

# 2025 Building Electrification Forecast

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# Cold Climate Air Source Heat Pump Technology Overview

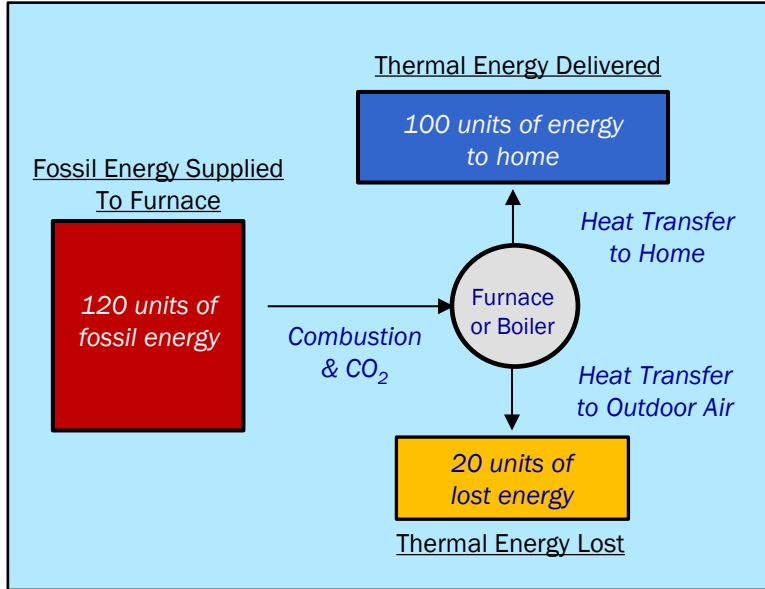
# Technology Overview

## Air Source Heat Pump Principles of Operation

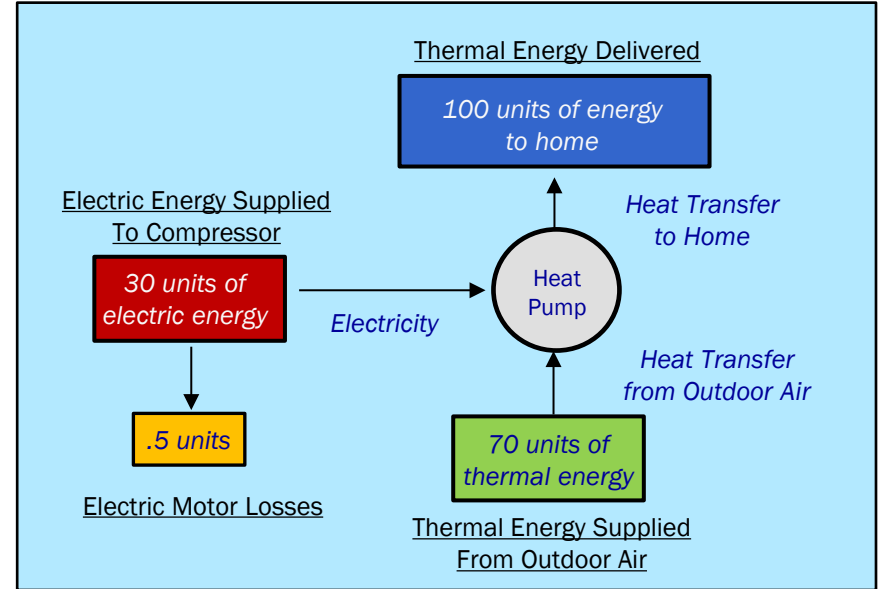
- **Efficient electric technology that provides space heating and cooling by moving thermal energy heat between indoor and outdoor spaces, similar to a refrigerator or air conditioner.**
- **Air source heat pump performance is highly dependent on the outside air temperature.**
  - Heating capacity and efficiency decreases the colder it gets in winter
  - Cooling capacity and efficiency decreases the warmer it gets in summer
- **Below a certain temperature, supplemental heat is needed in winter to maintain room temperature at its set point.**

# Comparison of Fossil Fuel Furnace Operation vs Air Source Heat Pump

## Fossil Fuel Furnace



## Air Source Heat Pump



Notes:

- (1) The heat pump diagram does not include any supplemental heat that may be needed in very cold operating conditions.
- (2) The relative proportions of electric energy and thermal energy for the heat pump vary considerably with outdoor temperature. The specific values shown are illustrative only.

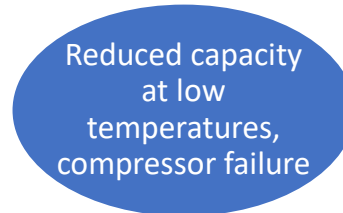
# The Challenge of Low-Temperature Operation with Current Air Source Heat Pumps

Current Air Source Heat Pumps face three major technical issues when operating at the coldest outside air temperatures (5 F and below), which cause them to produce only 40% to 80% of heating capacity as compared to heating capacity at their rated temperature (45°F to 50°F).

## Performance Issues



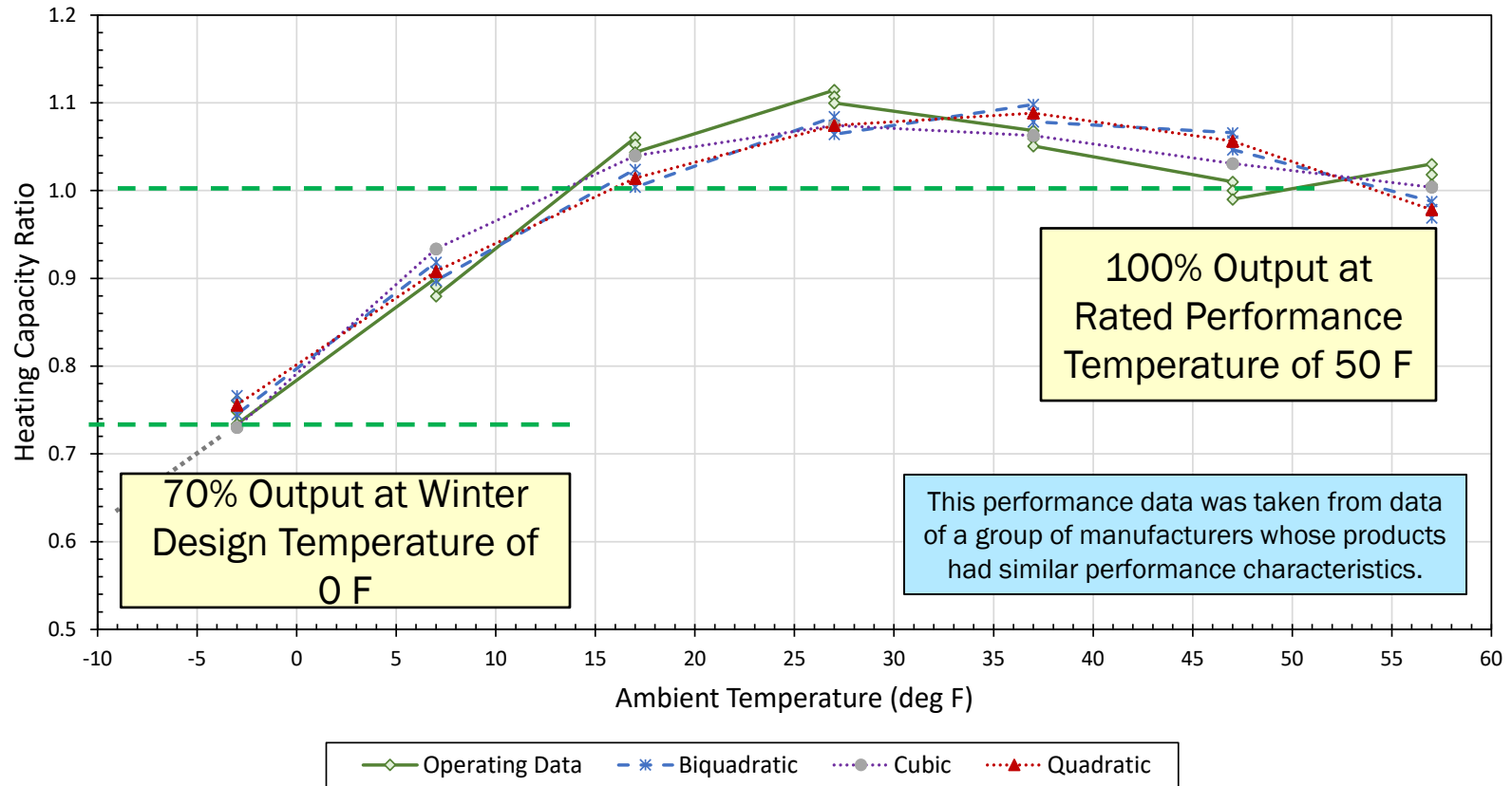
## Impact on Equipment

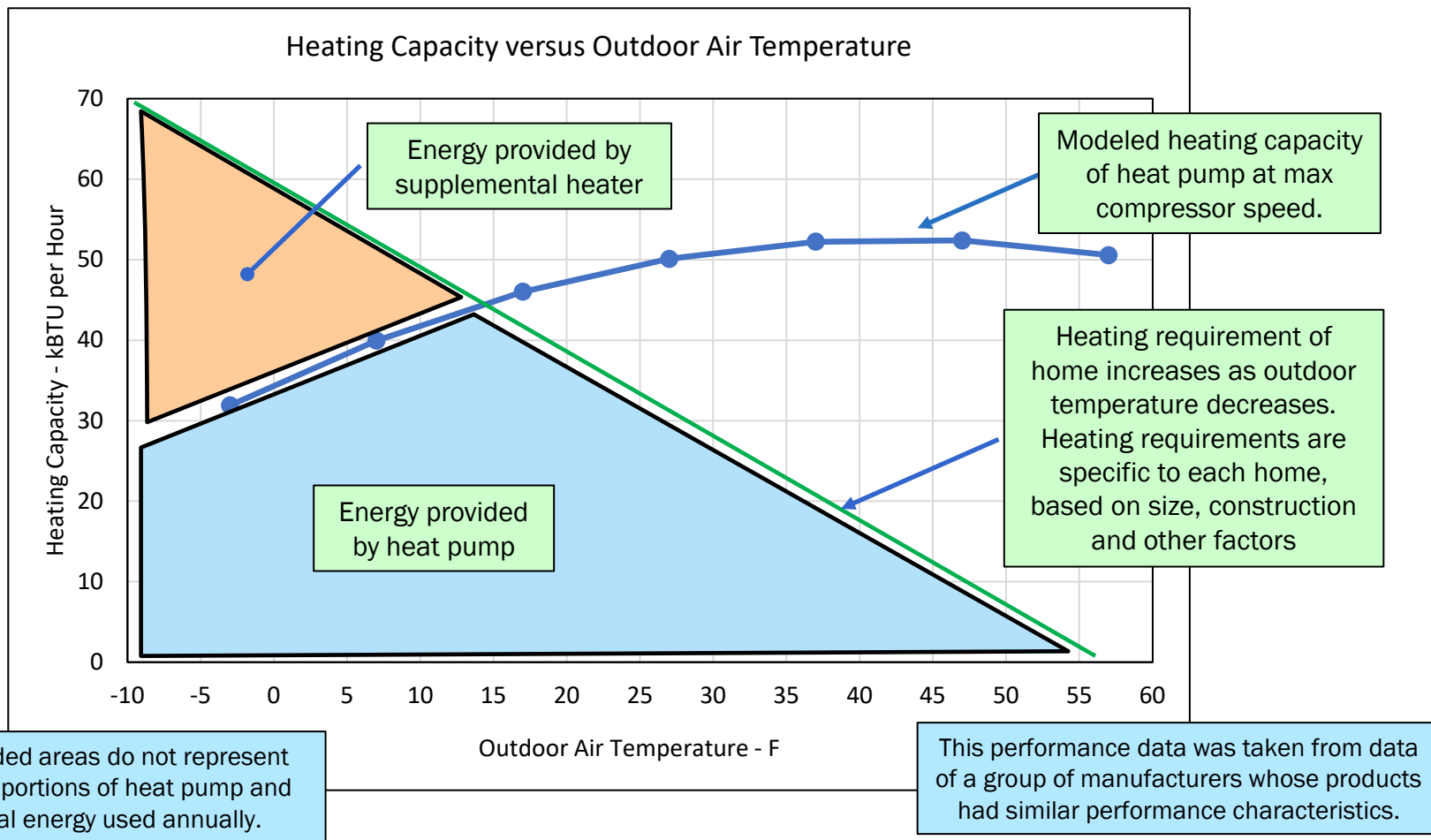


## Macro-level Effects

- Heat pump rated capacity must be significantly increased in size
- OR*
- Supplemental heat source must be used (Electric Resistance, Fossil Fuel etc.)

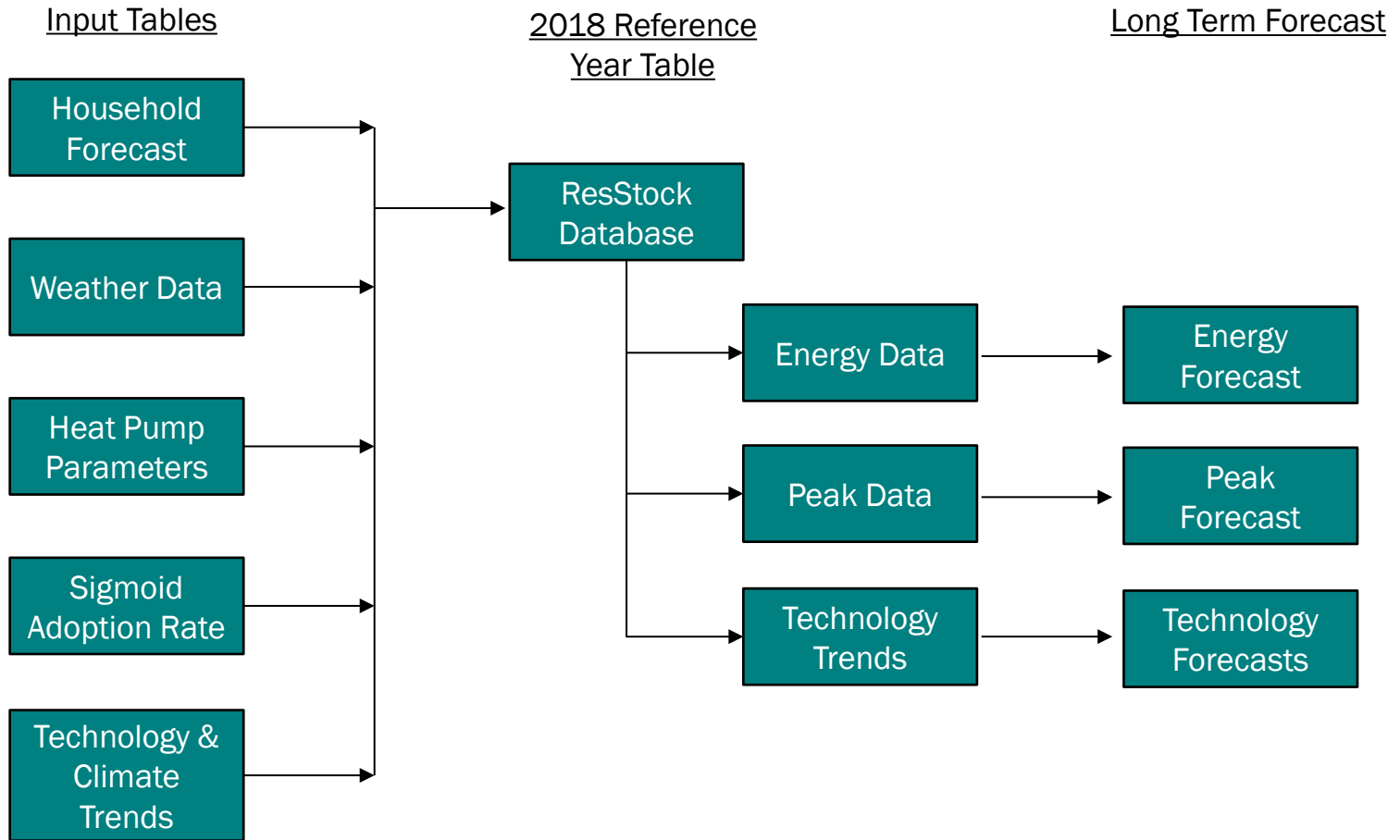
# Heating Capacity Ratios at Median Compressor Speed Model Capacity = 1.0 at 47 F





# Building Electrification Method

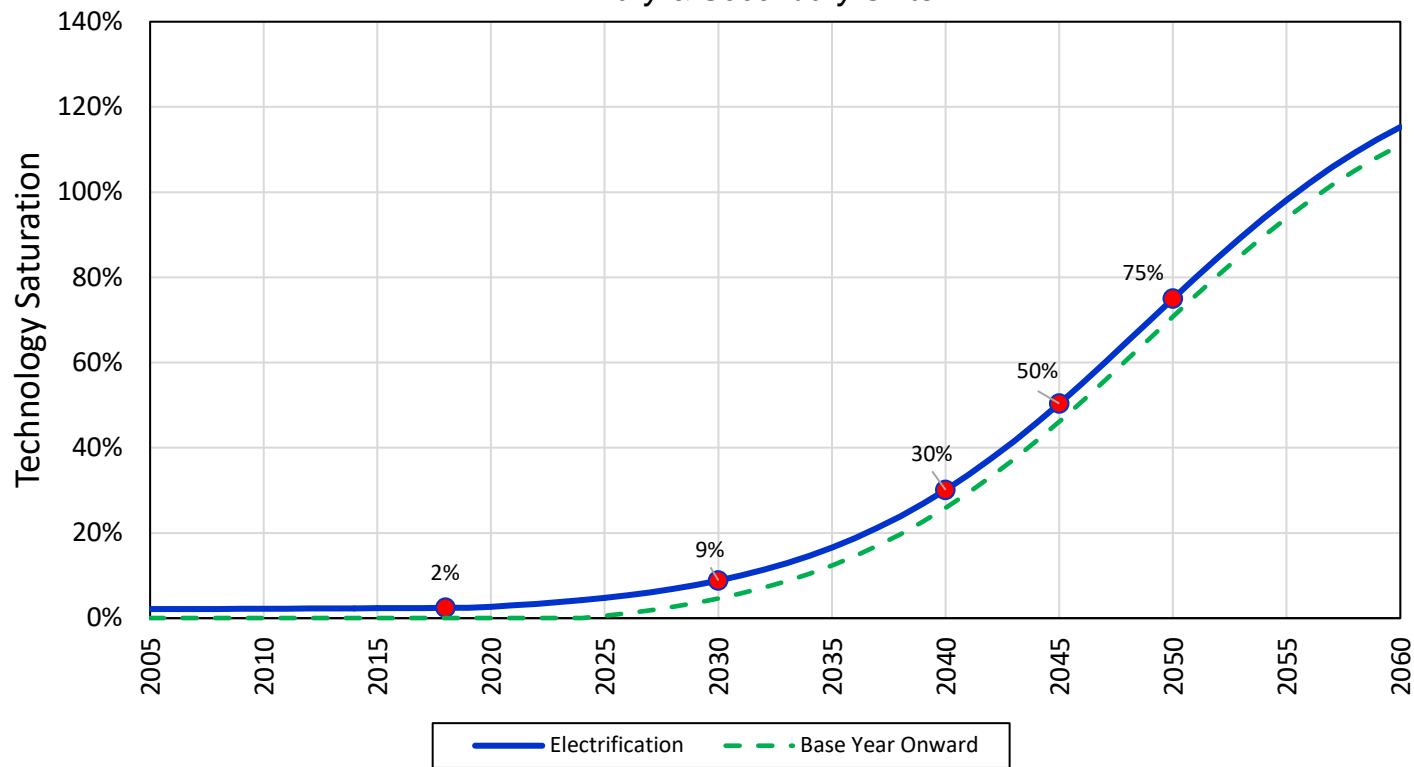




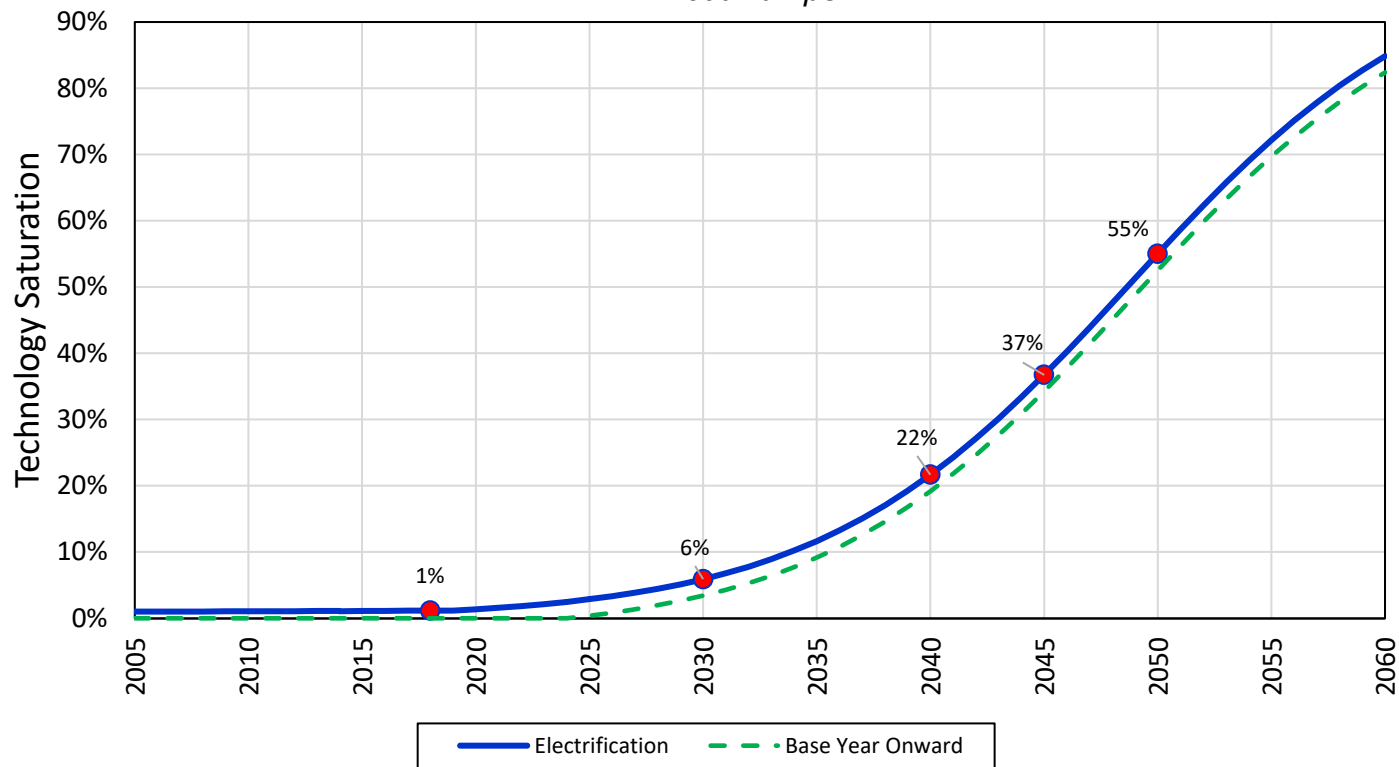
# Household Forecast & Adoption Rates of Space Heating Technologies

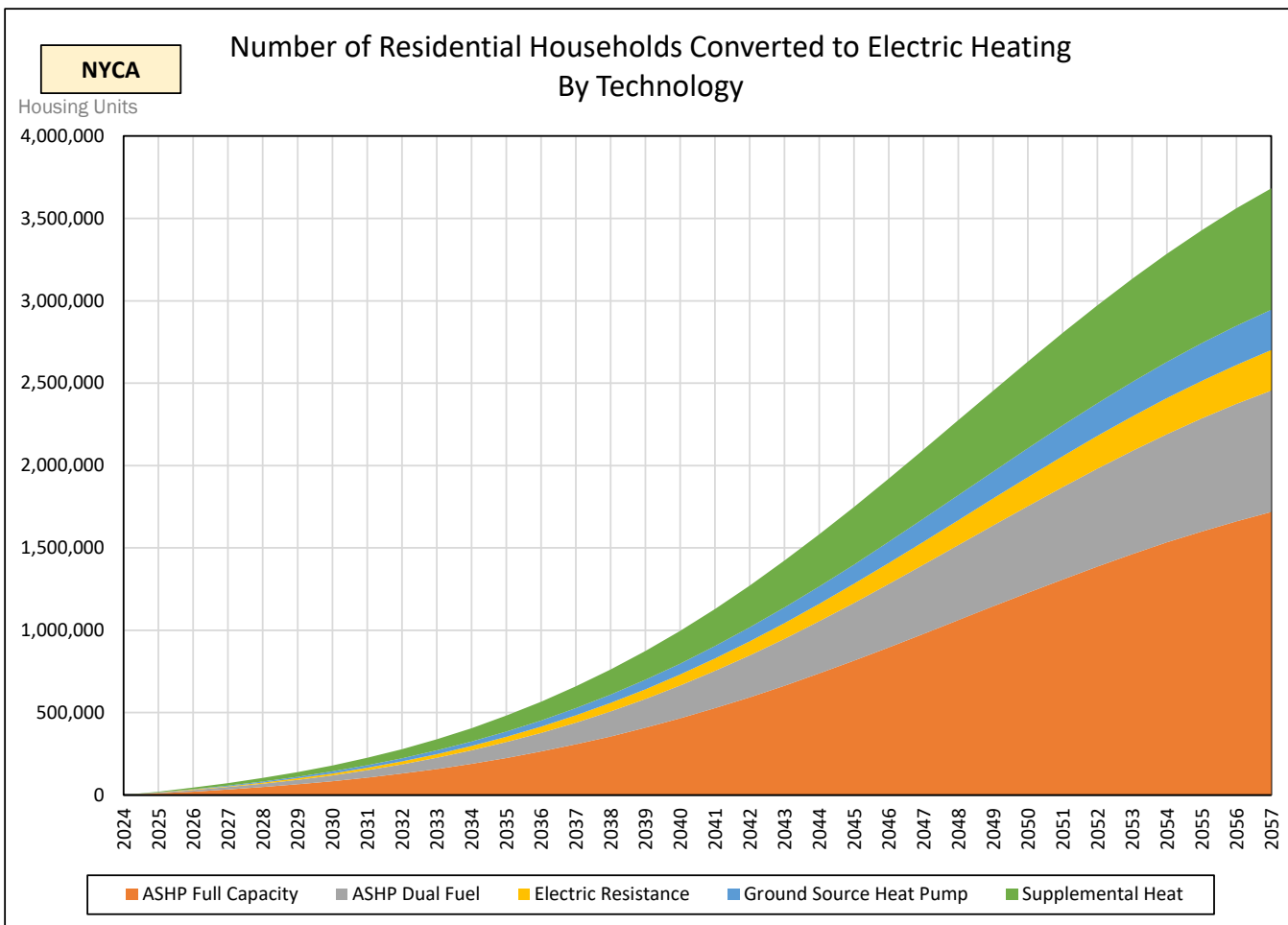
| HH Template for TO Forecasts |         |        |         |         |       |        |        |        |         |
|------------------------------|---------|--------|---------|---------|-------|--------|--------|--------|---------|
|                              |         |        |         |         |       |        |        |        |         |
|                              |         |        |         |         |       |        |        |        |         |
|                              | ConEd   | CenHud | LIPA    | NGrid   | NYPA  | NYSEG  | OR     | RGE    | NYCA    |
| 2024                         | 3643.41 | 214.25 | 1002.52 | 1719.70 | 33.24 | 427.28 | 251.90 | 449.89 | 7742.18 |
| 2025                         | 3652.61 | 214.85 | 1005.28 | 1724.68 | 33.39 | 428.68 | 255.95 | 451.18 | 7766.61 |
| 2026                         | 3647.59 | 214.59 | 1004.56 | 1722.96 | 33.35 | 428.14 | 259.57 | 450.85 | 7761.61 |
| 2027                         | 3632.63 | 213.81 | 1001.67 | 1717.21 | 33.21 | 426.53 | 262.44 | 449.47 | 7736.96 |
| 2028                         | 3620.91 | 213.17 | 999.61  | 1712.45 | 33.08 | 425.18 | 265.11 | 448.37 | 7717.90 |
| 2029                         | 3611.70 | 212.59 | 998.10  | 1708.04 | 32.93 | 423.81 | 267.28 | 447.40 | 7701.84 |
| 2030                         | 3612.30 | 212.47 | 998.53  | 1707.09 | 32.84 | 423.38 | 270.15 | 447.30 | 7704.06 |
| 2031                         | 3615.64 | 212.46 | 999.43  | 1707.12 | 32.80 | 423.29 | 273.26 | 447.44 | 7711.43 |
| 2032                         | 3617.80 | 212.37 | 1000.03 | 1706.59 | 32.73 | 423.06 | 276.16 | 447.42 | 7716.17 |
| 2033                         | 3619.30 | 212.22 | 1000.44 | 1705.73 | 32.64 | 422.73 | 278.96 | 447.33 | 7719.35 |
| 2034                         | 3618.64 | 211.91 | 1000.20 | 1703.65 | 32.52 | 422.11 | 281.47 | 446.94 | 7717.43 |
| 2035                         | 3617.71 | 211.59 | 999.89  | 1701.45 | 32.39 | 421.46 | 283.86 | 446.51 | 7714.85 |
| 2036                         | 3615.49 | 211.20 | 999.29  | 1698.50 | 32.24 | 420.52 | 286.08 | 445.91 | 7709.23 |
| 2037                         | 3608.29 | 210.57 | 997.36  | 1693.37 | 32.05 | 418.92 | 287.80 | 444.72 | 7693.09 |
| 2038                         | 3599.68 | 209.91 | 995.10  | 1687.61 | 31.86 | 417.19 | 289.38 | 443.36 | 7674.09 |
| 2039                         | 3590.10 | 209.22 | 992.61  | 1681.45 | 31.65 | 415.32 | 290.84 | 441.88 | 7653.06 |
| 2040                         | 3580.61 | 208.54 | 990.18  | 1675.38 | 31.43 | 413.47 | 292.28 | 440.41 | 7632.30 |
| 2041                         | 3570.08 | 207.83 | 987.50  | 1668.88 | 31.20 | 411.49 | 293.59 | 438.82 | 7609.39 |
| 2042                         | 3558.66 | 207.06 | 984.60  | 1661.99 | 30.96 | 409.40 | 294.80 | 437.12 | 7584.60 |
| 2043                         | 3546.35 | 206.25 | 981.49  | 1654.71 | 30.71 | 407.21 | 295.90 | 435.32 | 7557.94 |
| 2044                         | 3533.32 | 205.41 | 978.23  | 1647.14 | 30.45 | 404.94 | 296.92 | 433.43 | 7529.84 |
| 2045                         | 3520.92 | 204.60 | 975.17  | 1639.88 | 30.20 | 402.73 | 297.99 | 431.61 | 7503.09 |
| 2046                         | 3507.80 | 203.75 | 971.94  | 1632.28 | 29.93 | 400.44 | 298.97 | 429.71 | 7474.80 |
| 2047                         | 3494.46 | 202.90 | 968.70  | 1624.64 | 29.66 | 398.11 | 299.91 | 427.79 | 7446.16 |
| 2048                         | 3481.24 | 202.04 | 965.54  | 1617.04 | 29.39 | 395.77 | 300.86 | 425.85 | 7417.73 |
| 2049                         | 3468.24 | 201.21 | 962.44  | 1609.55 | 29.12 | 393.43 | 301.81 | 423.95 | 7389.75 |
| 2050                         | 3455.41 | 200.39 | 959.40  | 1602.19 | 28.85 | 391.13 | 302.76 | 422.11 | 7362.23 |

# New York State Electrification Adoption Curve *Primary & Secondary Units*



# New York State Electrification Adoption Curve *All Heat Pumps*





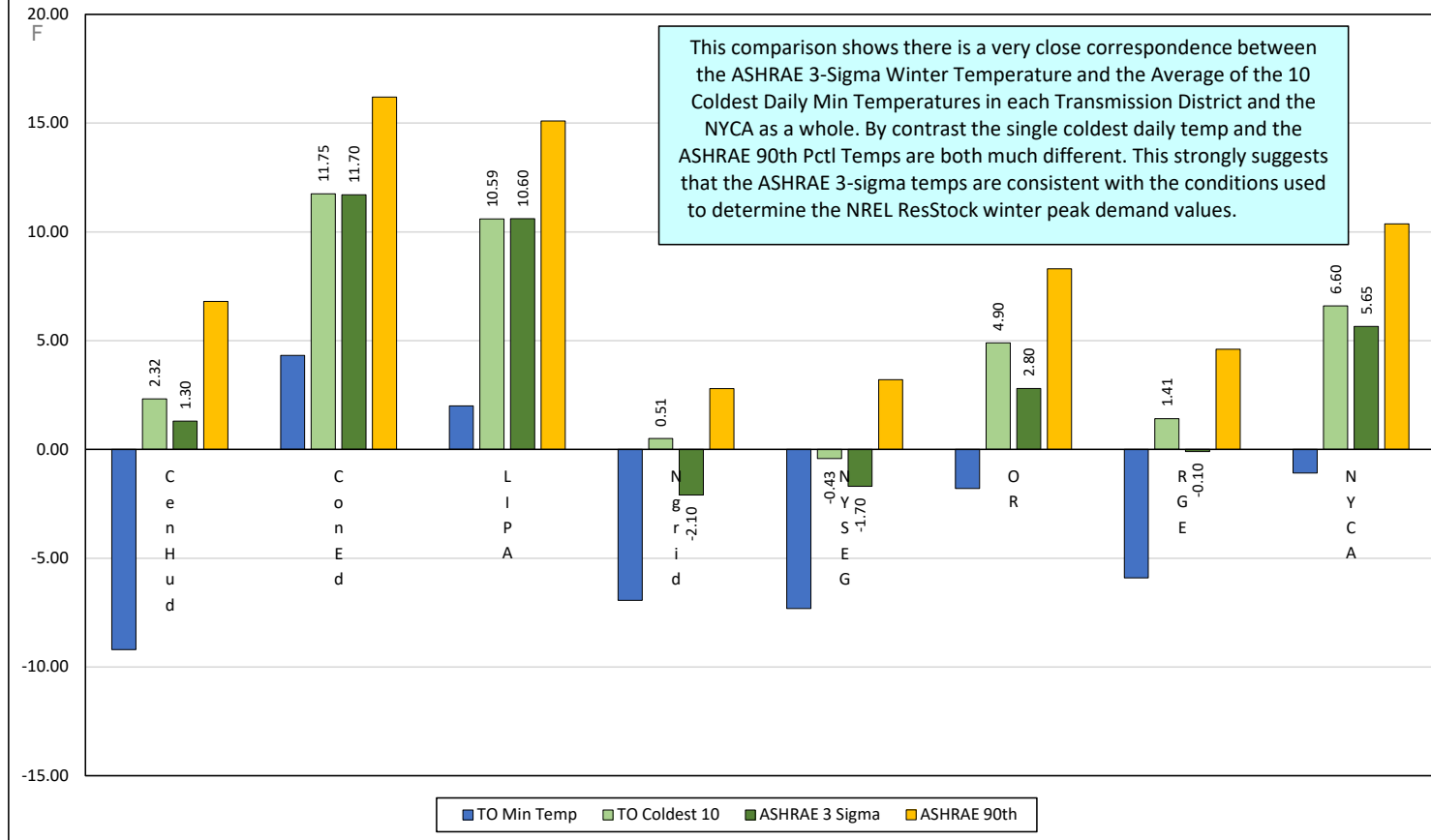
# Winter Design Weather Conditions

| Summary of Data Used to Compare ASHRAE Design Day Data to NYISO's TO 2018 Weather Data                                    |             |               |                |             |            |
|---------------------------------------------------------------------------------------------------------------------------|-------------|---------------|----------------|-------------|------------|
|                                                                                                                           | TO_Weather  | TO_Weather    | ASHRAE         | ASHRAE      | MW Weights |
| TO                                                                                                                        | TO Min Temp | TO Coldest 10 | ASHRAE 3 Sigma | ASHRAE 90th | Adj Weight |
| CenHud                                                                                                                    | -9.20       | 2.32          | 1.30           | 6.80        | 0.0342     |
| ConEd                                                                                                                     | 4.32        | 11.75         | 11.70          | 16.20       | 0.3761     |
| LIPA                                                                                                                      | 2.00        | 10.59         | 10.60          | 15.10       | 0.1684     |
| Ngrid                                                                                                                     | -6.94       | 0.51          | -2.10          | 2.80        | 0.2364     |
| NYSEG                                                                                                                     | -7.31       | -0.43         | -1.70          | 3.20        | 0.1013     |
| OR                                                                                                                        | -1.80       | 4.90          | 2.80           | 8.30        | 0.0341     |
| RGE                                                                                                                       | -5.91       | 1.41          | -0.10          | 4.60        | 0.0495     |
| NYCA                                                                                                                      | -1.09       | 6.60          | 5.65           | 10.37       | 1.0000     |
| Note - The analysis of NREL ResStock Winter Peak Data is based upon the Average Usage for the Coldest 10 days of the year |             |               |                |             |            |

ASHRAE is the American Society for Heating,  
Refrigeration & Air-Conditioning Engineers

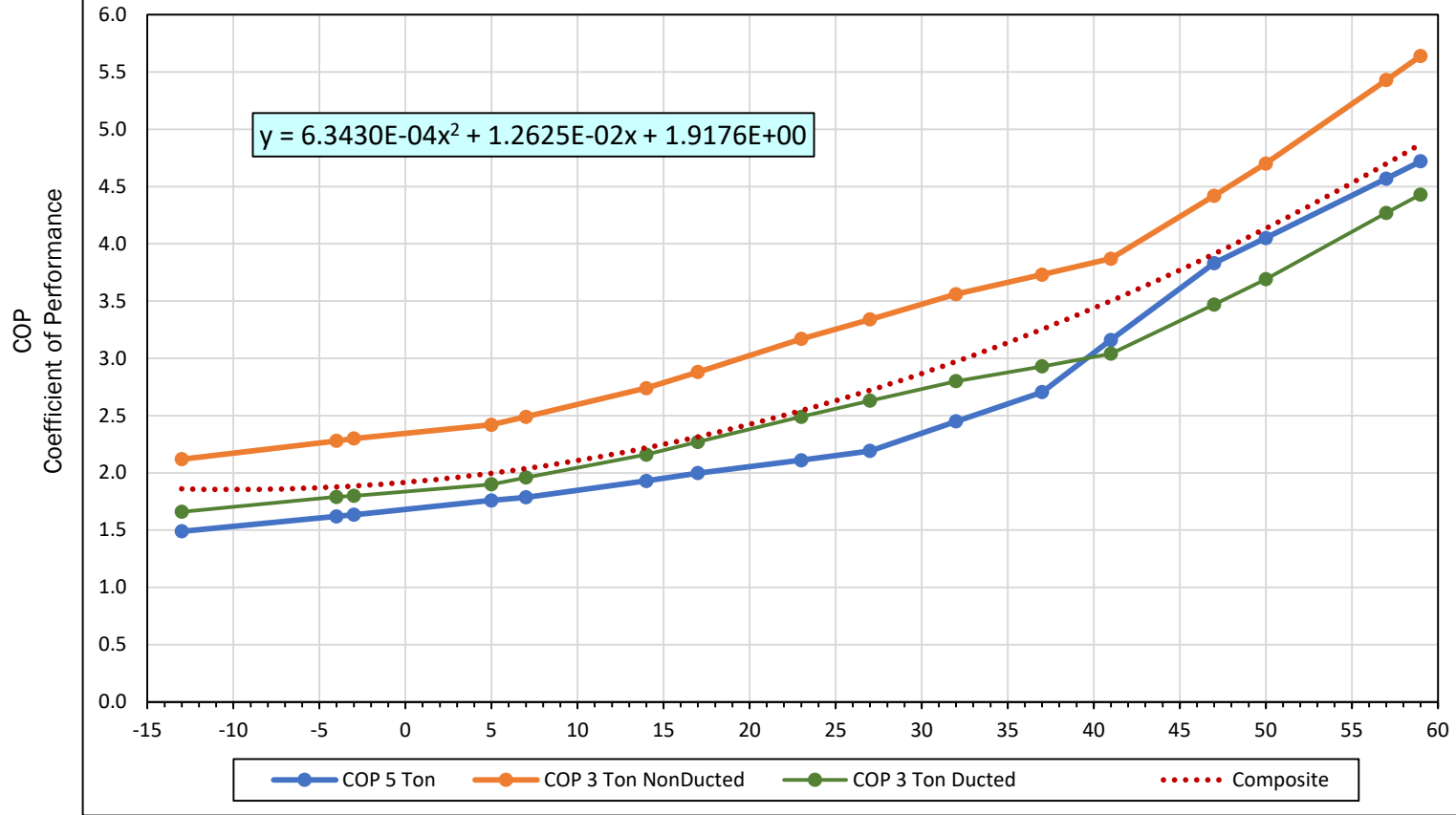


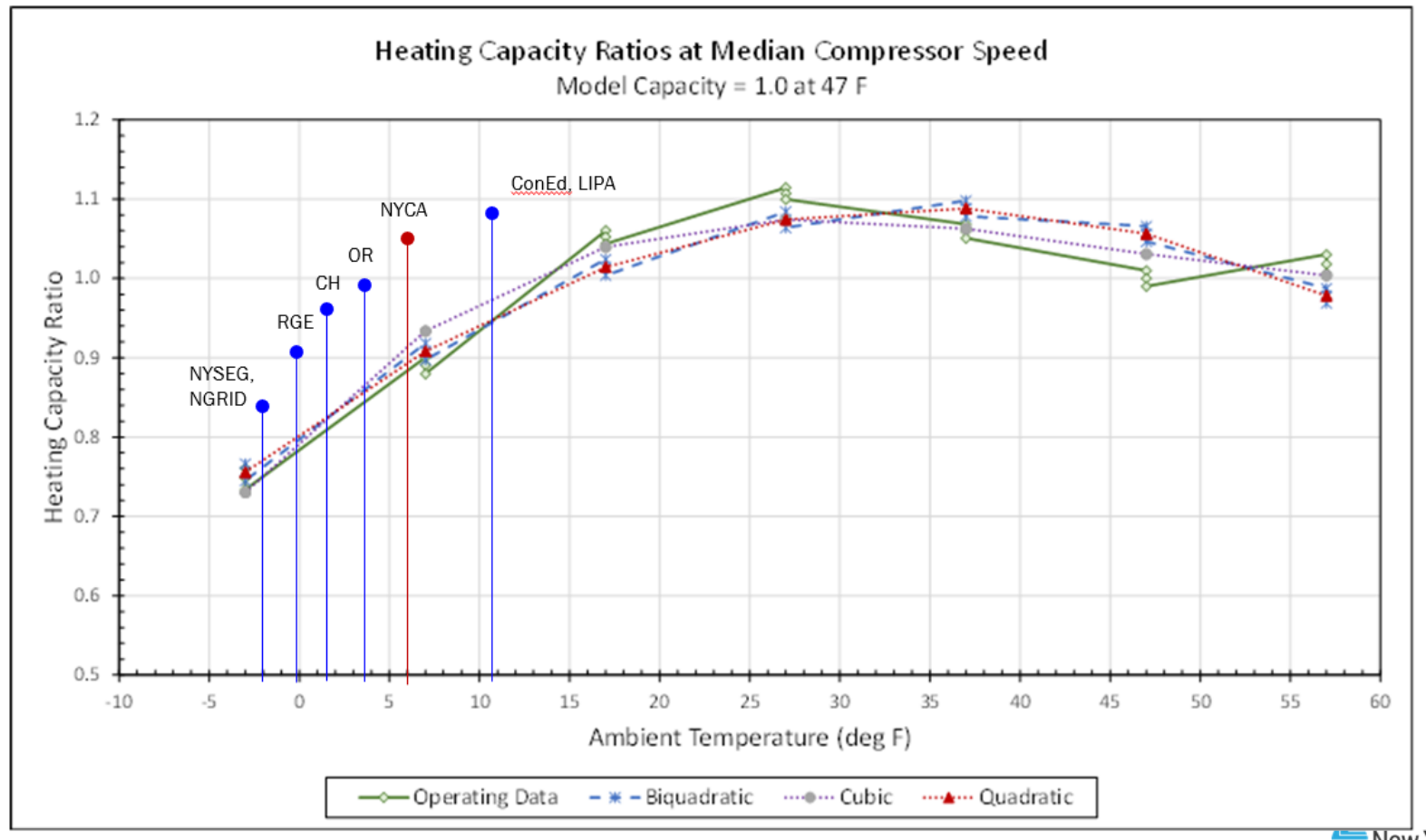
## Comparison of ASHRAE Design Temperatures to 2018 Winter Extreme Temperatures



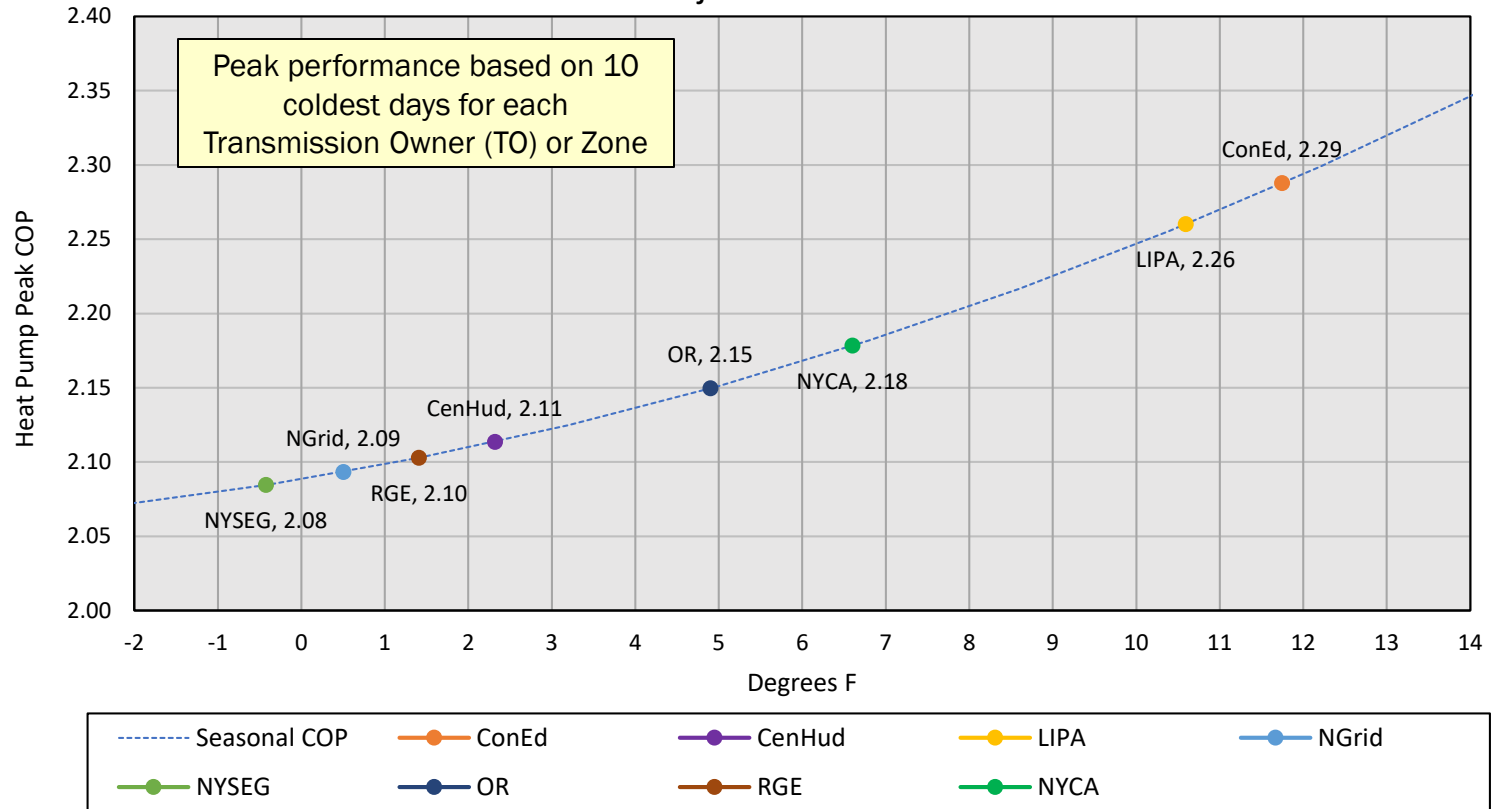
# Cold Climate Air Source Heat Pump Performance Characteristics

Composite COP vs Temperature

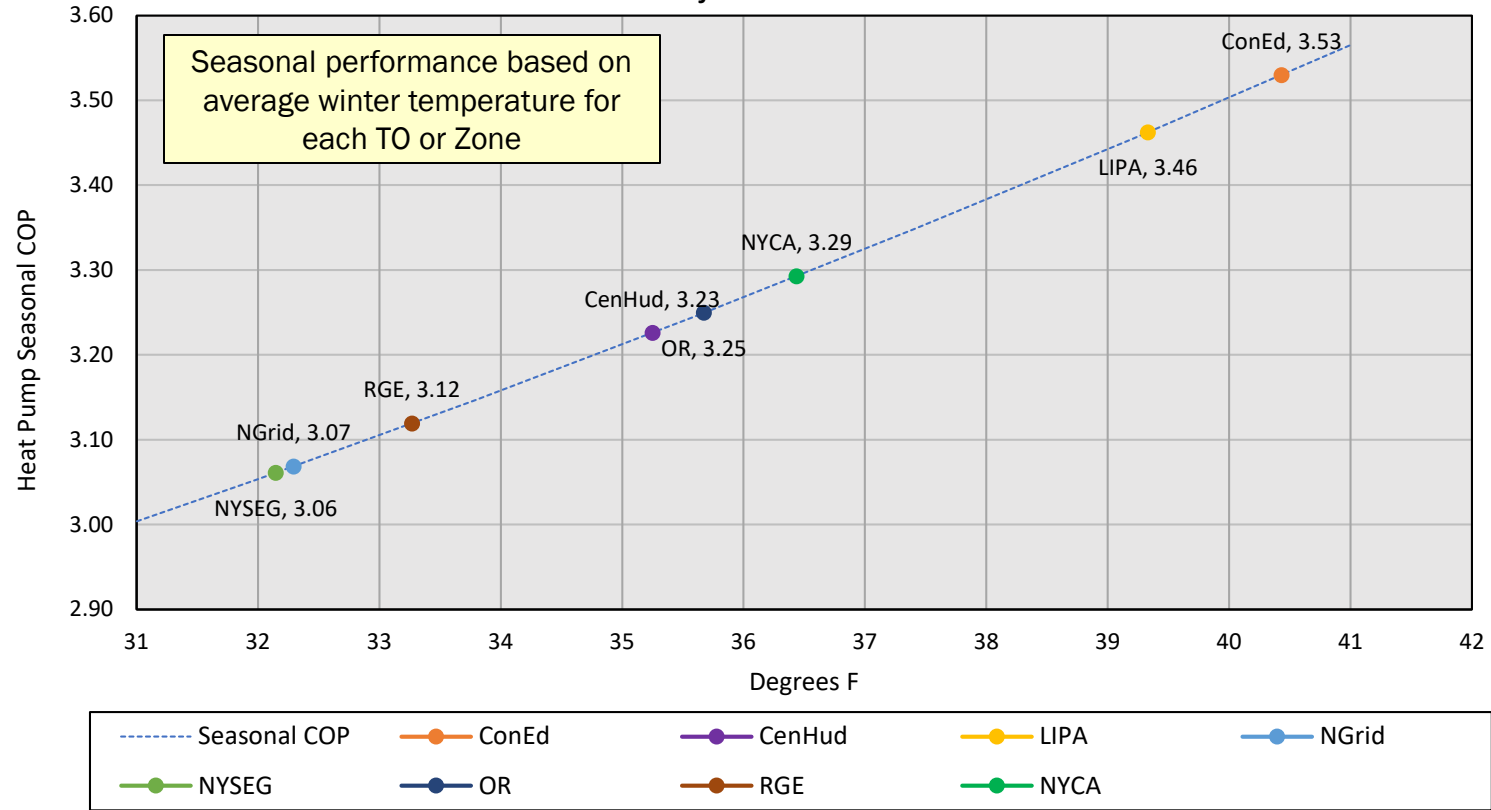




## Heat Pump Peak COP as a Function of 10 Coldest Days in Winter Temperature For Major NY Utilities



## Heat Pump Seasonal COP as a Function of Average Winter Temperature For Major NY Utilities

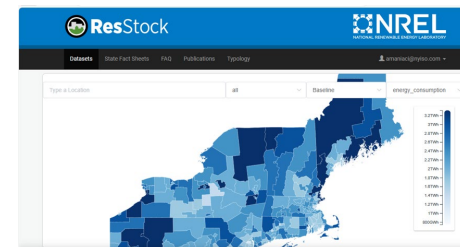


# New York Residential Home Heating Requirements From NREL ResStock Database

# New York ResStock Data

## Energy & Usage Characteristics for All Homes in 2018 with Fossil Space Heating Equipment

| All Fossil Fuel Housing Stock by Utility & Size of Home |         |          |         |        |         |         |         |        |         |           |         |             |  |
|---------------------------------------------------------|---------|----------|---------|--------|---------|---------|---------|--------|---------|-----------|---------|-------------|--|
| 69_in.hvac_heating_type_and_fuel (Multiple Items)       |         |          |         |        |         |         |         |        |         |           |         |             |  |
| 41_in.geometry_building_type_acs (All)                  |         |          |         |        |         |         |         |        |         |           |         |             |  |
|                                                         |         |          |         |        |         |         |         |        |         |           |         |             |  |
| Sum of 8_weight                                         |         | Column 1 |         |        |         |         |         |        |         |           |         |             |  |
| Row Labels                                              | A       | B        | C       | D      | E       | F       | G       | H      | I       | J         | K       | Grand Total |  |
| 300                                                     | 14,770  | 4,116    | 9,685   |        | 8,232   | 7,506   | 17,433  | 3,632  | 18,644  | 329,056   | 29,540  | 442,615     |  |
| 600                                                     | 52,542  | 24,697   | 27,845  | 1,695  | 24,939  | 36,078  | 32,446  | 7,748  | 35,351  | 601,938   | 48,910  | 894,190     |  |
| 800                                                     | 95,400  | 49,153   | 64,165  | 2,179  | 38,499  | 69,007  | 48,668  | 9,685  | 46,247  | 755,933   | 86,199  | 1,265,135   |  |
| 1100                                                    | 161,744 | 96,368   | 118,402 | 3,632  | 83,535  | 120,823 | 89,831  | 18,160 | 55,932  | 708,960   | 196,853 | 1,654,239   |  |
| 1600                                                    | 124,213 | 81,840   | 103,874 | 5,811  | 67,312  | 92,978  | 76,998  | 19,613 | 27,845  | 241,647   | 195,158 | 1,037,289   |  |
| 2000                                                    | 86,683  | 53,753   | 66,344  | 3,390  | 43,826  | 55,448  | 73,124  | 16,223 | 18,886  | 128,814   | 190,799 | 737,289     |  |
| 2400                                                    | 46,005  | 29,056   | 34,625  | 1,695  | 23,487  | 38,257  | 53,269  | 7,990  | 12,833  | 67,070    | 106,053 | 420,339     |  |
| 3000                                                    | 48,668  | 25,424   | 36,562  | 2,179  | 26,150  | 40,678  | 43,584  | 10,412 | 15,496  | 112,349   | 119,371 | 480,872     |  |
| Grand Total                                             | 630,025 | 364,407  | 461,502 | 20,581 | 315,981 | 460,775 | 435,352 | 93,463 | 231,235 | 2,945,766 | 972,882 | 6,931,969   |  |



Source data: NREL ResStock database for New York



# (1) 2018 Fossil Heating Usage – Average and Peak by Zone

| All Residential Fossil - Avg kBTU |         |         |         |         |         |         |         |         |         |         |         |         |  |
|-----------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--|
| Average Heating Energy - kBTU     |         |         |         |         |         |         |         |         |         |         |         |         |  |
| Row Labels                        | A       | B       | C       | D       | E       | F       | G       | H       | I       | J       | K       | NYCA    |  |
| 300                               | 22,785  | 21,528  | 19,694  | 21,788  | 23,883  | 22,377  | 18,619  | 23,392  | 20,473  | 16,177  | 18,439  | 17,260  |  |
| 600                               | 47,488  | 41,783  | 40,890  | 39,555  | 46,181  | 42,176  | 30,483  | 31,739  | 30,784  | 30,336  | 31,652  | 33,033  |  |
| 800                               | 64,897  | 56,113  | 56,734  | 53,141  | 57,359  | 58,263  | 45,094  | 50,740  | 49,096  | 41,771  | 44,590  | 46,881  |  |
| 1100                              | 94,519  | 85,261  | 81,421  | 71,077  | 82,403  | 82,887  | 63,304  | 71,860  | 76,022  | 57,520  | 66,958  | 69,824  |  |
| 1600                              | 126,240 | 113,915 | 115,954 | 102,621 | 111,702 | 115,990 | 93,638  | 108,629 | 117,695 | 86,410  | 99,384  | 104,929 |  |
| 2000                              | 139,357 | 130,493 | 127,351 | 138,632 | 137,042 | 126,825 | 101,304 | 128,364 | 136,059 | 114,896 | 111,015 | 120,838 |  |
| 2400                              | 164,327 | 148,886 | 144,900 | 131,054 | 137,984 | 138,754 | 114,965 | 152,702 | 162,336 | 123,970 | 126,480 | 135,200 |  |
| 3000                              | 246,766 | 206,897 | 198,327 | 217,593 | 209,173 | 194,263 | 168,246 | 190,761 | 248,373 | 196,573 | 180,448 | 197,890 |  |
| Grand Total                       | 113,711 | 104,330 | 102,648 | 107,068 | 103,411 | 101,464 | 85,608  | 102,142 | 85,504  | 55,001  | 97,286  | 81,062  |  |

| All Residential Fossil - Peak Demand - BTUH |         |         |         |         |         |         |        |         |         |         |         |         |  |
|---------------------------------------------|---------|---------|---------|---------|---------|---------|--------|---------|---------|---------|---------|---------|--|
| Load Factor                                 | 20%     |         |         |         |         |         |        |         |         |         |         |         |  |
| Average Peak Demand - kBTUH                 |         |         |         |         |         |         |        |         |         |         |         |         |  |
| Sq Ft                                       | A       | B       | C       | D       | E       | F       | G      | H       | I       | J       | K       | NYCA    |  |
| 300                                         | 13,005  | 12,288  | 11,241  | 12,436  | 13,632  | 12,773  | 10,627 | 13,351  | 11,685  | 9,233   | 10,525  | 9,852   |  |
| 600                                         | 27,105  | 23,849  | 23,339  | 22,577  | 26,359  | 24,073  | 17,399 | 18,116  | 17,571  | 17,315  | 18,066  | 18,854  |  |
| 800                                         | 37,042  | 32,028  | 32,382  | 30,332  | 32,739  | 33,255  | 25,738 | 28,961  | 28,023  | 23,842  | 25,451  | 26,759  |  |
| 1100                                        | 53,949  | 48,665  | 46,473  | 40,569  | 47,034  | 47,310  | 36,132 | 41,016  | 43,391  | 32,831  | 38,218  | 39,854  |  |
| 1600                                        | 72,055  | 65,020  | 66,184  | 58,574  | 63,757  | 66,204  | 53,446 | 62,003  | 67,177  | 49,321  | 56,726  | 59,891  |  |
| 2000                                        | 79,542  | 74,483  | 72,689  | 79,128  | 78,220  | 72,388  | 57,822 | 73,267  | 77,659  | 65,580  | 63,365  | 68,972  |  |
| 2400                                        | 93,794  | 84,980  | 82,705  | 74,803  | 78,758  | 79,197  | 65,619 | 87,159  | 92,657  | 70,759  | 72,192  | 77,169  |  |
| 3000                                        | 140,848 | 118,092 | 113,201 | 124,197 | 119,391 | 110,881 | 96,031 | 108,882 | 141,765 | 112,199 | 102,996 | 112,951 |  |
| Average                                     | 64,904  | 59,549  | 58,589  | 61,112  | 59,024  | 57,913  | 48,863 | 58,300  | 48,804  | 31,393  | 55,529  | 46,268  |  |

Source data: NREL ResStock database for New York

## (2) 2018 Equivalent Fossil Energy Usage Converted to Electric Resistance Heating

| All Residential Elec Res - Avg kWh Heat |                                                           |        |        |        |        |        |        |        |        |        |        |        |  |
|-----------------------------------------|-----------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| Gas Furnace Eff.                        | 80%                                                       |        |        |        |        |        |        |        |        |        |        |        |  |
| T&D Losses                              | Excluded to keep rated capacity values at homeowner level |        |        |        |        |        |        |        |        |        |        |        |  |
| Average of Heating_kWh                  |                                                           |        |        |        |        |        |        |        |        |        |        |        |  |
| Sq Ft                                   | A                                                         | B      | C      | D      | E      | F      | G      | H      | I      | J      | K      | NYCA   |  |
| 300                                     | 5,342                                                     | 5,048  | 4,618  | 5,109  | 5,600  | 5,247  | 4,365  | 5,485  | 4,800  | 3,793  | 4,323  | 4,047  |  |
| 600                                     | 11,134                                                    | 9,797  | 9,587  | 9,274  | 10,828 | 9,889  | 7,147  | 7,442  | 7,218  | 7,113  | 7,421  | 7,745  |  |
| 800                                     | 15,216                                                    | 13,157 | 13,302 | 12,460 | 13,449 | 13,661 | 10,573 | 11,897 | 11,511 | 9,794  | 10,455 | 10,992 |  |
| 1100                                    | 22,162                                                    | 19,991 | 19,091 | 16,665 | 19,321 | 19,434 | 14,843 | 16,849 | 17,825 | 13,487 | 15,699 | 16,371 |  |
| 1600                                    | 29,599                                                    | 26,709 | 27,187 | 24,061 | 26,190 | 27,196 | 21,955 | 25,470 | 27,596 | 20,260 | 23,302 | 24,602 |  |
| 2000                                    | 32,675                                                    | 30,596 | 29,859 | 32,505 | 32,132 | 29,736 | 23,752 | 30,097 | 31,901 | 26,939 | 26,029 | 28,333 |  |
| 2400                                    | 38,529                                                    | 34,909 | 33,974 | 30,728 | 32,353 | 32,533 | 26,956 | 35,804 | 38,062 | 29,067 | 29,655 | 31,700 |  |
| 3000                                    | 57,858                                                    | 48,511 | 46,501 | 51,018 | 49,044 | 45,548 | 39,448 | 44,727 | 58,235 | 46,090 | 42,309 | 46,399 |  |
| Grand Total                             | 26,661                                                    | 24,462 | 24,067 | 25,104 | 24,246 | 23,790 | 20,072 | 23,949 | 20,048 | 12,896 | 22,810 | 19,006 |  |

| All Residential Elec Res - Peak Demand - kW |        |        |        |        |        |        |        |        |        |        |        |        |  |
|---------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| Load Factor                                 | 20%    |        |        |        |        |        |        |        |        |        |        |        |  |
| Average Peak Demand - kW                    |        |        |        |        |        |        |        |        |        |        |        |        |  |
| Sq Ft                                       | A      | B      | C      | D      | E      | F      | G      | H      | I      | J      | K      | NYCA   |  |
| 300                                         | 3.049  | 2.881  | 2.636  | 2.916  | 3.196  | 2.995  | 2.492  | 3.130  | 2.740  | 2.165  | 2.468  | 2.310  |  |
| 600                                         | 6.355  | 5.592  | 5.472  | 5.294  | 6.180  | 5.644  | 4.080  | 4.248  | 4.120  | 4.060  | 4.236  | 4.421  |  |
| 800                                         | 8.685  | 7.510  | 7.593  | 7.112  | 7.676  | 7.797  | 6.035  | 6.790  | 6.570  | 5.590  | 5.967  | 6.274  |  |
| 1100                                        | 12.649 | 11.410 | 10.896 | 9.512  | 11.028 | 11.093 | 8.472  | 9.617  | 10.174 | 7.698  | 8.961  | 9.344  |  |
| 1600                                        | 16.894 | 15.245 | 15.518 | 13.734 | 14.949 | 15.523 | 12.531 | 14.538 | 15.751 | 11.564 | 13.300 | 14.042 |  |
| 2000                                        | 18.650 | 17.464 | 17.043 | 18.553 | 18.340 | 16.973 | 13.557 | 17.179 | 18.208 | 15.376 | 14.857 | 16.172 |  |
| 2400                                        | 21.992 | 19.925 | 19.392 | 17.539 | 18.466 | 18.569 | 15.386 | 20.436 | 21.725 | 16.591 | 16.927 | 18.094 |  |
| 3000                                        | 33.024 | 27.689 | 26.542 | 29.120 | 27.993 | 25.998 | 22.516 | 25.529 | 33.239 | 26.307 | 24.149 | 26.483 |  |
| Average                                     | 15.218 | 13.962 | 13.737 | 14.329 | 13.839 | 13.579 | 11.457 | 13.669 | 11.443 | 7.361  | 13.020 | 10.848 |  |

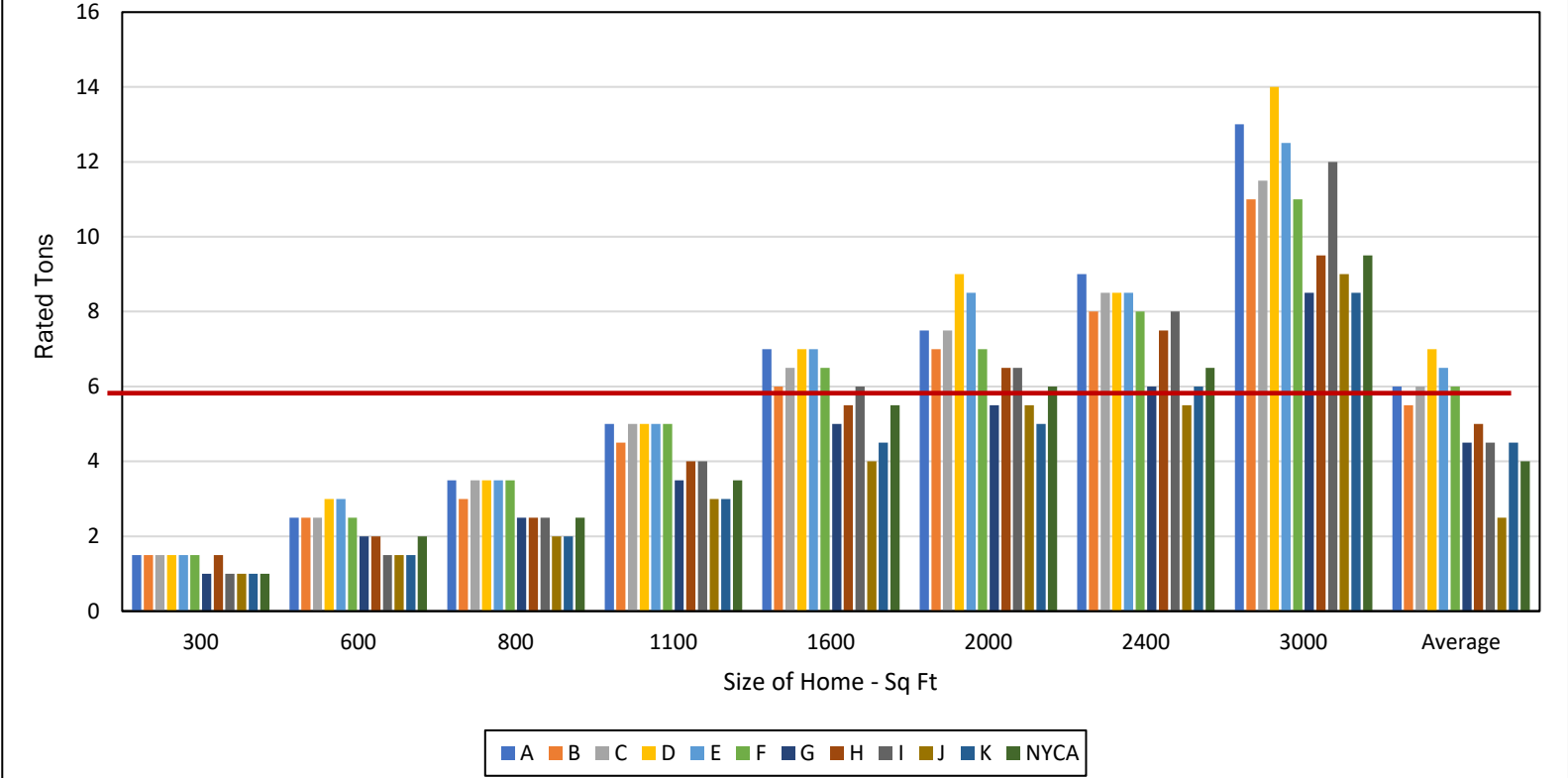
Source data: NREL ResStock database for New York

### (3) 2018 Equivalent Usage Converted to Air Source Heat Pumps

| All Residential Heat Pump - Avg kWh          |        |        |        |        |        |        |        |        |        |        |        |        |  |
|----------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| HSPF2                                        | 10.43  | 10.54  | 10.30  | 9.72   | 10.01  | 10.51  | 10.96  | 11.17  | 11.43  | 12.02  | 11.71  | 11.13  |  |
| SEER                                         | 3.06   | 3.09   | 3.02   | 2.85   | 2.93   | 3.08   | 3.21   | 3.27   | 3.35   | 3.52   | 3.43   | 3.26   |  |
| Average of Heating_kWh                       |        |        |        |        |        |        |        |        |        |        |        |        |  |
| Sq Ft                                        | A      | B      | C      | D      | E      | F      | G      | H      | I      | J      | K      | NYCA   |  |
| 300                                          | 1,748  | 1,634  | 1,529  | 1,793  | 1,908  | 1,704  | 1,359  | 1,676  | 1,433  | 1,077  | 1,259  | 1,240  |  |
| 600                                          | 3,644  | 3,171  | 3,174  | 3,255  | 3,690  | 3,211  | 2,225  | 2,273  | 2,155  | 2,019  | 2,162  | 2,373  |  |
| 800                                          | 4,979  | 4,258  | 4,404  | 4,373  | 4,583  | 4,436  | 3,292  | 3,634  | 3,436  | 2,780  | 3,045  | 3,368  |  |
| 1100                                         | 7,252  | 6,470  | 6,321  | 5,849  | 6,584  | 6,311  | 4,621  | 5,147  | 5,321  | 3,828  | 4,573  | 5,017  |  |
| 1600                                         | 9,686  | 8,644  | 9,002  | 8,445  | 8,925  | 8,832  | 6,836  | 7,781  | 8,237  | 5,751  | 6,788  | 7,539  |  |
| 2000                                         | 10,692 | 9,902  | 9,887  | 11,408 | 10,949 | 9,657  | 7,395  | 9,195  | 9,523  | 7,647  | 7,582  | 8,682  |  |
| 2400                                         | 12,608 | 11,298 | 11,249 | 10,785 | 11,024 | 10,565 | 8,392  | 10,938 | 11,362 | 8,251  | 8,638  | 9,714  |  |
| 3000                                         | 18,933 | 15,700 | 15,397 | 17,906 | 16,712 | 14,792 | 12,282 | 13,664 | 17,383 | 13,084 | 12,324 | 14,219 |  |
| Grand Total                                  | 8,725  | 7,917  | 7,969  | 8,811  | 8,262  | 7,726  | 6,249  | 7,316  | 5,984  | 3,661  | 6,644  | 5,824  |  |
| All Residential Heat Pump - Peak Demand - kW |        |        |        |        |        |        |        |        |        |        |        |        |  |
| Peak COP                                     | 2.11   | 2.10   | 2.07   | 2.06   | 2.06   | 2.08   | 2.13   | 2.16   | 2.20   | 2.30   | 2.26   | 2.18   |  |
|                                              |        |        |        |        |        |        |        |        |        |        |        |        |  |
| Sq Ft                                        | A      | B      | C      | D      | E      | F      | G      | H      | I      | J      | K      | NYCA   |  |
| 300                                          | 1.448  | 1.370  | 1.272  | 1.418  | 1.553  | 1.438  | 1.168  | 1.451  | 1.248  | 0.941  | 1.092  | 1.060  |  |
| 600                                          | 3.018  | 2.659  | 2.640  | 2.575  | 3.004  | 2.710  | 1.913  | 1.969  | 1.876  | 1.765  | 1.874  | 2.030  |  |
| 800                                          | 4.124  | 3.571  | 3.663  | 3.459  | 3.731  | 3.743  | 2.829  | 3.148  | 2.992  | 2.430  | 2.640  | 2.880  |  |
| 1100                                         | 6.006  | 5.426  | 5.257  | 4.626  | 5.359  | 5.325  | 3.972  | 4.459  | 4.633  | 3.346  | 3.965  | 4.290  |  |
| 1600                                         | 8.022  | 7.250  | 7.487  | 6.679  | 7.265  | 7.452  | 5.875  | 6.740  | 7.173  | 5.027  | 5.885  | 6.447  |  |
| 2000                                         | 8.855  | 8.305  | 8.223  | 9.023  | 8.913  | 8.148  | 6.356  | 7.965  | 8.292  | 6.684  | 6.574  | 7.424  |  |
| 2400                                         | 10.442 | 9.476  | 9.356  | 8.530  | 8.974  | 8.914  | 7.214  | 9.475  | 9.893  | 7.212  | 7.489  | 8.307  |  |
| 3000                                         | 15.680 | 13.168 | 12.806 | 14.163 | 13.604 | 12.481 | 10.557 | 11.836 | 15.136 | 11.436 | 10.685 | 12.158 |  |
| Average                                      | 7.225  | 6.640  | 6.628  | 6.969  | 6.726  | 6.519  | 5.371  | 6.338  | 5.211  | 3.200  | 5.761  | 4.980  |  |

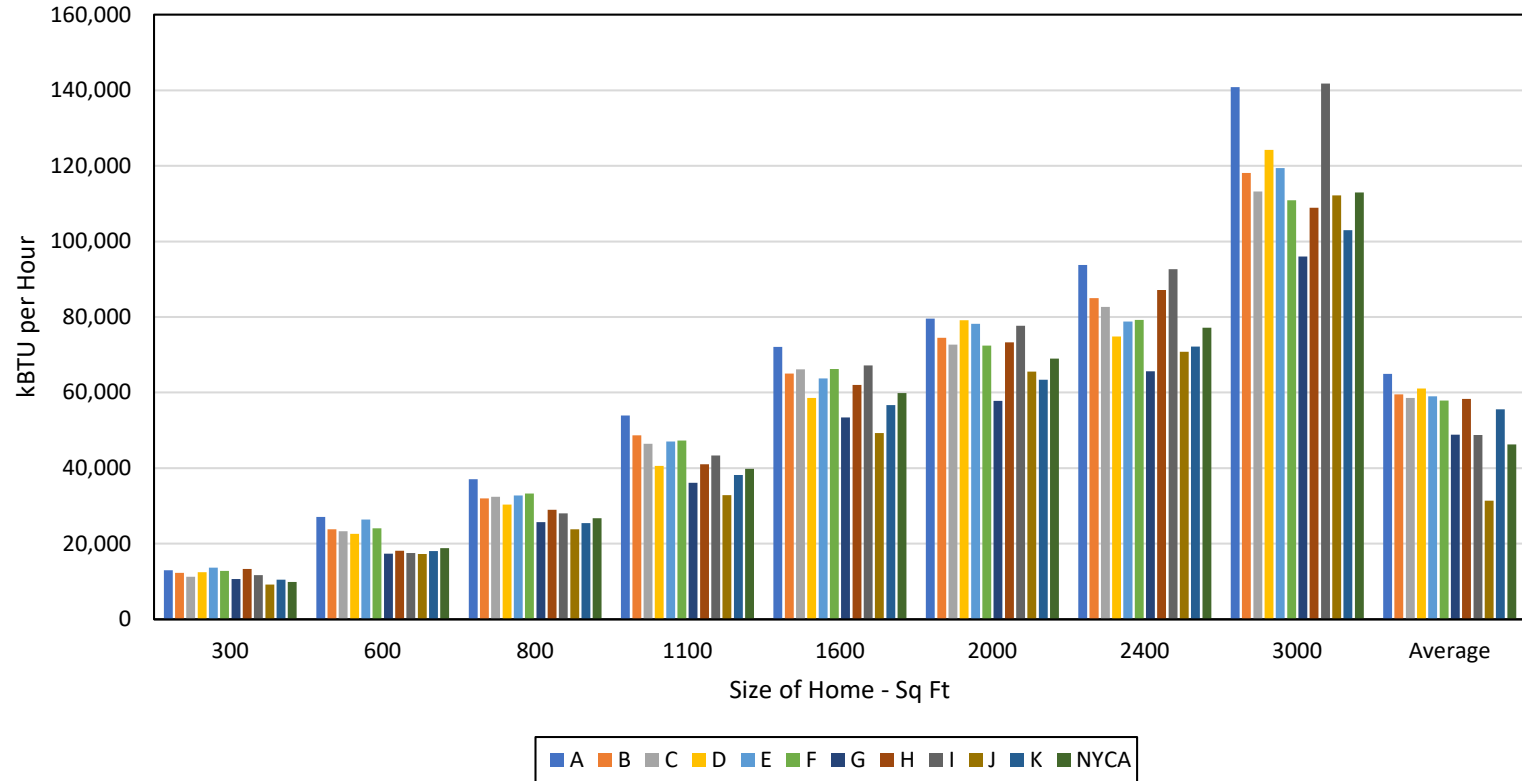
Source data: NREL ResStock database for New York

Average Equivalent Rated Size of Air Source Heat Pump - Tons  
Single Family & Multi-Family Homes



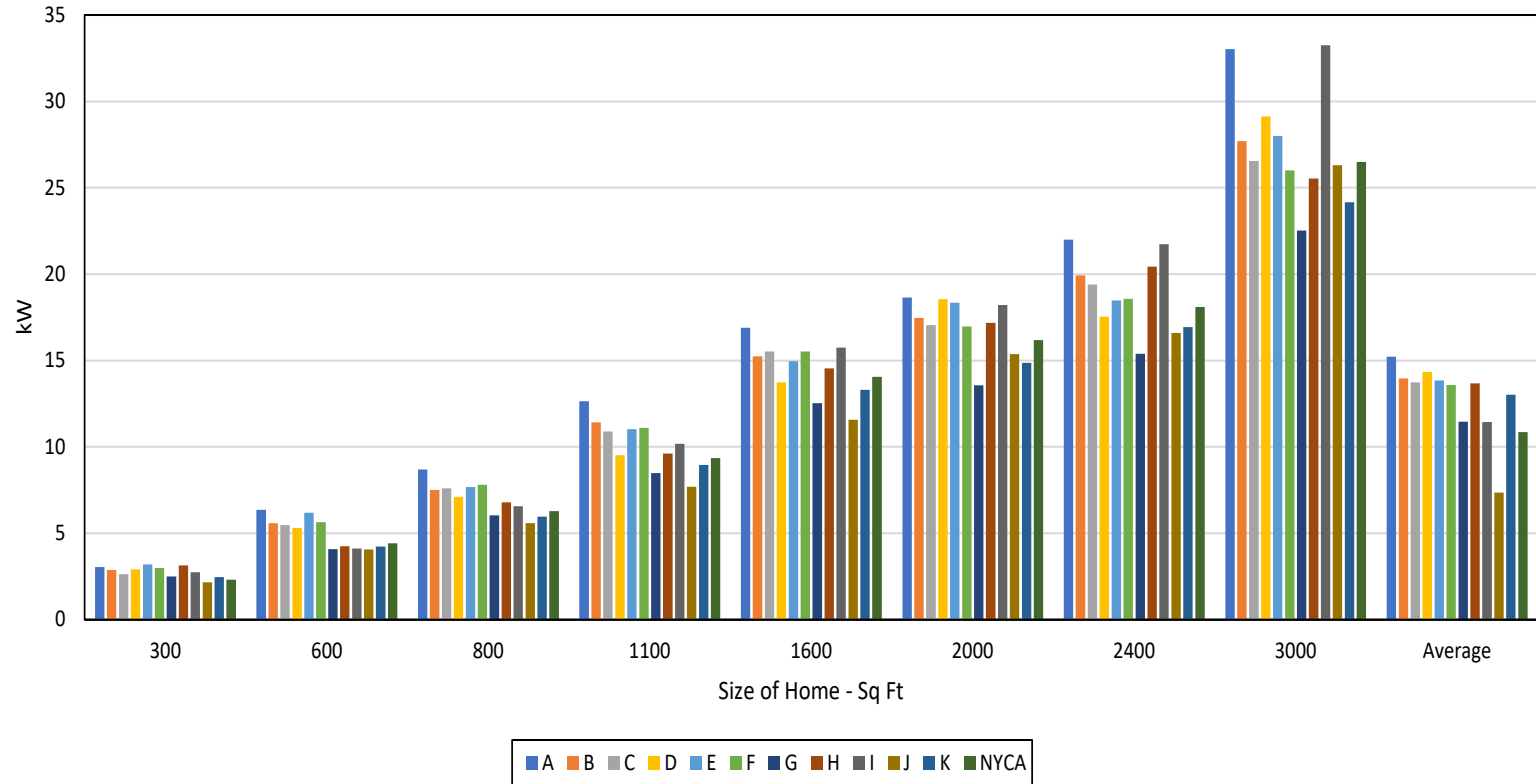
Source data: NREL ResStock database for New York

## Average Peak Demand of Fossil-Fueled Furnace - kBTU per Hour Single Family & Multi-Family Homes



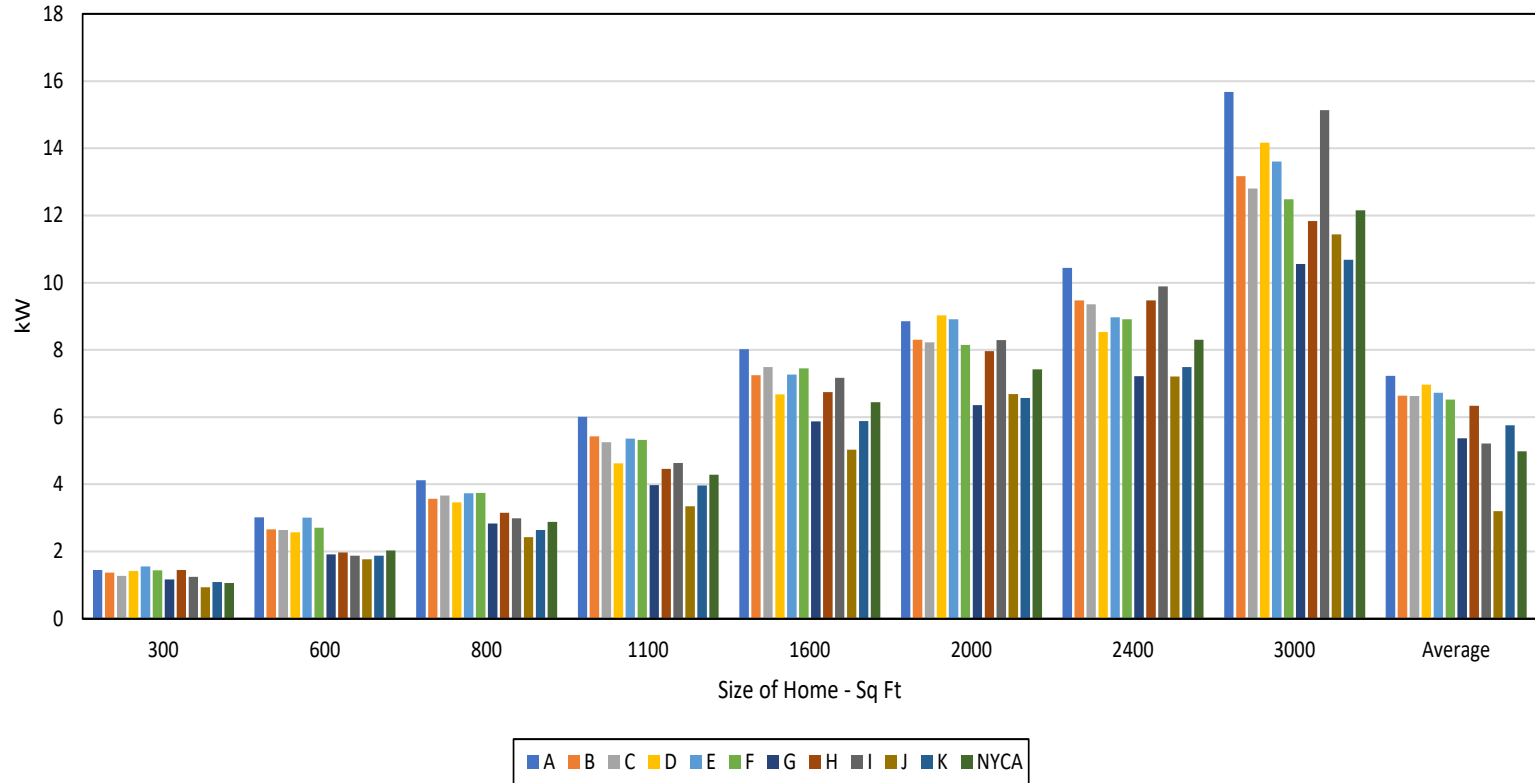
Source data: NREL ResStock database for New York

# Average Peak Demand of Electric Resistance Heat - kW Single Family & Multi-Family Homes



Source data: NREL ResStock database for New York

## Average Peak Demand of Air Source Heat Pump - kW Single Family & Multi-Family Homes

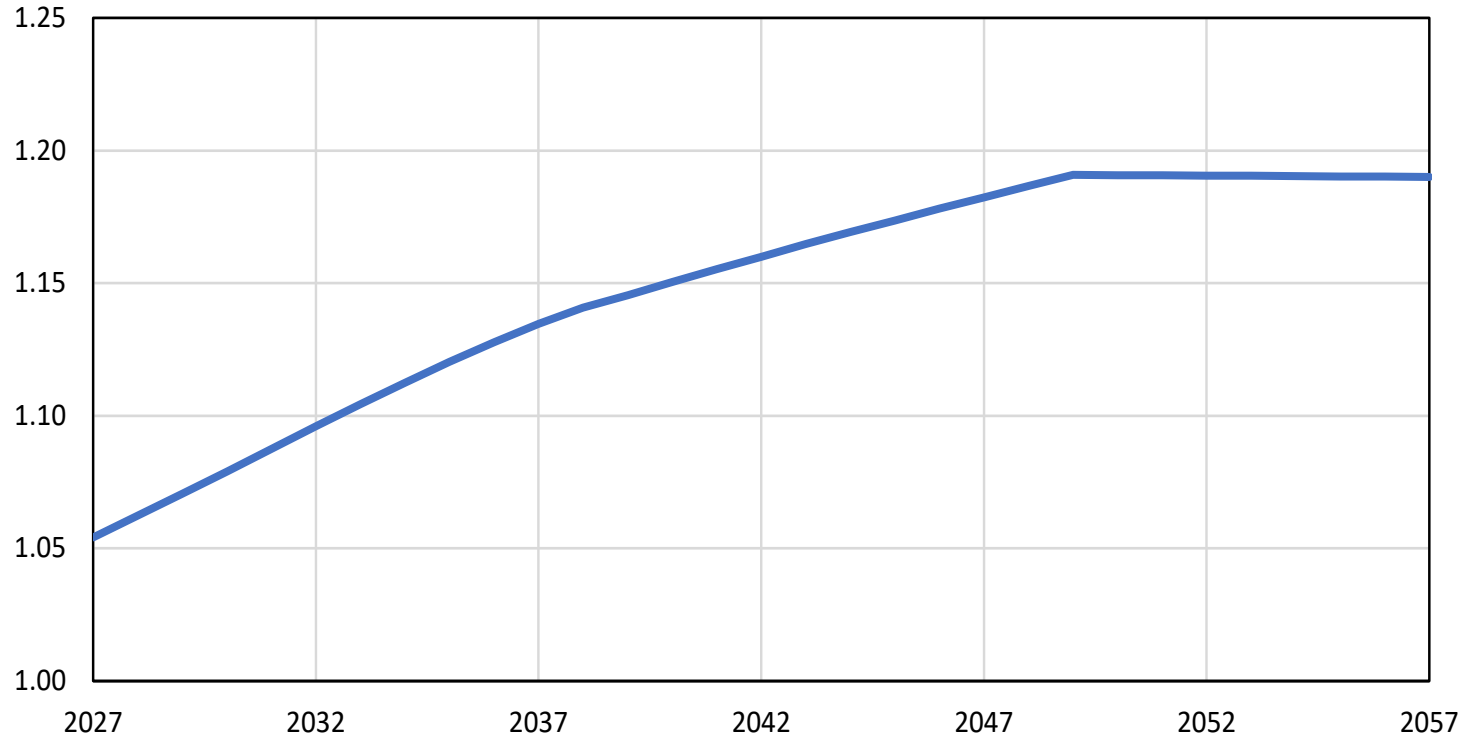


Source data: NREL ResStock database for New York

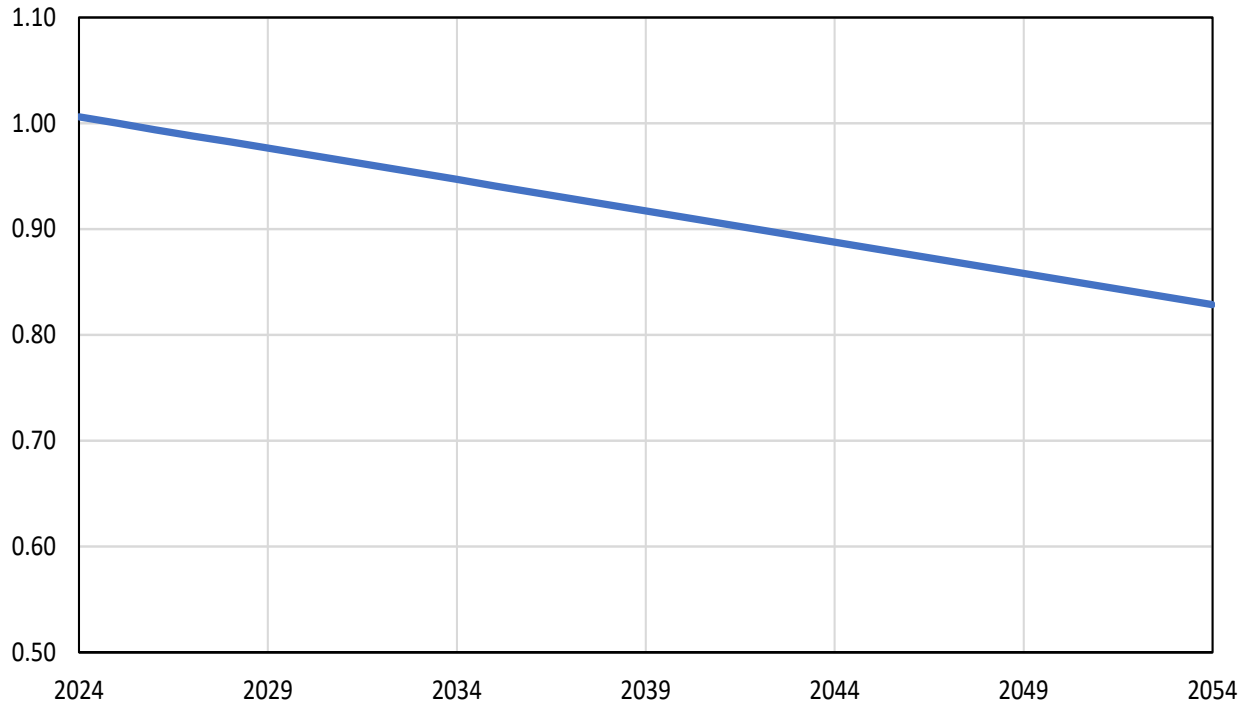
# Technology & Building Shell Trends



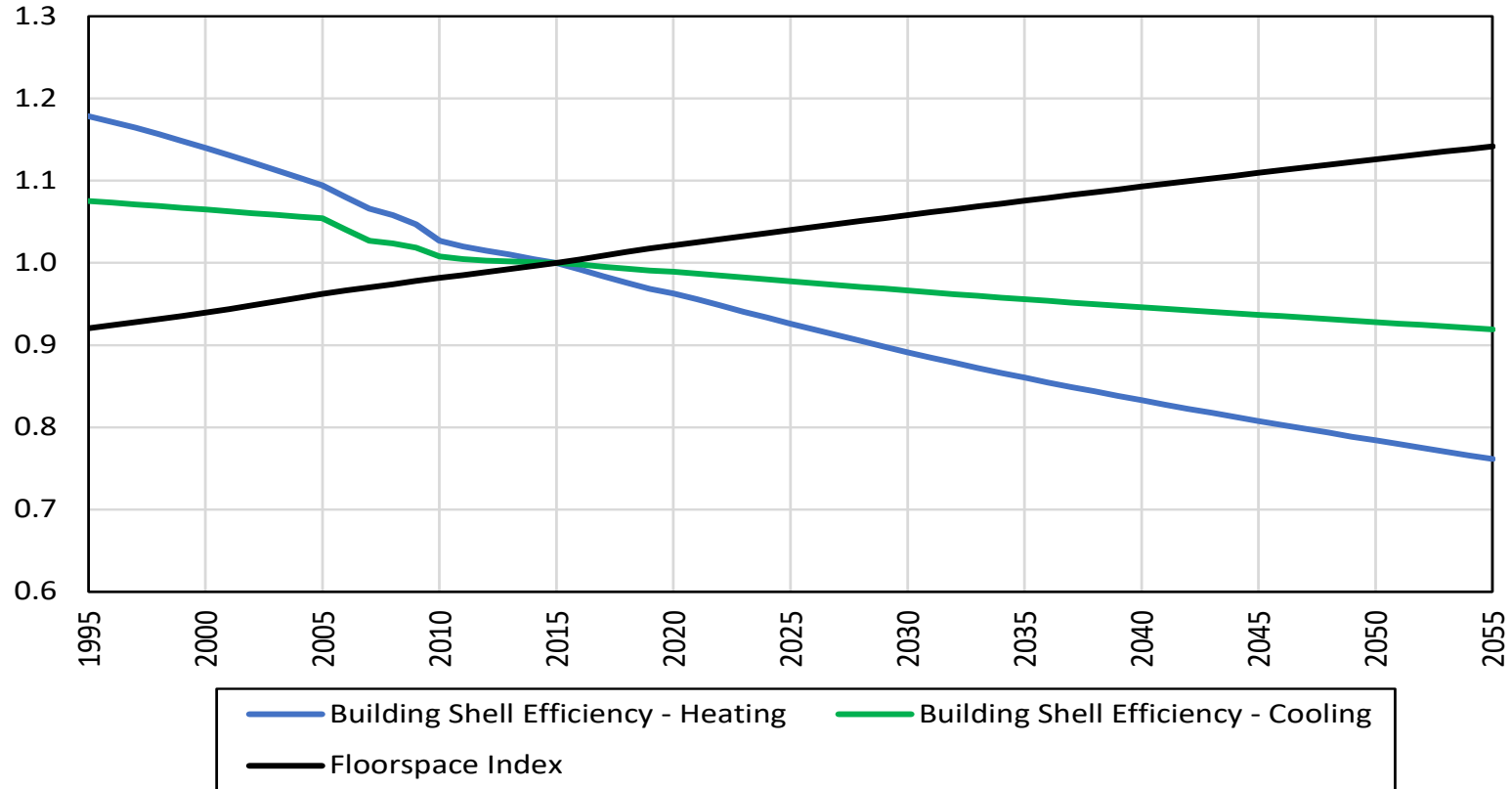
## Heat Pump Efficiency Improvement Factor Relative to Electric Resistance Heating



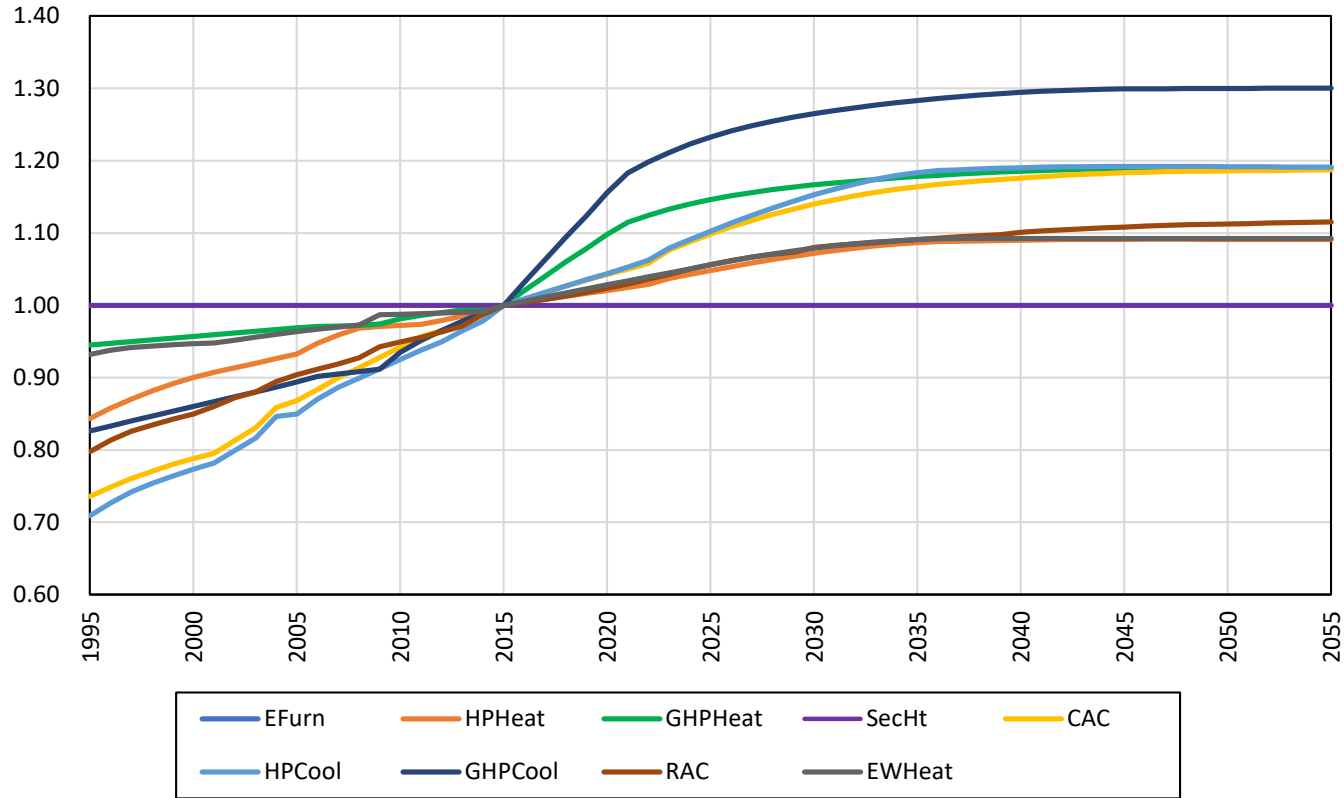
## Decreasing Usage Index Due To Climate Trend



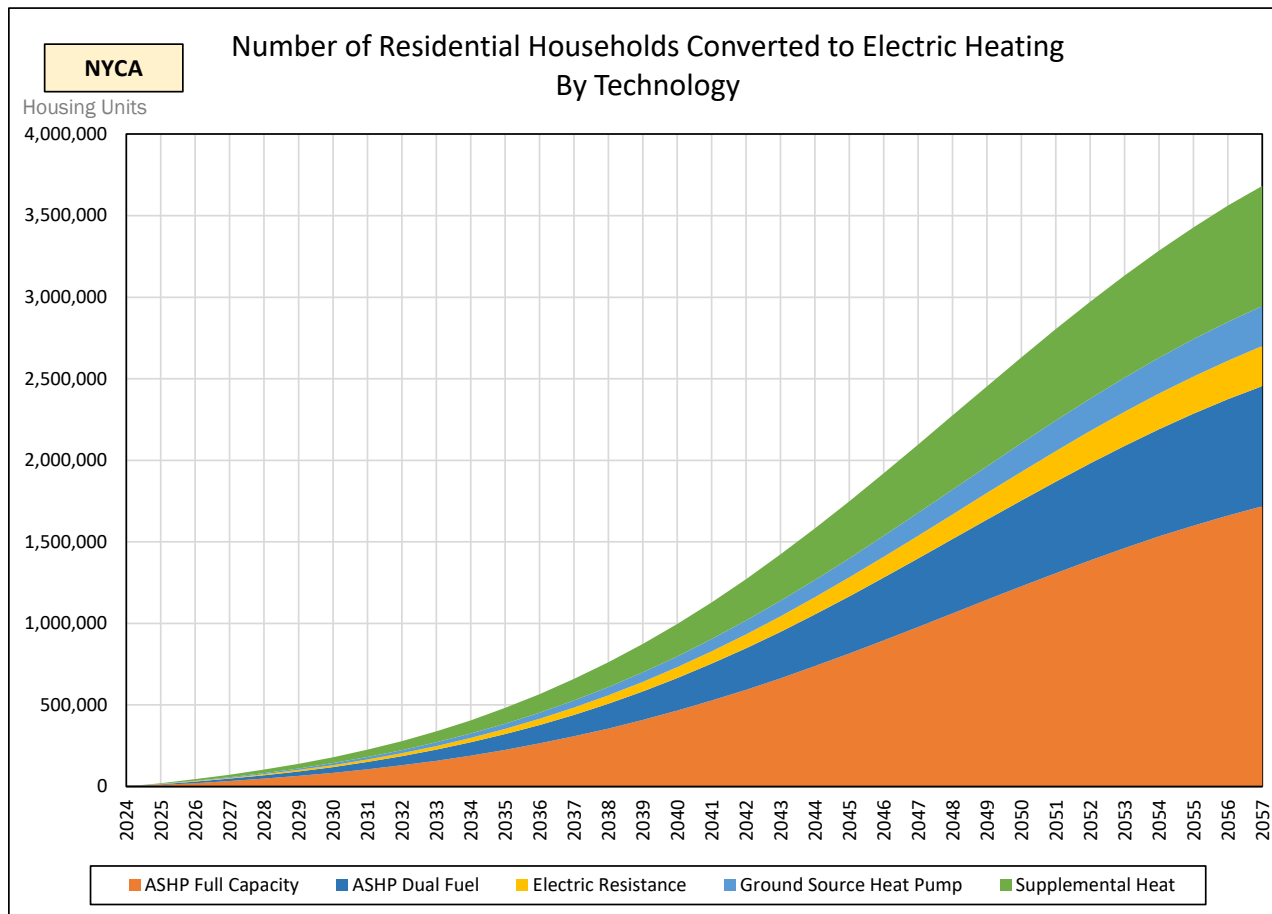
## Building Shell Efficiency Indexes

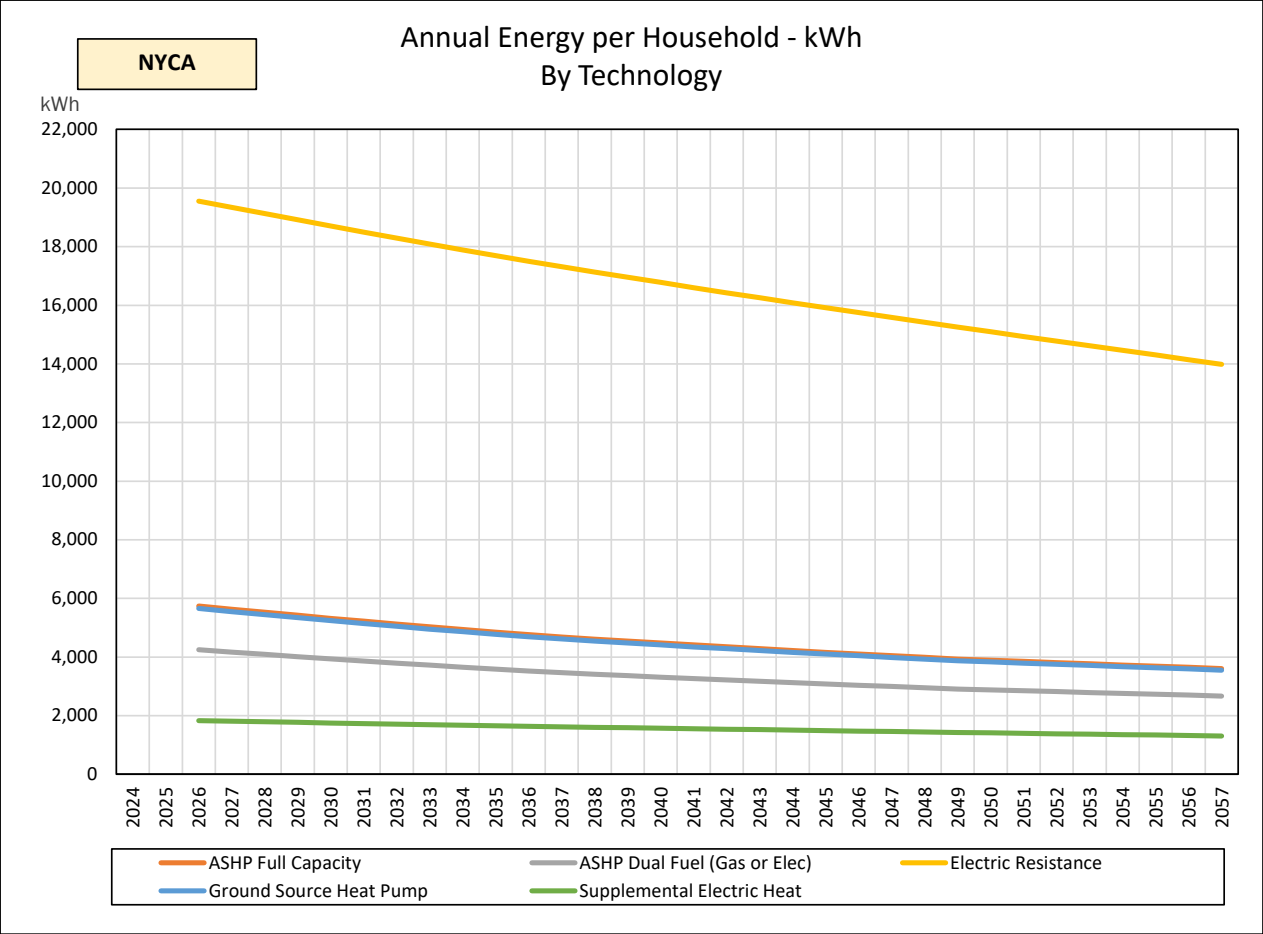


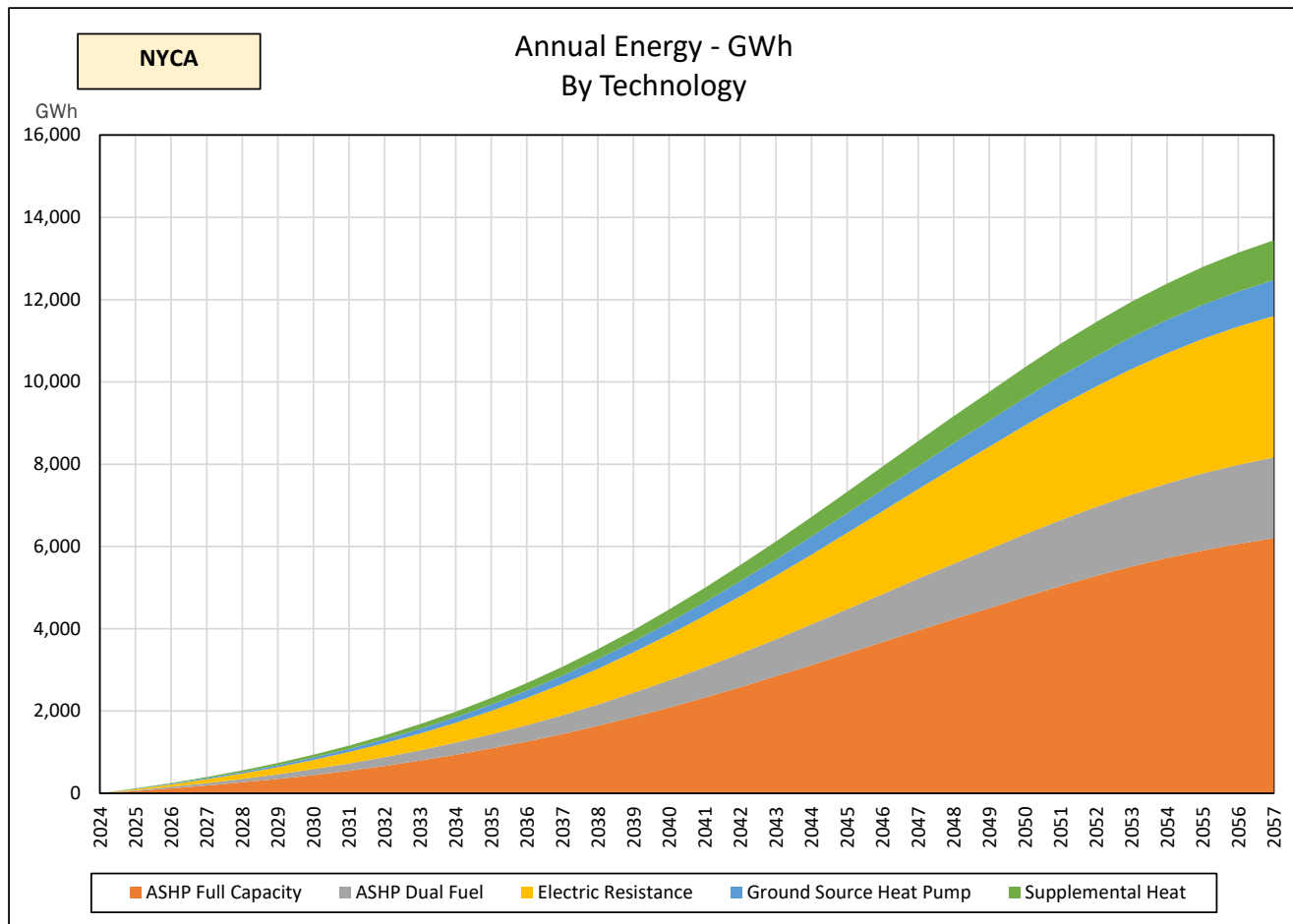
## Energy Efficiency Indexes for Space Heating & Cooling Technologies



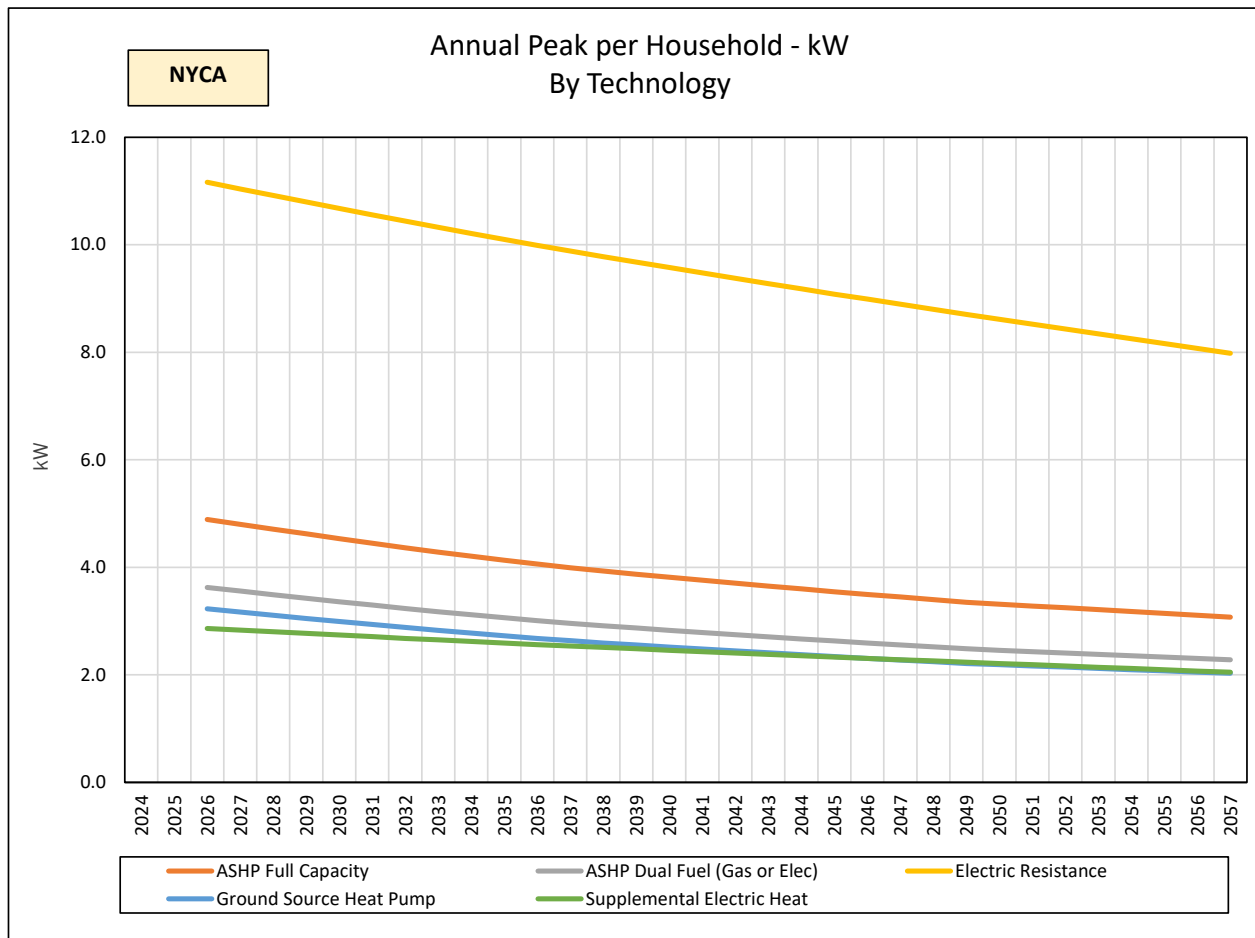
# Building Electrification Forecast – Residential Heating

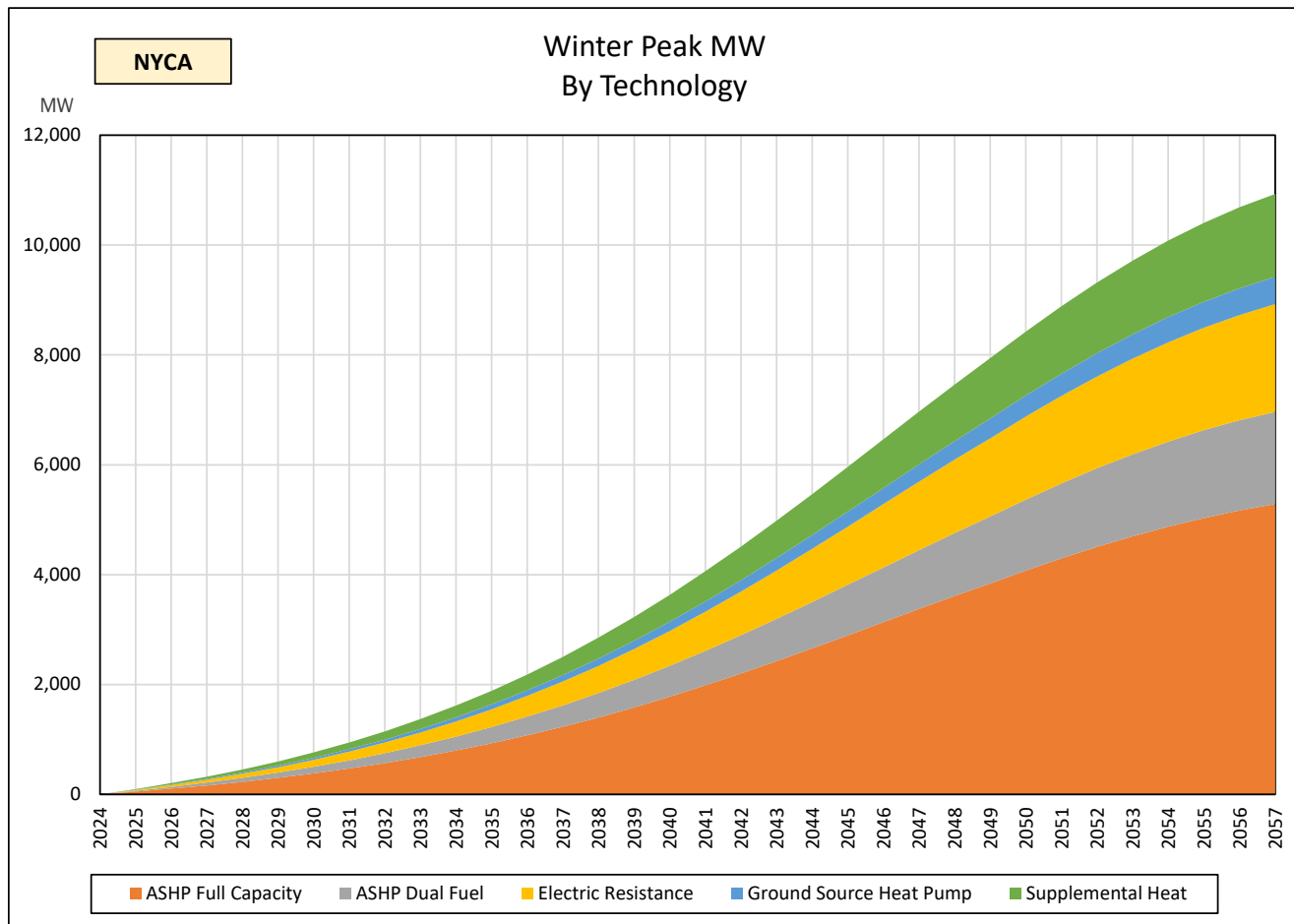












# Our Mission & Vision



## Mission

Ensure power system reliability and competitive markets for New York in a clean energy future



## Vision

Working together with stakeholders to build the cleanest, most reliable electric system in the nation

# Questions?