HP, ES-CC, Existing BU	None	<1%
6.15	MSHP, EnergySTAR Cold Climate Ductless, Existing Fuel Oil Backup	Heat Pump, Existing Heating Backup	None	HP, ES-CC, Existing BU	None	1%
6.16	MSHP, Higher Efficiency Cold Climate Ductless, Existing NG Backup	Heat Pump, Existing Heating Backup	None	HP, HE-CC, Existing BU	None	5%
6.17	MSHP, Higher Efficiency Cold Climate Ductless, Existing Propane Backup	Heat Pump, Existing Heating Backup	None	HP, HE-CC, Existing BU	None	<1%
6.18	MSHP, Higher Efficiency Cold Climate Ductless, Existing Fuel Oil Backup	Heat Pump, Existing Heating Backup	None	HP, HE-CC, Existing BU	None	1%
7.01	ASHP, EnergySTAR Ducted, Elec Backup, if Existing Elec Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	None	30%
7.02	ASHP, EnergySTAR Ducted, Elec Backup, if Existing NG Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	None	44%
7.03	ASHP, EnergySTAR Ducted, Elec Backup, if Existing Propane Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	None	2%

7.04	ASHP, EnergySTAR Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	None	3%
7.05	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Elec Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	None	30%
7.06	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing NG Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	None	44%
7.07	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Propane Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	None	2%
7.08	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	None	3%
7.09	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Elec Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, HE-CC, Elec BU	None	30%
7.10	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing NG Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, HE-CC, Elec BU	None	44%

7.11	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Propane Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, HE-CC, Elec BU	None	2%
7.12	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, HE-CC, Elec BU	None	3%
7.13	MSHP, EnergySTAR Ductless, Elec Backup, if Existing Elec Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	None	9%
7.14	MSHP, EnergySTAR Ductless, Elec Backup, if Existing NG Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	None	9%
7.15	MSHP, EnergySTAR Ductless, Elec Backup, if Existing Propane Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	None	<1%
7.16	MSHP, EnergySTAR Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	None	2%
7.17	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Elec Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	None	9%
7.18	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing NG	Heat Pump, Electric Backup	Envelope, Light Touch	HP, ES-CC, Elec BU	None	9%

	Heating + Envelope, Light Touch	with Envelope, Light Touch				
7.19	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Propane Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	None	<1%
7.20	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	None	2%
7.21	MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Elec Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, HE-CC, Elec BU	None	9%
7.22	MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing NG Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, HE-CC, Elec BU	None	9%
7.23	MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Propane Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, HE-CC, Elec BU	None	<1%
7.24	MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Light Touch	Heat Pump, Electric Backup with Envelope, Light Touch	Envelope, Light Touch	HP, HE-CC, Elec BU	None	2%
8.01	ASHP, EnergySTAR Ducted, Elec Backup, if	Heat Pump, Electric Backup	Envelope, Intermediate	HP, ES, Elec BU	None	30%

	Existing Elec Heating + Envelope, Intermediate	with Envelope, Intermediate				
8.02	ASHP, EnergySTAR Ducted, Elec Backup, if Existing NG Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES, Elec BU	None	44%
8.03	ASHP, EnergySTAR Ducted, Elec Backup, if Existing Propane Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES, Elec BU	None	2%
8.04	ASHP, EnergySTAR Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES, Elec BU	None	3%
8.05	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Elec Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES-CC, Elec BU	None	30%
8.06	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing NG Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES-CC, Elec BU	None	44%
8.07	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Propane Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES-CC, Elec BU	None	2%
8.08	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES-CC, Elec BU	None	3%

8.09	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Elec Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, HE-CC, Elec BU	None	30%
8.10	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing NG Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, HE-CC, Elec BU	None	44%
8.11	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Propane Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, HE-CC, Elec BU	None	2%
8.12	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, HE-CC, Elec BU	None	3%
8.13	MSHP, EnergySTAR Ductless, Elec Backup, if Existing Elec Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES, Elec BU	None	9%
8.14	MSHP, EnergySTAR Ductless, Elec Backup, if Existing NG Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES, Elec BU	None	9%
8.15	MSHP, EnergySTAR Ductless, Elec Backup, if Existing Propane Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES, Elec BU	None	<1%
8.16	MSHP, EnergySTAR Ductless, Elec Backup, if	Heat Pump, Electric Backup	Envelope, Intermediate	HP, ES, Elec BU	None	2%

	Existing Fuel Oil Heating + Envelope, Intermediate	with Envelope, Intermediate				
8.17	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Elec Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES-CC, Elec BU	None	9%
8.18	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing NG Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES-CC, Elec BU	None	9%
8.19	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Propane Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES-CC, Elec BU	None	<1%
8.20	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES-CC, Elec BU	None	2%
8.21	MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Elec Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, HE-CC, Elec BU	None	9%
8.22	MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing NG Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, HE-CC, Elec BU	None	9%
8.23	MSHP, Higher Efficiency Cold Climate Ductless,	Heat Pump, Electric Backup	Envelope, Intermediate	HP, HE-CC, Elec BU	None	<1%

	Elec Backup, if Existing Propane Heating + Envelope, Intermediate	with Envelope, Intermediate				
8.24	MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Intermediate	Heat Pump, Electric Backup with Envelope, Intermediate	Envelope, Intermediate	HP, HE-CC, Elec BU	None	2%
9.01	ASHP, EnergySTAR Ducted, Elec Backup, if Existing Elec Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES, Elec BU	None	30%
9.02	ASHP, EnergySTAR Ducted, Elec Backup, if Existing NG Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES, Elec BU	None	44%
9.03	ASHP, EnergySTAR Ducted, Elec Backup, if Existing Propane Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES, Elec BU	None	2%
9.04	ASHP, EnergySTAR Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES, Elec BU	None	3%
9.05	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Elec Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES-CC, Elec BU	None	30%
9.06	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing NG Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES-CC, Elec BU	None	44%

9.07	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Propane Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES-CC, Elec BU	None	2%
9.08	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES-CC, Elec BU	None	3%
9.09	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Elec Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, HE-CC, Elec BU	None	30%
9.10	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing NG Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, HE-CC, Elec BU	None	44%
9.11	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Propane Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, HE-CC, Elec BU	None	2%
9.12	ASHP, Higher Efficiency Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, HE-CC, Elec BU	None	3%
9.13	MSHP, EnergySTAR Ductless, Elec Backup, if Existing Elec Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES, Elec BU	None	9%

9.14	MSHP, EnergySTAR Ductless, Elec Backup, if Existing NG Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES, Elec BU	None	9%
9.15	MSHP, EnergySTAR Ductless, Elec Backup, if Existing Propane Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES, Elec BU	None	<1%
9.16	MSHP, EnergySTAR Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES, Elec BU	None	2%
9.17	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Elec Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES-CC, Elec BU	None	9%
9.18	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing NG Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES-CC, Elec BU	None	9%
9.19	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Propane Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES-CC, Elec BU	None	<1%
9.20	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, ES-CC, Elec BU	None	2%
9.21	MSHP, Higher Efficiency Cold Climate Ductless,	Heat Pump, Electric Backup	Envelope, Advanced	HP, HE-CC, Elec BU	None	9%

	Elec Backup, if Existing Elec Heating + Envelope, Advanced	with Envelope, Advanced				
9.22	MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing NG Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, HE-CC, Elec BU	None	9%
9.23	MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Propane Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, HE-CC, Elec BU	None	<1%
9.24	MSHP, Higher Efficiency Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + Envelope, Advanced	Heat Pump, Electric Backup with Envelope, Advanced	Envelope, Advanced	HP, HE-CC, Elec BU	None	2%
10.01	ASHP, EnergySTAR Ducted, Existing NG Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Existing BU	None	43%
10.02	ASHP, EnergySTAR Ducted, Existing Propane Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Existing BU	None	2%
10.03	ASHP, EnergySTAR Ducted, Existing Fuel Oil Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Existing BU	None	3%

10.04	ASHP, EnergySTAR Cold Climate Ducted, Existing NG Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Existing BU	None	43%
10.05	ASHP, EnergySTAR Cold Climate Ducted, Existing Propane Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Existing BU	None	2%
10.06	ASHP, EnergySTAR Cold Climate Ducted, Existing Fuel Oil Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Existing BU	None	3%
10.07	ASHP, Higher Efficiency Cold Climate Ducted, Existing NG Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, HE-CC, Existing BU	None	43%
10.08	ASHP, Higher Efficiency Cold Climate Ducted, Existing Propane Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, HE-CC, Existing BU	None	2%
10.09	ASHP, Higher Efficiency Cold Climate Ducted, Existing Fuel Oil Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, HE-CC, Existing BU	None	3%
10.10	MSHP, EnergySTAR Ductless, Existing NG Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with	Envelope, Light Touch	HP, ES, Existing BU	None	5%

		Envelope, Light Touch				
10.11	MSHP, EnergySTAR Ductless, Existing Propane Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Existing BU	None	<1%
10.12	MSHP, EnergySTAR Ductless, Existing Fuel Oil Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Existing BU	None	1%
10.13	MSHP, EnergySTAR Cold Climate Ductless, Existing NG Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Existing BU	None	5%
10.14	MSHP, EnergySTAR Cold Climate Ductless, Existing Propane Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Existing BU	None	<1%
10.15	MSHP, EnergySTAR Cold Climate Ductless, Existing Fuel Oil Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Existing BU	None	1%
10.16	MSHP, Higher Efficiency Cold Climate Ductless, Existing NG Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, HE-CC, Existing BU	None	5%
10.17	MSHP, Higher Efficiency Cold Climate Ductless,	Heat Pump, Existing Heating	Envelope, Light Touch	HP, HE-CC, Existing BU	None	<1%

	Existing Propane Backup + Envelope, Light Touch	Backup with Envelope, Light Touch				
10.18	MSHP, Higher Efficiency Cold Climate Ductless, Existing Fuel Oil Backup + Envelope, Light Touch	Heat Pump, Existing Heating Backup with Envelope, Light Touch	Envelope, Light Touch	HP, HE-CC, Existing BU	None	1%
11.01	ASHP, EnergySTAR Ducted, Existing NG Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES, Existing BU	None	43%
11.02	ASHP, EnergySTAR Ducted, Existing Propane Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES, Existing BU	None	2%
11.03	ASHP, EnergySTAR Ducted, Existing Fuel Oil Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES, Existing BU	None	3%
11.04	ASHP, EnergySTAR Cold Climate Ducted, Existing NG Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES-CC, Existing BU	None	43%
11.05	ASHP, EnergySTAR Cold Climate Ducted, Existing Propane Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES-CC, Existing BU	None	2%

11.06	ASHP, EnergySTAR Cold Climate Ducted, Existing Fuel Oil Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES-CC, Existing BU	None	3%
11.07	ASHP, Higher Efficiency Cold Climate Ducted, Existing NG Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, HE-CC, Existing BU	None	43%
11.08	ASHP, Higher Efficiency Cold Climate Ducted, Existing Propane Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, HE-CC, Existing BU	None	2%
11.09	ASHP, Higher Efficiency Cold Climate Ducted, Existing Fuel Oil Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, HE-CC, Existing BU	None	3%
11.10	MSHP, EnergySTAR Ductless, Existing NG Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES, Existing BU	None	5%
11.11	MSHP, EnergySTAR Ductless, Existing Propane Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES, Existing BU	None	<1%
11.12	MSHP, EnergySTAR Ductless, Existing Fuel Oil Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with	Envelope, Intermediate	HP, ES, Existing BU	None	1%

		Envelope, Intermediate				
11.13	MSHP, EnergySTAR Cold Climate Ductless, Existing NG Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES-CC, Existing BU	None	5%
11.14	MSHP, EnergySTAR Cold Climate Ductless, Existing Propane Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES-CC, Existing BU	None	<1%
11.15	MSHP, EnergySTAR Cold Climate Ductless, Existing Fuel Oil Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, ES-CC, Existing BU	None	1%
11.16	MSHP, Higher Efficiency Cold Climate Ductless, Existing NG Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, HE-CC, Existing BU	None	5%
11.17	MSHP, Higher Efficiency Cold Climate Ductless, Existing Propane Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, HE-CC, Existing BU	None	<1%
11.18	MSHP, Higher Efficiency Cold Climate Ductless, Existing Fuel Oil Backup + Envelope, Intermediate	Heat Pump, Existing Heating Backup with Envelope, Intermediate	Envelope, Intermediate	HP, HE-CC, Existing BU	None	1%
12.01	ASHP, EnergySTAR Ducted, Existing NG	Heat Pump, Existing Heating	Envelope, Advanced	HP, ES, Existing BU	None	43%

	Backup + Envelope, Advanced	Backup with Envelope, Advanced				
12.02	ASHP, EnergySTAR Ducted, Existing Propane Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, ES, Existing BU	None	2%
12.03	ASHP, EnergySTAR Ducted, Existing Fuel Oil Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, ES, Existing BU	None	3%
12.04	ASHP, EnergySTAR Cold Climate Ducted, Existing NG Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, ES-CC, Existing BU	None	43%
12.05	ASHP, EnergySTAR Cold Climate Ducted, Existing Propane Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, ES-CC, Existing BU	None	2%
12.06	ASHP, EnergySTAR Cold Climate Ducted, Existing Fuel Oil Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, ES-CC, Existing BU	None	3%
12.07	ASHP, Higher Efficiency Cold Climate Ducted, Existing NG Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, HE-CC, Existing BU	None	43%

12.08	ASHP, Higher Efficiency Cold Climate Ducted, Existing Propane Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, HE-CC, Existing BU	None	2%
12.09	ASHP, Higher Efficiency Cold Climate Ducted, Existing Fuel Oil Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, HE-CC, Existing BU	None	3%
12.10	MSHP, EnergySTAR Ductless, Existing NG Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, ES, Existing BU	None	5%
12.11	MSHP, EnergySTAR Ductless, Existing Propane Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, ES, Existing BU	None	<1%
12.12	MSHP, EnergySTAR Ductless, Existing Fuel Oil Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, ES, Existing BU	None	1%
12.13	MSHP, EnergySTAR Cold Climate Ductless, Existing NG Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, ES-CC, Existing BU	None	5%
12.14	MSHP, EnergySTAR Cold Climate Ductless, Existing Propane Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with	Envelope, Advanced	HP, ES-CC, Existing BU	None	<1%

		Envelope, Advanced				
12.15	MSHP, EnergySTAR Cold Climate Ductless, Existing Fuel Oil Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, ES-CC, Existing BU	None	1%
12.16	MSHP, Higher Efficiency Cold Climate Ductless, Existing NG Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, HE-CC, Existing BU	None	5%
12.17	MSHP, Higher Efficiency Cold Climate Ductless, Existing Propane Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, HE-CC, Existing BU	None	<1%
12.18	MSHP, Higher Efficiency Cold Climate Ductless, Existing Fuel Oil Backup + Envelope, Advanced	Heat Pump, Existing Heating Backup with Envelope, Advanced	Envelope, Advanced	HP, HE-CC, Existing BU	None	1%
13.01	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Elec Heating + HPWH	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	HP, ES-CC, Elec BU	HPWH	30%
13.02	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing NG Heating + HPWH	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	HP, ES-CC, Elec BU	HPWH	44%
13.03	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Propane Heating + HPWH	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	HP, ES-CC, Elec BU	HPWH	2%

13.04	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + HPWH	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	HP, ES-CC, Elec BU	HPWH	3%
13.05	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Elec Heating + HPWH	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	HP, ES-CC, Elec BU	HPWH	9%
13.06	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing NG Heating + HPWH	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	HP, ES-CC, Elec BU	HPWH	9%
13.07	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Propane Heating + HPWH	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	HP, ES-CC, Elec BU	HPWH	<1%
13.08	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Fuel Oil Heating + HPWH	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	HP, ES-CC, Elec BU	HPWH	2%
13.09	ASHP, EnergySTAR Cold Climate Ducted, Existing NG Backup + HPWH	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	HP, ES-CC, Existing BU	HPWH	43%
13.10	ASHP, EnergySTAR Cold Climate Ducted, Existing Propane Backup + HPWH	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	HP, ES-CC, Existing BU	HPWH	2%
13.11	ASHP, EnergySTAR Cold Climate Ducted, Existing Fuel Oil Backup + HPWH	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	HP, ES-CC, Existing BU	HPWH	3%
13.12	MSHP, EnergySTAR Cold Climate Ductless, Existing NG Backup + HPWH	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	HP, ES-CC, Existing BU	HPWH	5%

13.13	MSHP, EnergySTAR Cold Climate Ductless, Existing Propane Backup + HPWH	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	HP, ES-CC, Existing BU	HPWH	<1%
13.14	MSHP, EnergySTAR Cold Climate Ductless, Existing Fuel Oil Backup + HPWH	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	HP, ES-CC, Existing BU	HPWH	1%
13.15	HPWH + Light Touch Envelope	HPWH with Heat Pump; Furnace; Boiler; or Envelope	Envelope, Light Touch	None	HPWH	>99%
13.16	HPWH + Intermediate Envelope	HPWH with Heat Pump; Furnace; Boiler; or Envelope	Envelope, Intermediate	None	HPWH	>99%
13.17	HPWH + Advanced Envelope	HPWH with Heat Pump; Furnace; Boiler; or Envelope	Envelope, Advanced	None	HPWH	>99%
13.18	HPWH + 96% AFUE natural gas furnace	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	Furnace/Boiler, 96%	HPWH	42%
13.19	HPWH + 96% AFUE natural gas boiler	HPWH with Heat Pump; Furnace; Boiler; or Envelope	None	Furnace/Boiler, 96%	HPWH	3%
14.01	Furnace, 96% AFUE NG, Replaces NG Furnace + Envelope, Light Touch	Furnace or Boiler with Envelope	Envelope, Light Touch	Furnace/Boiler, 96%	None	42%
14.02	Furnace, 96% AFUE NG, Replaces Propane Furnace if NG Available + Envelope, Light Touch	Furnace or Boiler with Envelope	Envelope, Light Touch	Furnace/Boiler, 96%	None	<1%
14.03	Furnace, 96% AFUE NG, Replaces Fuel Oil Furnace if NG Available + Envelope, Light Touch	Furnace or Boiler with Envelope	Envelope, Light Touch	Furnace/Boiler, 96%	None	<1%

14.04	Boiler, 96% AFUE NG, Replaces NG Boiler + Envelope, Light Touch	Furnace or Boiler with Envelope	Envelope, Light Touch	Furnace/Boiler, 96%	None	3%
14.05	Boiler, 96% AFUE NG, Replaces Propane Boiler if NG Available + Envelope, Light Touch	Furnace or Boiler with Envelope	Envelope, Light Touch	Furnace/Boiler, 96%	None	<1%
14.06	Boiler, 96% AFUE NG, Replaces Fuel Oil Boiler if NG Available + Envelope, Light Touch	Furnace or Boiler with Envelope	Envelope, Light Touch	Furnace/Boiler, 96%	None	<1%
14.07	Furnace, 96% AFUE NG, Replaces NG Furnace + Envelope, Intermediate	Furnace or Boiler with Envelope	Envelope, Intermediate	Furnace/Boiler, 96%	None	42%
14.08	Furnace, 96% AFUE NG, Replaces Propane Furnace if NG Available + Envelope, Intermediate	Furnace or Boiler with Envelope	Envelope, Intermediate	Furnace/Boiler, 96%	None	<1%
14.09	Furnace, 96% AFUE NG, Replaces Fuel Oil Furnace if NG Available + Envelope, Intermediate	Furnace or Boiler with Envelope	Envelope, Intermediate	Furnace/Boiler, 96%	None	<1%
14.10	Boiler, 96% AFUE NG, Replaces NG Boiler + Envelope, Intermediate	Furnace or Boiler with Envelope	Envelope, Intermediate	Furnace/Boiler, 96%	None	3%
14.11	Boiler, 96% AFUE NG, Replaces Propane Boiler if NG Available + Envelope, Intermediate	Furnace or Boiler with Envelope	Envelope, Intermediate	Furnace/Boiler, 96%	None	<1%
14.12	Boiler, 96% AFUE NG, Replaces Fuel Oil Boiler if NG Available + Envelope, Intermediate	Furnace or Boiler with Envelope	Envelope, Intermediate	Furnace/Boiler, 96%	None	<1%

14.13	Furnace, 96% AFUE NG, Replaces NG Furnace + Envelope, Advanced	Furnace or Boiler with Envelope	Envelope, Advanced	Furnace/Boiler, 96%	None	42%
14.14	Furnace, 96% AFUE NG, Replaces Propane Furnace if NG Available + Envelope, Advanced	Furnace or Boiler with Envelope	Envelope, Advanced	Furnace/Boiler, 96%	None	<1%
14.15	Furnace, 96% AFUE NG, Replaces Fuel Oil Furnace if NG Available + Envelope, Advanced	Furnace or Boiler with Envelope	Envelope, Advanced	Furnace/Boiler, 96%	None	<1%
14.16	Boiler, 96% AFUE NG, Replaces NG Boiler + Envelope, Advanced	Furnace or Boiler with Envelope	Envelope, Advanced	Furnace/Boiler, 96%	None	3%
14.17	Boiler, 96% AFUE NG, Replaces Propane Boiler if NG Available + Envelope, Advanced	Furnace or Boiler with Envelope	Envelope, Advanced	Furnace/Boiler, 96%	None	<1%
14.18	Boiler, 96% AFUE NG, Replaces Fuel Oil Boiler if NG Available + Envelope, Advanced	Furnace or Boiler with Envelope	Envelope, Advanced	Furnace/Boiler, 96%	None	<1%
15.01	ASHP, EnergySTAR Ducted, Elec Backup, if Existing Elec Heating + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	HPWH	30%
15.02	ASHP, EnergySTAR Ducted, Elec Backup, if Existing Propane Heating + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	HPWH	2%
15.03	ASHP, EnergySTAR Ducted, Elec Backup, if	Heat Pump with HPWH with	Envelope, Light Touch	HP, ES, Elec BU	HPWH	44%

	Existing NG Heating + HPWH + Envelope, Light Touch	Envelope, Light Touch				
15.04	ASHP, EnergySTAR Ducted, Elec Backup, if Existing Fuel Oil Heating + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	HPWH	3%
15.05	MSHP, EnergySTAR Ductless, Elec Backup, if Existing Elec Heating + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	HPWH	9%
15.06	MSHP, EnergySTAR Ductless, Elec Backup, if Existing Propane Heating + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	HPWH	<1%
15.07	MSHP, EnergySTAR Ductless, Elec Backup, if Existing NG Heating + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	HPWH	9%
15.08	MSHP, EnergySTAR Ductless, Elec Backup, if Existing Fuel Oil Heating + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Elec BU	HPWH	2%
15.09	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Elec Heating + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	HPWH	30%

15.10	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Propane Heating + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	HPWH	2%
15.11	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing NG Heating + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	HPWH	44%
15.12	ASHP, EnergySTAR Cold Climate Ducted, Elec Backup, if Existing Fuel Oil Heating + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	HPWH	3%
15.13	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Elec Heating + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	HPWH	9%
15.14	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Propane Heating + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	HPWH	<1%
15.15	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing NG Heating + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	HPWH	9%
15.16	MSHP, EnergySTAR Cold Climate Ductless, Elec Backup, if Existing Fuel Oil	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	HPWH	2%

	Heating + HPWH + Envelope, Light Touch					
15.17	ASHP, EnergySTAR Ducted, Existing NG Backup + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Elec BU	HPWH	43%
15.18	ASHP, EnergySTAR Ducted, Existing Propane Backup + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Existing BU	HPWH	2%
15.19	ASHP, EnergySTAR Ducted, Existing Fuel Oil Backup + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Existing BU	HPWH	3%
15.20	MSHP, EnergySTAR Ductless, Existing NG Backup + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Existing BU	HPWH	5%
15.21	MSHP, EnergySTAR Ductless, Existing Propane Backup + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Existing BU	HPWH	<1%
15.22	MSHP, EnergySTAR Ductless, Existing Fuel Oil Backup + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES, Existing BU	HPWH	1%
15.23	ASHP, EnergySTAR Cold Climate Ducted, Existing NG Backup + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Existing BU	HPWH	43%
15.24	ASHP, EnergySTAR Cold Climate Ducted, Existing Propane Backup + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Existing BU	HPWH	2%

15.25	ASHP, EnergySTAR Cold Climate Ducted, Existing Fuel Oil Backup + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Existing BU	HPWH	3%
15.26	MSHP, EnergySTAR Cold Climate Ductless, Existing NG Backup + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Existing BU	HPWH	5%
15.27	MSHP, EnergySTAR Cold Climate Ductless, Existing Propane Backup + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Existing BU	HPWH	<1%
15.28	MSHP, EnergySTAR Cold Climate Ductless, Existing Fuel Oil Backup + HPWH + Envelope, Light Touch	Heat Pump with HPWH with Envelope, Light Touch	Envelope, Light Touch	HP, ES-CC, Existing BU	HPWH	1%