

APPENDIX 7-A. RECS 2005 VARIABLES AND VALUES

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APPENDIX 7-A. RECS 2005 VARIABLES AND VALUES

7-A.1 INTRODUCTION

Using Microsoft ACCESS, DOE created a database containing a subset of the records and variables from DOE's Energy Information Administration (EIA)'s RECS 2005.¹ DOE used this RECS subset in the life-cycle cost (LCC) analysis of the Furnace Fan Rulemaking. This appendix explains the variable name abbreviations and provides definitions of the variable values. For the entire RECS 2005 dataset, refer to <http://www.eia.doe.gov/emeu/recs/recspubuse05/pubuse05.html>.

7-A.2 SAMPLE DETERMINATION

The subset of RECS 2005 records used to study furnace fans met all of the following criteria:

- used a furnace as the main or secondary source of heat;
- used a heating fuel that is natural gas, liquefied petroleum gas (LPG), fuel oil, or electricity;
- heated only one housing unit; and
- had an energy consumption greater than zero.

DOE divided the furnace subset into several subsets designed to include households that use one of the three furnace product classes (Table 7-A.2.1).

The RECS 2005 weighting indicates how commonly each household configuration occurs in the general population. DOE made some adjustments to EIA's weightings for each RECS 2005 household in order to create a furnace fan population weight for 2018. The first adjustment was to compensate for the fact that the RECS 2005 sample does not distinguish between weatherized and non-weatherized gas furnaces. Therefore, to account for the furnace fans associated with non-weatherized gas furnaces, DOE assumed that a fraction of the households in the south with both a central air conditioner and gas furnace were using weatherized furnaces. Based on AHRI shipment data for weatherized and non-weatherized furnaces (which shows that about 10% of total furnace shipments are weatherized furnaces), DOE multiplied the RECS 2005 weight for households in the south region with both a central air conditioner and gas furnace by 0.80.² It was assumed that 25 percent of the south region shipments would be condensing by 2018, therefore 25 percent of the households in the south were assigned to the non-weatherized non-condensing furnace fans product class.

DOE also took into account the growth in population by region from 2005 to 2018 based on U.S. census population projections.³ Finally, DOE adjusted the weightings to account for households with multiple furnaces. According to the 2008 American Comfort Survey, 7 percent of households in the U.S. have multiple gas furnaces.⁴ For the sake of simplicity, DOE assumed that these households had two furnaces. Therefore, for 7 percent of the households, the weighting

was doubled, so it could be representative of the furnace weight. DOE believes that the household records, along with their adjusted weightings, are representative of housing nationwide in 2018.

Table 7-A.2.1 Selection of RECS 2005 Records for Furnace Fans

Product Class	Algorithm	No. of Records	RECS 2005	DOE 2018
			Number of Houses <i>million</i>	Number of Furnaces <i>million</i>
Non-Weatherized, Non-Condensing Gas Furnace Fan	Primary or Secondary Heating Equipment = Gas Furnace ^a Region = South Housing Type = non-mobile home	736	19.6	14.5
Non-Weatherized, Condensing Gas Furnace Fan	Primary or Secondary Heating Equipment = Gas Furnace Housing Type = non-mobile home	1726	45.5	35.6
Weatherized Gas Furnace Fan	Primary or Secondary Heating Equipment = Gas Furnace Region = South Housing Type = non-mobile home Primary or Secondary Cooling Equipment = Central Air Conditioner	565	15.6	3.6
Oil Furnace Fan	Primary or Secondary Heating Equipment = Oil Furnace Housing Type = non-mobile home	150	2.9	3.3
Electric Furnace / Modular Blower Fan	Primary or Secondary Heating Equipment = Electric Furnace Housing Type = non-mobile home	576	15.4	17.9
Manufactured Home Non-Weatherized, Non-Condensing Gas Furnace Fan	Primary or Secondary Heating Equipment = Gas Furnace Region = South Housing Type = mobile home	51	1.2	1.2
Manufactured Home Non-Weatherized, Condensing Gas Furnace Fan	Primary or Secondary Heating Equipment = Gas Furnace Housing Type = mobile home	109	2.5	1.6
Manufactured Home Electric Furnace / Modular Blower Fan	Primary or Secondary Heating Equipment = Electric Furnace Housing Type = mobile home	68	1.9	2.1
Hydronic Air Handler Fan (Heat/Cool)	Primary or Secondary Heating Equipment = Gas Furnace Region = South Housing Type = non-mobile home Primary or Secondary Cooling Equipment = Central Air Conditioner Water Heater Equipment = Gas Water Heater Household Square Footage <2000 sq ft	40	1.3	0.8

^a Natural Gas or LPG Furnace.

Table 7-A.2.2 lists the variables use in the analysis.

Table 7-A.2.2 List of RECS 2005 Variables Used for Furnace Fans

Variable	Description
Location Variables	
REGIONC	Census region
DIVISION	Census division
LRGSTATE	Four largest states
CD65	Cool Deg-Days: Base65 01 TO 12-2005 (Inoculated)
HD65	Heat Deg-Days: Base65 01 TO 12-2005 (Inoculated)
Household Characteristics Variables	
DOEID	4-digit identification number
NWEIGHT	The Final Weight
TYPEHUQ	Type of Home (Respondent answer)
YEARMADE	Year Home Built
STORIES	Reported Stories in Housing Unit
BTUNGSPH	Natural Gas Space Heat Use (Estimated)
BTULPSPH	LPG Space Heat Use (Estimated)
BTUFOSPH	Fuel Oil Space Heat Use (Estimated)
BTUELCOL	Electric AC Use (Estimated)
EQUIPM	Type of heating equipment provides the heat
FUELHEAT	Main fuel used for heating home
HEATOTH	Main heating system also heat other apartments
DNTHEAT	Have any heating equipment Use it or not
HEATOFF	Number of rooms not heated last winter
WARMAIR	Sec Ht Eqp Central warm-air furnace with ducts
FURNFUEL	What fuel used in secondary warm air furnace
REVERSE	Sec Ht Eqp Heat pump
EQUIPAGE	How old is equipment identified in D-2 heat system
EQUIPAUX	Use any other types of equipment to heat home

UGASAUX	Secondary heating fuel - Natural Gas
LPGAUX	Secondary heating fuel - LPG
FOILAU	Secondary heating fuel - Fuel Oil
ELECAUX	Secondary heating fuel - Electricity
EQMAMT	How much heat main heating equipment provides
NUMTHERM	How many thermostats are used
COOLTYPE	What kind of air-conditioning equipment you have
CENACHP	Is your central AC system a heat pump
USECENAC	How household uses central AC during the summer
AGECENAC	How old is your households central AC equipment
ACOTHERS	The central AC also cool apartments condos
NUMBERAC	Number of window or wall AC units in your home
USEWWAC	How household uses window AC
WWACAGE	How old is households most-used window/wall unit
FUELH2O	Fuel used for heating water washing or bathing
WHEATOTH	Main equipment also heat water for apartments
WHEATSIZ	Size of households main water heater tank
NCOMBATH	Number of Complete Baths
WHEATAGE	How old is your households main water heater
WeatherLocationID	Weather Location ID based on closest fit of HDD and CDD*
TOTSQFT	Total square footage
TOTHSQFT	Total heated square footage
TOTCSQFT	Total air-conditional square footage
NHSLDMEM	How many people normally live in this household
NUMTHERM	How many thermostats are used
Seniors	Senior Only Household*
POOR100	Below 100 percent of poverty
HHINCOME	Mid-point of MONEYPY range

* Not part of RECS 2005 variables.

7-A.3 RECS 2005 DATABASE VARIABLE RESPONSE CODES

Table 7-A.3.1 provides the response codes for all RECS 2005 variables used in the Heating Products samples.

Table 7-A.3.1 Definitions of RECS 2005 Variables Used in Life-Cycle Cost Analysis

Variable	Definition
ACOTHERS	The central AC also cool apartments condos 1 = Yes 0 = No 9 = Legitimate Skip
AGECENAC	How old is your households central AC equipment 1 = Less than 2 years old 2 = 2 to 4 years old 3 = 5 to 9 years old 4 = 10 to 19 years old 5 = 20 years or older 96 = Don't know 99 = Legitimate skip
BTUELCOL	Electric AC use estimated (in thousands of BTU 1- 9999998) 9999999=Not Applicable
BTUFOSPH	Fuel Oil Space Heat use estimated (in thousands of BTU 1- 9999998) 9999999=Not Applicable
BTULPSPH	LPG space heating use estimated (in thousands of BTU 1- 9999998) 9999999=Not Applicable
BTUNGSPH	Natural gas space heating use estimated (in thousands of BTU 1- 9999998) 9999999=Not Applicable
CD65	Number of degree days
CELLAR	Home has a basement 1 = Yes 0 = No 9 = Legitimate Skip
CENACHP	Is your central AC system a heat pump 1 = Yes 0 = No 9 = Legitimate Skip
COOLTYPE	What kind of air-conditioning equipment you have 1 = A central system 2 = Individual units in the window or walls 3 = Both central and individual units 9 = Legitimate skip

DIVISION	Census division 1 = New England 2 = Middle Atlantic 3 = East North Central 4 = West North Central 5 = South Atlantic 6 = East South Central 7 = West South Central 8 = Mountain 9 = Pacific
DNTHEAT	Have any heating equipment Use it or not 1 = Have equipment, but don't use it 2 = Don't have any heating equipment 9 = Legitimate skip
DOEID	Sample ID (1-4382)
ELECAUX	Secondary heating fuel - Electricity 1 = Yes 2 = No
EQMAMT	How much heat main heating equipment provides 1 = Almost all 2 = About three-fourths 3 = Closer to half 9 = Legitimate Skip
EQUIPAGE	Age of main heating equipment 1 = Less than 2 years old 2 = 2 to 4 years old 3 = 5 to 9 years old 4 = 10 to 19 years old 5 = 20 years or older 6 = Don't know 9 = Legitimate Skip
EQUIPAUX	Use any other types of equipment to heat home 1 = Yes 2 = No

EQUIPM	<p>Type of heating equipment provides the heat</p> <ul style="list-style-type: none"> 4 = Heat pump 3 = Central warm-air furnace with ducts 2 = Steam/hot water system with radiators 5 = Built-in electric units installed in walls 6 = Built-in floor/wall pipeless furnace 7 = Built-in heater burning gas, oil, kerosene 8 = Heating stove burning wood, coal, coke 10 = Portable electric heaters 11 = Portable kerosene heaters 9 = Fireplace 12 = Cooking stove used to heat and cook 14 = Geothermal heat pump 21 = Equipment not listed 00 = No heating equipment used
FOILAU	<p>Secondary heating fuel - Fuel Oil</p> <ul style="list-style-type: none"> 1 = Yes 2 = No
FUELH2O	<p>Fuel used for heating water</p> <ul style="list-style-type: none"> 1 = Natural gas from underground pipes 2 = Bottled gas (LPG or propane) 3 = Fuel oil 4 = Kerosene 5 = Electricity 7 = Wood 8 = Solar 21 = Other 95 = Don't use hot water
FUELHEAT	<p>Main fuel used for heating home</p> <ul style="list-style-type: none"> 1 = Natural gas from underground pipes 2 = Bottled gas (LPG or propane) 3 = Fuel oil 4 = Kerosene 5 = Electricity 7 = Wood 8 = Solar 9 = District steam 10 = Coal 21 = Other 99 = Don't heat home

FURNFUEL	What fuel used in secondary warm air furnace 1 = Natural gas from underground pipes 2 = Bottled Gas (LPG or Propane) 3 = Fuel oil 4 = Kerosene 5 = Electricity 7 = Wood 8 = Solar 21 = Other 99 = Legitimate Skip
HD65	Number of degree days
HEATOFF	Number of rooms not heated last winter 0 = Turned off all the time 1 = Turned on only a few days or nights 2 = Turned on quite a bit 3 = Turned on just about all winter 9 = Legitimate skip
HEATOTH	Does the main space heating equipment also heat other residences? 1 = Yes 0 = No
HHINCOME	Number of dollars (0-120.000)
LPGAUX	Secondary heating fuel - LPG 1 = Yes 0 = No
LRGSTATE	Large state designation 0 = Other 1 = New York State 2 = California 3 = Texas 4 = Florida
NCOMBATH	Number of Full Bathrooms (0-9)
NHSLDMEM	Number that live in household (1-15)
NUMBERAC	Number of window or wall AC units (0-15) 99 = Legitimate skip
NUMTHERM	How many thermostats are used 1 = Yes 0 = No 9 = Legitimate skip
NWEIGHT	Sample weight
POOR100	Household is below 100 percent of poverty 1 = Poor 100% 0 = Nonpoor
REGIONC	Census region 1 = Northeast 2 = Midwest 3 = South 4 = West

REVERSE	See Ht Eqp Heat Pump 1 = Yes 0 = No 9 = Legitimate skip
STORIES	Reported Stories in Housing Unit 10 = One story 20 = Two stories 31 = Three stories 32 = Four or more stories 40 = Split-level 55 = Some other type 99 = Legitimate skip
TOTCSQFT	Total air-conditional number of square feet (0-9999)
TOTHSQFT	Total heated number of square feet (0-9999)
TOTSQFT	Total number of square feet (0-9999)
TYPEHUQ	Respondents reported type of home 1 = Mobile Home 2 = Single-family detached house 3 = Single-family attached house 4 = Apartment building with 2-4 units 5 = Apartment building with 5 or more units
UGASAUX	Secondary heating fuel - Natural Gas 1 = Yes 0 = No
USECENAC	How household uses central AC during the summer 0 = Not used at all 1 = Turned on only a few days or nights 2 = Turned on quite a bit 3 = Turned on just about all summer 9 = Legitimate skip
USEWWAC	How household uses window AC 0 = Not used at all 1 = Turned on only a few days or nights 2 = Turned on quite a bit 3 = Turned of just about all summer 9 = Legitimate skip
WARMAIR	Sec Ht Eqp Central warm-air furnace with ducts 1 = Yes 2 = No 9 = Legitimate skip
WeatherLocationID	Weather Location ID based on closest fit of HDD and CDD*

WHEATAGE	How old is your household's main water heater 0 = No separate water heater 1 = Less than 2 years old 2 = 2 to 4 years old 3 = 5 to 9 years old 4 = 10 to 19 years old 5 = 20 years or older 6 = Don't know 9 = Don't use hot water
WHEATOTH	Main equipment also heat water for apartments 1 = Yes 0 = No 9 = Don't use hot water
WHEATSIZ	Size of household's main water heater tank 0 = Don't have a separate water heater 1 = Small (30 gallons or less) 2 = Medium (31 to 49 gallons) 3 = Large (50 gallons or more) 6 = Have a tankless water heater 9 = Don't use hot water
WWACAGE	How old is households main water heater 1 = Less than 2 years old 2 = 2 to 4 years old 3 = 5 to 9 years old 4 = 10 to 19 years old 5 = 20 years or older 6 = Don't know 9 = Legitimate skip
YEARMADE	Year home built 1 = Before 1940 2 = 1940-49 3 = 1950-59 4 = 1960-69 5 = 1970-79 6 = 1980-84 7 = 1985-89 8 = 1990-94 9 = 1995-99 10 = 2000-2002 11 = 2003 12 = 2004 13 = 2005

* Not part of RECS 2005 variables.

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