

Residential Thermostat Settings and Temperature Preferences Study

Final Report

July 2021

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Executive Summary

This report presents the findings from a survey with 239 households in late 2020 to early 2021 about thermostat settings, setbacks, and type of thermostat in the home. The households were sampled from the Northeast Census Region which includes the New England and Mid-Atlantic Divisions.

There were several goals for this research.

1. **Temperature Preferences:** Understand the thermostat setpoints for households in the Northeast.
2. **Temperature Setbacks:** Develop information on the use of setbacks in the winter and summer, when no one is at home and when everyone in the home is asleep.
3. **Thermostat Types:** Estimate the penetration of programmable thermostats and smart thermostats.
4. **Smart Thermostat Use:** Develop additional information on use of smart phone apps and other features.

This information can help program implementers understand how to set thermostats on initial install, what level of setbacks are acceptable, and the potential for use of smart thermostat features.

Survey Methodology

APPRISE purchased a Postal Delivery Sequence File from Marketing Systems Group, a commercial provider of sample data. This Address Based Sample (ABS) was built using the United States Postal Service Computerized Delivery Sequence File (CDSF) and covers nearly all of the households in the United States. Our sample included addresses from the New England and Mid-Atlantic regions. We selected a random sample of 2,000 households stratified by state from the provided sample.

The following procedures were used to implement the surveys.

- APPRISE sent an advance letter to all households selected for the survey. The letter provided the following information.
 - An explanation of the purpose of the survey.
 - A link to an online version of the survey.
 - A toll free number for households to call in to complete the survey over the phone.
 - The letter also notified households with valid phone numbers that they would begin receiving calls from APPRISE to complete the survey.
- Half of the sample was sent a five dollar incentive in cash in this initial advance letter.

- APPRISE also sent an advance email to all participants in the sample with a valid email address. The contents of the advance email were identical to the contents of the advance letter.
- Following the advance letters and emails, APPRISE staff started calling all participants with a valid phone number. Daytime, evening, and weekend calls were made.
- The telephone survey length was approximately five minutes.
- After six days in the field, APPRISE sent a follow-up postcard to all open cases reminding the participants about the survey and encouraging them to complete it online or over the phone.
- After twelve days in the field, APPRISE sent a follow-up advance email to all open cases with an email address.
- After a month in the field, 12.5 percent of the respondents who received the incentive completed the survey, compared to 6.2 percent of those who did not.
- APPRISE sent a second advance letter to all open cases in the sample. Households who had not received a five dollar incentive in the first round were sent the five dollar incentive in their second letter, while those who had received an incentive with their first letter did not receive an incentive in the second round.
- Surveys were completed between November 18, 2020 and January 8, 2021.

Survey Response

APPRISE completed 239 surveys for a completion rate of 12 percent. The cooperation rate, the completion rate for customers who were contacted and who were eligible for the survey, was 50 percent. The response rate was 23 percent.

Phone numbers were available for only 70 percent of the address-based sample, which brought down the overall response rate. While the overall response rate was 23 percent, the response rate among those with a working phone number was 30 percent, and the response rate among those with a working phone number, email, and a physical address that did not return the advance letter as undeliverable was 33 percent.

While 52 percent of the surveys were completed online, 48 percent were completed over the phone.

Single-family homeowners were overrepresented in the survey data. APPRISE developed weights to create a sample that was more representative of the population. The weighted survey data do a much better job of representing homeowners and single-family home occupants. However, white households are still over-represented in the weighted data.

Thermostat Settings

Key findings on thermostat settings are summarized below.

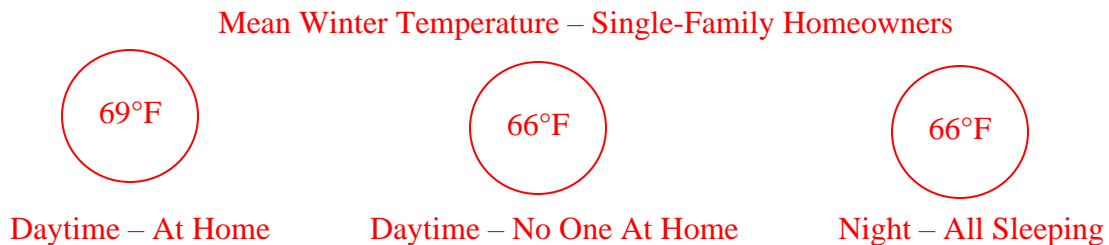
Terminology

We first provide key terminology with respect to temperature setting because of confusion that is common in this area.

- In the winter heating season, turning the thermostat down to a lower setpoint results in the heating system activating less frequently and/or for less time, thereby saving energy. This logically associates with the term “setback” for this behavior, whether manual or automated.
- In the summer air conditioning season, turning the thermostat up to a higher setpoint results in the cooling system activating less frequently and/or for less time, thereby saving energy. Though less logical, the term “setback” is often still used for this behavior (as reflected in this report). The more accurate term “setup” is sometimes used, but may be less ubiquitously understood.
- Adding to the confusion, manufacturer and program educational materials often assume that nighttime represents the universal energy saving period, meaning cooler while sleeping in the winter and warmer while sleeping in the summer. Historically, this assumption has been reflected in operator manuals, device default settings and even ENERGY STAR required settings in its original programmable thermostat certification protocol.

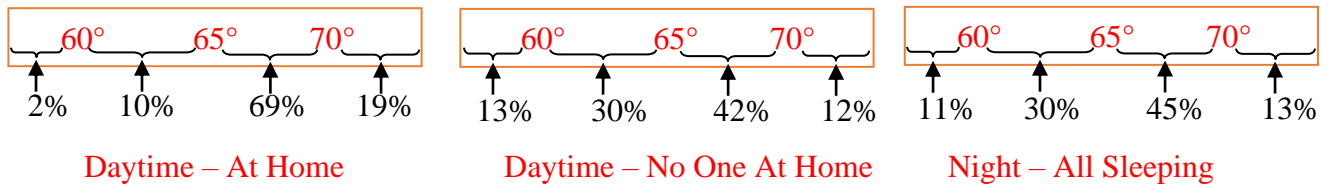
Winter Temperature Settings

- Mean Winter Temperature Settings: Single-family homeowners reported a mean winter temperature setting of 69 degrees Fahrenheit in the winter during the day when someone is home, 66 degrees during the day when no one is home, and 66 degrees at night when everyone in the home is sleeping. Other respondents kept their homes at about two degrees higher on average.



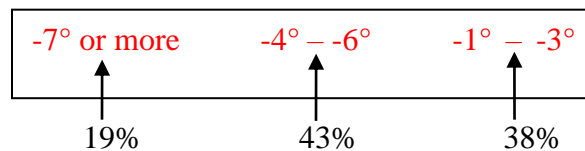
- Winter Temperature Ranges: 69 percent of the single-family homeowners reported that they kept the home at 66 to 70 degrees when they are home. While only two percent reported that they keep the temperature at less than 60 degrees and ten percent at 61 to 65 degrees when someone is home during the day, 13 percent reported that they keep the temperature at less than 60 degrees and 30 percent at 61 to 65 degrees during the day when no one is home. They were also more likely to use these lower settings when everyone was sleeping. They were also more likely to use these lower settings when everyone was sleeping.

Winter Temperature Range – Single-Family Homeowners



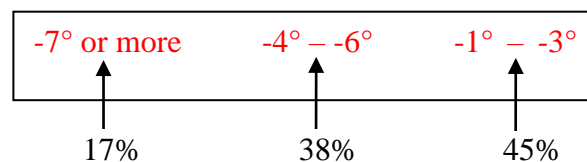
- Winter Temperature Lack of Setbacks: While 43 percent of single-family homeowners don't change the temperature when no one is home in the winter, 41 percent do not change the temperature at night (based on reported temperature settings).
- Winter Daytime Setbacks: Of those single-family homeowners who change the setpoint, 38 percent reported that they lower the temperature by one to three degrees, and 43 percent reduce the temperature by four to six degrees. The remaining 19 percent set it back by seven or more degrees.

Winter Daytime Setbacks – Single-Family Homeowners who Use Setbacks



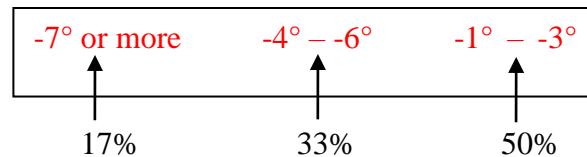
- Winter Night Setbacks – Single-Family: Fifty-four percent of single-family homeowners reported that they set their temperature back at night in the winter and five percent set their heat to higher temperatures. Of those who set their temperature back, 45 percent set it back by one to three degrees, 38 percent set it back by four to six degrees, and 17 percent set it back by more than six degrees.

Winter Night Setbacks – Single-Family Homeowners who Use Setbacks



- Winter Night Setbacks – Multi-Family: Forty-four percent of multi-family households reported that they make a temperature setback at night. Of these, 50 percent reported that they lowered the temperature by only one to three degrees, and 33 percent reduced the temperature by four to six degrees.

Winter Night Setbacks – Multi-Family Homeowners who Use Setbacks



- Elderly Households Winter Settings: Single-family homeowners with a household member 62 or older reported that they keep their homes at higher winter temperatures than those without elderly household members. While ten percent with an elderly member reported that they set their heat at or above 73 during the day when someone is home, ten percent of those without an elderly member reported that they set their heat at or above 71 degrees.
- Elderly Household Winter Setbacks: Single-family homeowners with elderly members were less likely to set back their heat during their day in the winter (because there is always someone home during the day). Ten percent with an elderly member set their heat at or below 60 degrees when no one is at home during the day compared to 16 percent without elderly members. Households with elderly members also set their homes at higher temperatures in the winter at night when everyone is asleep.
- Elderly Household Nighttime Settings: While 35 percent of elderly member single-family households reported a nighttime winter setpoint of 65 degrees or lower, only ten percent reported those setpoints during the day when someone is home, indicating that 25 percent have a lower nighttime temperature.

Summer Temperature Settings

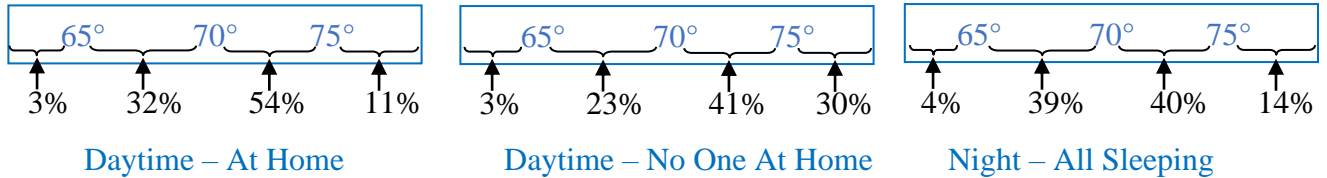
- Mean Summer Temperature Settings: Single-family homeowners with central air conditioning reported a mean summer temperature of 72 degrees Fahrenheit during the day when someone is home, 74 degrees during the day when no one is home, and 72 degrees at night when everyone in the home is sleeping.

Mean Summer Temperature – Single-Family Homeowners with Central Air



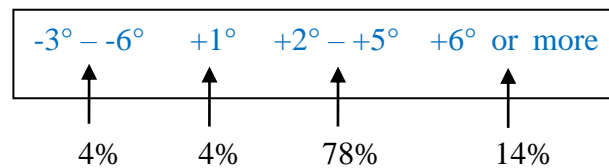
- **Summer Temperature Ranges:** Fifty-four percent of the single-family homeowners reported that they kept the home at 71 to 75 degrees when they are home during the day, while 32 percent reported that they keep the temperature between 66 and 70 degrees when someone is home during the day. A significant majority (71%) reported that they keep the temperature at 71 or above during the day when no one is home, while 43 percent reported below 71 degree range at night.

Summer Temperature Range – Single-Family Homeowners



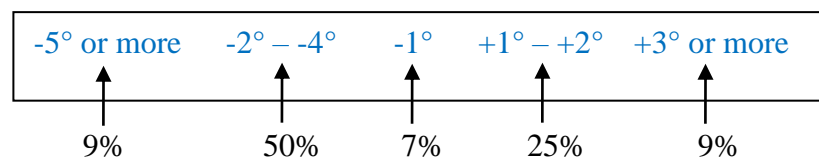
- **Summer Temperature Lack of Setbacks:** Approximately half (51 percent) of single-family homeowners reported that they do not change setpoints during the day when no one is home, while 57 percent do not adjust the temperature at night when sleeping.
- **Summer Daytime Setbacks:** Of the 49 percent of single-family homeowners who change setpoint during the day when no one is home, 78 percent increase the temperature by two to five degrees and another 14 percent increase the setpoint by more than five degrees.

Summer Daytime Setbacks – Single-Family Homeowners who Use Setbacks

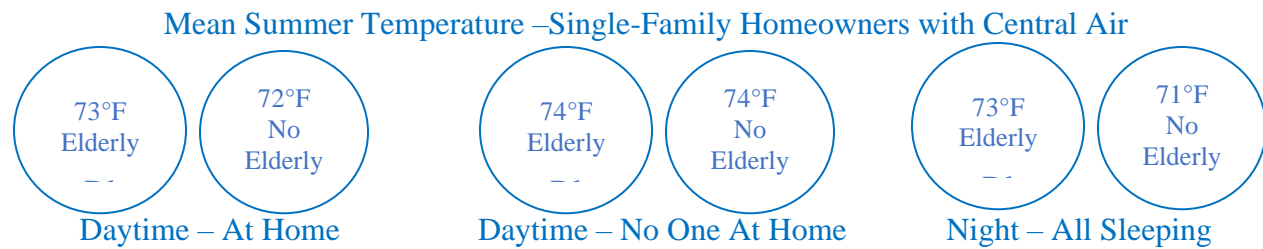


- **Summer Night Setbacks:** Of the 43 percent of single-family homeowners who change the summer setpoint at night when everyone is sleeping, about two thirds (66%) lower the temperature at night; 50 percent by two to four degrees. Only about one-third of those who reported that they change the setpoint at night raise the temperature; 25 percent by just one to two degrees.

Summer Night Setbacks – Single-Family Homeowners who Use Setbacks



- **Elderly Household Summer Daytime Settings:** Single-family homeowners with air conditioning and a household member 62 or older reported that they keep their homes at only slightly warmer temperatures (average 73 degrees) during the day when someone is home than those without elderly household members (average 72 degrees). While 13 percent with elderly reported that they set the temperature higher than 75 degrees, nine percent without elderly reported that they set the temperature higher than 75 degrees.



- **Elderly Household Night Summer Settings:** Single-family homeowners with air conditioning and a household member 62 or older also keep their homes at warmer summer temperatures when everyone is asleep compared with households without an elderly member. While 64 percent with an elderly member set their air conditioning at or above 71 degrees at night, 46 percent of those without an elderly member set their air conditioning at or above 71 degrees at night.
- As more than 40 percent of respondents reported that they do not set back the thermostat, this appears to be a significant energy-saving opportunity. However, setting preferences among those who are already setting back indicate that initial or default setbacks should not be overly aggressive (not more than two to three degrees).

Energy Conservation

- While 32 percent said they set their home at less than comfortable temperature during the day in the winter to save energy, 25 percent said they set their home at a less than comfortable temperature at night in the winter.
- A smaller proportion (15 percent) said they set their home at a less than comfortable temperature during the day in the summer to save energy, and 11 percent at a less than comfortable temperature at night in the summer.

Thermostats Technology as a Catalyst for Setback Behavior

- Forty-nine percent reported that they have a manual thermostat, 38 percent reported that they have a programmable thermostat, and only 12 percent reported that they have a smart thermostat.
- When asked how they set back their thermostat when no one is home, 33 percent changed the temperature manually, 16 percent changed it with a programmed setting, two percent changed it with a smart phone, and two percent changed it directly through their smart thermostat.

- Only eight percent had a smart thermostat with an app that was set up, two-thirds of those who had a smart thermostat.

Recommendations

We make the following recommendations based on this research.

Setpoints and Setbacks

- When considering default setpoints, setbacks and schedules for device replacement and thermostat education programs, be prepared to develop different protocols for elderly and non-elderly member households, both with respect to occupancy patterns and temperature preferences for each period.
 - For non-elderly households, the energy saving setback opportunity periods may most typically be nighttime/sleep in winter and daytime/home in summer.
 - For a significant proportion of elderly member households, the setback opportunity period may be daytime/home in both summer and winter.
- Direct resident interaction will always be preferable for establishing the schedule and setpoints for any individual household. If programmatically infeasible, default settings should be selected carefully to maximize initial receptivity, coupled with effective educational resources and support opportunities regarding the setup and operation of the new thermostat for comfort and energy savings.
- Elderly member households are more likely to be home all day and therefore should not have a default daytime/away setback enabled without consultation. Non-elderly households, on the other hand, appear receptive to conventional wisdom assumptions of a lower setpoint when away from home in winter and a higher setpoint when away in summer.
 - For households without an elderly member, consider a default winter setting of 69 during the day with a setback of three degrees to 66 at night; and 72 degrees at night in the summer with a setup of 2 degrees to 74 during the day.
 - For households with an elderly member, consider a default winter setting of 70 degrees in the winter and 74 degrees in the summer, but without any predetermined setbacks.

Baseline Conservation Behavior

- If current settings are being used as the baseline for determining new energy saving setpoints, consider whether household members are already sacrificing comfort to conserve energy, as these households may have less tolerance for additional energy savings in their heating and cooling settings.

- If installing new thermostats with default settings, keep in mind that the default settings may save less energy than the current settings of some households. Existing older thermostats may also be providing inaccurate temperature readings contributing to the perceived discomfort.
- We recommend always providing the opportunity for a resident interview in combination with the installation of a new thermostat so that default settings can be modified accordingly. Similarly, providing the opportunity for “live” training empowers residents to modify default settings with an understanding of the energy and comfort implications.
- Education materials should always be provided in advance of or at the time of a new thermostat installation, providing easy to understand instructions on basic set-up, day-to-day operation and optional advanced features.

Smart Thermostats

- Smart thermostats represent a good opportunity for energy savings based on a number of factors evident from this survey.
 - Low existing penetration rate.
 - Many households still do not practice thermostat setbacks.
 - Of the households practicing setbacks, most are doing so manually.
- The capability of smart thermostats to adjust settings based on occupancy awareness appears to provide a significant advantage in that it obviates the need for direct interaction by the resident (other than to enable the feature).
- However, the fact that many respondents did not use the app in conjunction with a smart thermostat indicates that this feature will be more effective when triggered by an on-board sensor rather than being reliant on the geofencing capabilities of a linked smart phone.

I. Introduction

This report presents the findings from a survey about thermostat characteristics, settings, and setbacks. The 239 respondent households were randomly sampled from an address based sample frame in the New England and Mid-Atlantic Census Divisions.

A. *Research Goals*

There were several goals for this research.

1. **Temperature Preferences:** Understand the winter and summer thermostat setpoints for households in the Northeast.
2. **Temperature Setbacks:** Develop information on the use of thermostat setbacks in the winter and summer, when no one is at home and when everyone in the home is asleep.
3. **Thermostat Types:** Estimate the penetration of programmable thermostats and smart thermostats.
4. **Smart Thermostat Use:** Develop additional information on use of smart phone apps and other smart thermostat features.

This information can help program implementers understand how to set smart thermostats temperatures on initial install, what level of setbacks will be accepted, and the potential for use of smart thermostat features.

B. *Organization of the Report*

Three sections follow this introduction.

- **Section II – Methodology:** This section describes the sample design, survey implementation, the survey response, and survey weighting.
- **Section III – Detailed Findings:** This section provides detailed information on the survey findings.
- **Section IV – Summary:** This section provides a summary of the findings from the survey and resulting recommendations.

This report was prepared by APPRISE and MaGrann Associates.

II. Methodology

This section provides information on the sample frame and sample selection procedures, the survey implementation process, and the survey response.

A. Sample

We purchased a Postal Delivery Sequence File from Marketing Systems Group, a commercial provider of sample data. This Address Based Sample (ABS) was built using the United States Postal Service Computerized Delivery Sequence File (CDSF) and covers nearly all of the households in the United States.

We requested a sample of 5,000 addresses from the New England and Mid-Atlantic regions, with exclusion of the following address types.

- Drops: A single delivery point or receptacle that services multiple residences. Examples: Boarding Houses, Fraternities, single door slot shared by two residences (most common in NYC and Chicago). Drop units have the same exact address with no distinguishing apartment number.
- Traditional PO Boxes.
- Seasonals: An address that receives mail only during a specific season (for example, a summer only residence).
- Vacants: Delivery points that have been unoccupied for 90 days or longer.

We also obtained the name, land line phone number, cellular phone number, and email address where available. We utilized the “permission pass”, where the data provider emailed the addresses and furnished the households with an opportunity to opt out of receiving the email.

The opt-out email was as follows.

Subject: Upcoming Research Survey on Home Heating & Cooling / From: APPRISE

Dear First Name,

Thank you for taking the time to open and read this email. We value your time and respect your online privacy. Therefore, we would like to request your permission to allow APPRISE to communicate with you by email to conduct an important survey.

We hope you will take advantage of this opportunity to contribute to research on how new thermostats should be set and to make homes more comfortable. If you prefer not to receive the email from APPRISE please [click here](#).

Thank you for your time.

Sincerely,
APPRISE Incorporated
32 Nassau Street, Suite 200
Princeton, NJ 08542

We selected a random sample of 2,000 households stratified by state from the provided sample of 5,000 households.

B. Survey Implementation

The following procedures were used to implement the surveys.

- APPRISE sent an advance letter to all households selected for the survey. The letter provided the following information.
 - An explanation of the purpose of the survey.
 - A link to an online version of the survey.
 - A toll free number for households to call in to complete the survey over the phone.
 - The letter also notified households with valid phone numbers that they would begin receiving calls from APPRISE to complete the survey.
- Half of the sample was sent a five dollar incentive in cash in this initial advance letter.
- APPRISE also sent an advance email to all participants in the sample with a valid email address. The contents of the advance email were identical to the contents of the advance letter.
- Following the advance letters and emails, APPRISE staff started calling all participants with a valid phone number.
 - Daytime, evening, and weekend calls were made.
 - Households with a valid phone number were attempted seven times on average. The maximum number of phone attempts was 17.
- The telephone survey length was approximately five minutes.
- After six days in the field, APPRISE sent a follow-up postcard to all open cases reminding the participants about the survey and encouraging them to complete it online or over the phone.
- After twelve days in the field, APPRISE sent a follow-up advance email to all open cases with an email address.
- After a month in the field, 12.5 percent of the respondents who received the incentive completed the survey, compared to 6.2 percent of those who did not.

- APPRISE sent a second advance letter to all open cases in the sample. Households who had not received a five dollar incentive in the first round were sent the five dollar incentive in their second letter, while those who had received an incentive with their first letter did not receive an incentive in the second round.
- Surveys were completed between November 18, 2020 and January 8, 2021.

Table II-1 summarizes the outreach attempts that were made to each groups of 1,000 respondents.

**Table II-1
Survey Outreach Timeline**

Contact Method	Initial Incentive Group	Later Incentive Group
First Advance Letter	11/12/20	11/13/20
First Advance Email	11/13/20	11/13/20
Survey Calling Implementation	11/18/20	11/20/20
Postcard	11/24/20	11/24/20
Second Advance Email	11/30/20	11/30/20
Second Advance Letter	12/11/20	12/11/20
Survey Calling Ended	1/08/21	1/08/21

Note: Respondents in the Initial Incentive Group received a five dollar incentive in their first advance letter. Respondents in the Late Incentive Group received a five dollar incentive in their second advance letter.

C. Survey Response

Table II-2 provides information on the survey response. APPRISE completed 239 surveys for a completion rate of 12 percent. The cooperation rate, the completion rate for customers who were contacted and who were eligible for the survey, was 50 percent. The response rate was 23 percent.

**Table II-2
Survey Response**

	All Participants	
	Number	Percent
Total Selected	2,000	100%
Voicemail/No Answer	464	23%
Wrong Number	12	<1%
Refusal	233	12%
Non-Working Number	285	14%
Other Phone Problem	118	6%
Hearing/Language Barrier	16	<1%

	All Participants	
	Number	Percent
Total Selected	2,000	100%
Not Eligible	51	3%
Not Available/Ill/Deceased	11	<1%
Partial Complete	4	<1%
No Phone Provided	567	28%
Complete	239	12%
Cooperation Rate	-	50%
Response Rate	-	23%

Table II-3 provides information on the response and cooperation rates based on the contact information that was available for each household. The table shows that phone numbers were available for only 70 percent of the address-based sample, which brought down the overall response rate. While the overall response rate was 23 percent, the response rate among those with a working phone number was 30 percent, and the response rate among those with a working phone number, email, and a physical address (that did not return the advance letter as undeliverable) was 33 percent.

Table II-3
Survey Response
By Contact Information Available

	Contact Information Available							
	Phone Number		Phone Number and Correct Address		Email		Email, Phone, and Correct Address	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total Selected	1,411	100%	1,254	100%	371	100%	285	100%
Voicemail/No Answer	464	33%	417	33%	107	29%	94	33%
Wrong Number	12	<1%	9	<1%	5	1%	5	2%
Refusal	233	17%	219	17%	54	15%	51	18%
Non-Working Number	285	20%	218	17%	58	16%	46	16%
Other Phone Problem	118	8%	106	8%	26	7%	25	9%
Hearing/Language Barrier	16	1%	13	1%	1	<1%	1	<1%
Not Eligible	51	4%	49	4%	8	2%	8	3%
Not Available/Ill/Deceased	11	<1%	10	<1%	1	<1%	1	<1%
Partial Complete	4	<1%	4	<1%	1	<1%	1	<1%
No Phone Provided	-	-	-	-	52	14%	-	-
Complete	217	15%	209	17%	58	16%	53	19%
Cooperation Rate	48%		48%		51%		50%	

	Contact Information Available							
	Phone Number		Phone Number and Correct Address		Email		Email, Phone, and Correct Address	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total Selected	1,411	100%	1,254	100%	371	100%	285	100%
Response Rate	30%		31%		29%		33%	

Table II-4 provides information on the response and cooperation rates by incentive group. While the response rate was 26 percent for those who received the incentive with the first advance letter, the response rate was 20 percent for those who received the incentive with the second advance letter.

Table II-4
Survey Response
By Incentive Group

	Incentive Status				All Participants	
	Initial Incentive		Later Incentive			
	Number	Percent	Number	Percent	Number	Percent
Total Selected	1,000	100%	1,000	100%	2,000	100%
Voicemail/No Answer	237	24%	227	23%	464	23%
Wrong Number	7	<1%	5	<1%	12	<1%
Refusal	105	11%	128	13%	233	12%
Non-Working Number	139	14%	146	15%	285	14%
Other Phone Problem	57	6%	61	6%	118	6%
Hearing/Language Barrier	9	<1%	7	<1%	16	<1%
Not Eligible	26	3%	25	3%	51	3%
Not Available/Ill/Deceased	4	<1%	7	<1%	11	<1%
Partial Complete	2	<1%	2	<1%	4	<1%
No Phone Provided	275	28%	292	29%	567	28%
Complete	139	14%	100	10%	239	12%
Cooperation Rate	57%		43%		50%	
Response Rate	26%		20%		23%	

Table II-5 shows that 52 percent of the 239 households that completed the survey did so online, and 48 percent completed the survey over the phone.

Table II-5
Survey Response
By Completion Method

Completion Method	Number	Percent
Phone	125	52%
Online	114	48%
Total	239	100%

Table II-6 compares the characteristics of participant households to census data for all households in Northeastern United States. The table shows that single-family homeowners were overrepresented in the unweighted survey data. We developed weights to create a sample that was more representative of the population. The weighted survey data do a much better job of representing homeowners and single-family home occupants. However, white households are still over-represented in the weighted survey data.

Table II-6
Survey Representation

	Percent of Population		
	Survey Data		Census Data
	Unweighted	Weighted	
Own	85%	57%	62%
Single-Family	81%	60%	60%
Household Member 60+	46%	40%	43%
Household Member ≤ 18	27%	27%	28%
White	87%	82%	72%
Household Income < 50,000	29%	38%	35%
Household Income > 100,000	38%	36%	36%

Table II-7 compares the weighted and unweighted distribution of respondents by state to the Census data. The table shows that the weighted data over-represents New Jersey and Pennsylvania, and underrepresents New York.

**Table II-7
Respondents by State**

State	Survey Data		Census Data
	Unweighted	Weighted	
CT	7%	7%	6%
MA	10%	12%	12%
ME	2%	2%	3%
NH	2%	2%	2%
NJ	19%	19%	15%
NY	25%	20%	34%
PA	31%	33%	24%
RI	2%	2%	2%
VT	3%	2%	1%
Total	100%	100%	100%

III. Survey Findings

This section provides findings from the survey. Because the survey does a good job of representing single-family homeowners, most tables provide unweighted results for this group and for those not included in this group, as well as weighted results for all survey respondents.

A. Respondent Characteristics

Respondents were asked several questions to understand the characteristics of the respondent households. Information on these characteristics is presented in this section.

Table III-1 displays information on home ownership. Table II-2 shows that 55 percent of the respondents were homeowners. The number differs from that shown in the previous section, because the previous section's statistics does not include those who refused to answer this question or who reported that they did not know the answer.

**Table III-1
Home Ownership**

Do you rent or own your home?			
Home Ownership	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
Own	100%	37%	55%
Rent	-	50%	42%
Refused	-	12%	3%
Don't Know	-	1%	<1%
Total	100%	100%	100%

Table III-2 displays the distribution of respondents by dwelling type. The table shows that 59 percent of the respondents lived in single-family homes, 21 percent lived in multi-family buildings with fewer than five units, 16 percent lived in multi-family buildings with five or more units, and two percent lived in mobile homes.

**Table III-2
Home Type**

What type of home do you live in?			
Home Type	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
Single-Family	100%	28%	59%
Small Multi-Family (2-4 Units)	-	35%	21%

What type of home do you live in?			
Home Type	Single-Family Homeowners	Other Respondents	All Respondents
Large Multi-Family (5+ Units)	-	25%	16%
Mobile Home	-	6%	2%
Refused	-	6%	2%
Total	100%	100%	100%

Table III-3 displays the age distribution of the survey respondents. The table shows that 42 percent of the respondents were between 35 and 64.

Table III-3
Respondent Age

What is your age?			
Age	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
18-34	5%	15%	14%
35-54	29%	22%	25%
55-64	23%	15%	17%
65 or Older	34%	31%	30%
Refused	9%	18%	14%
Total	100%	100%	100%

Respondents were asked whether anyone in the household was 62 or older or 18 or younger. Table III-4 shows that 39 percent had someone 62 or older in the household, 26 percent had someone 18 or younger, and 33 percent did not have a household member in either of those age ranges.

Table III-4
Elderly Member or Child in Household

Is there anyone in your household that is aged 62 or older? Is there anyone in your household that is aged 18 or younger?			
Elderly Member or Child	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
Household Member \geq 62 Years	45%	41%	39%
Household Member \leq 18 Years	27%	22%	26%
Neither \geq 62 Years or \leq 18 Years	27%	29%	33%
Refused	4%	9%	4%

Table III-5 displays the race of the survey respondents. While 75 percent reported their race as White/Caucasian, six percent reported Black/African American, five percent reported Asian/Pacific Islander, and three percent reported Hispanic/Latino. Single-family homeowners were more likely to be White/Caucasian than other respondents.

**Table III-5
Respondent Race**

Which of the following races/ethnicities best describes you?			
Race	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
Asian/Pacific Islander	2%	6%	5%
Black/African American	3%	7%	6%
Hispanic/Latino	1%	4%	3%
Native American/Alaskan Native	0%	1%	<1%
White/Caucasian	84%	71%	75%
Multiracial/Biracial	2%	1%	1%
Refused	7%	9%	8%
Don't Know	1%	0%	<1%
Total	100%	100%	100%

Respondents were asked if English was their first language. Table III-6 shows that 91 percent of respondents reported that English was their first language.

**Table III-6
Respondent First Language**

Is English your first language?			
First Language	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
English is First Language	93%	88%	91%
English is Not First Language	5%	7%	6%
Refused	2%	4%	3%
Total	100%	100%	100%

Table III-7 displays the respondents' annual household income. While 11 percent reported an annual household income at or below \$25,000, 26 percent reported an annual household income above \$100,000.

**Table III-7
Annual Household Income**

What is your annual household income?			
Household Income	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
≤ \$25,000	5%	12%	11%
\$25,001 - \$50,000	12%	22%	16%
\$50,001 - \$75,000	15%	6%	10%
\$75,001 - \$100,000	13%	7%	9%
> \$100,000	29%	25%	26%
Refused	27%	24%	25%
Don't Know	0%	4%	2%
Total	100%	100%	100%

Respondents were asked whether they have central air conditioning in their home that is controlled by a thermostat. Table III-8 shows that 63 percent responded that they have central air conditioning.

**Table III-8
Central Air Conditioning**

Do you have central air conditioning and a thermostat in your home to set the exact temperature that you would like?			
Central Air Conditioning	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
Have Central Air Conditioning	65%	68%	63%
Do Not Have Central Air Conditioning	35%	32%	37%
Total	100%	100%	100%

B. Thermostat Settings

This section analyzes information provided by the respondents on home temperature settings.

Table III-9 shows that single-family homeowners reported a mean temperature setting of 69 degrees Fahrenheit in the winter during the day when someone is home, 66 degrees during the day when no one is home, and 66 degrees at night when everyone in the home is sleeping. Other respondents kept their homes at higher temperatures in the winter, averaging 70 degrees during the day when someone is home, 68 when no one is at home, and 68 at night when everyone is asleep.

**Table III-9
Winter Heating Settings**

Timing	Group	Respondents	Preferred Temperature					
			Mean	Percentile				
				P10	P25	P50	P75	P90
Daytime – Someone Home	SF Homeowners	171	69°F	65°F	68°F	68°F	70°F	72°F
	Other Respondents	67	70°F	65°F	68°F	70°F	72°F	74°F
	All Respondents	238	69°F	65°F	68°F	70°F	71°F	74°F
Daytime – No One Home	SF Homeowners	166	66°F	60°F	63°F	66°F	69°F	71°F
	Other Respondents	62	68°F	60°F	65°F	68°F	72°F	73°F
	All Respondents	228	67°F	60°F	64°F	68°F	70°F	73°F
Night	SF Homeowners	169	66°F	60°F	64°F	66°F	69°F	72°F
	Other Respondents	66	68°F	61°F	65°F	69°F	71°F	73°F
	All Respondents	235	67°F	60°F	65°F	68°F	70°F	73°F

Chart III-1A displays the winter heating setting distribution for single-family homeowners. Those who reported that they are “Always Home” have their daytime temperature recorded the same for when no one is home during the day. The table shows that 69 percent reported that they kept the home at 66 to 70 degrees when they are home. While only two percent reported that they keep the temperature at less than 60 degrees and ten percent at 61 to 65 degrees when someone is home during the day, 13 percent reported that they keep the temperature at less than 60 degrees and 30 percent at 61 to 65 degrees when no one is home during the day, 13 percent reported that they keep the temperature at less than 60 degrees and 30 percent at 61 to 65 degrees during the day when no one is home. They were also more likely to use these lower settings when everyone was sleeping. These details are also shown in Table III-10A.

**Chart III-1A
Winter Heating Settings: Single-Family Homeowners**

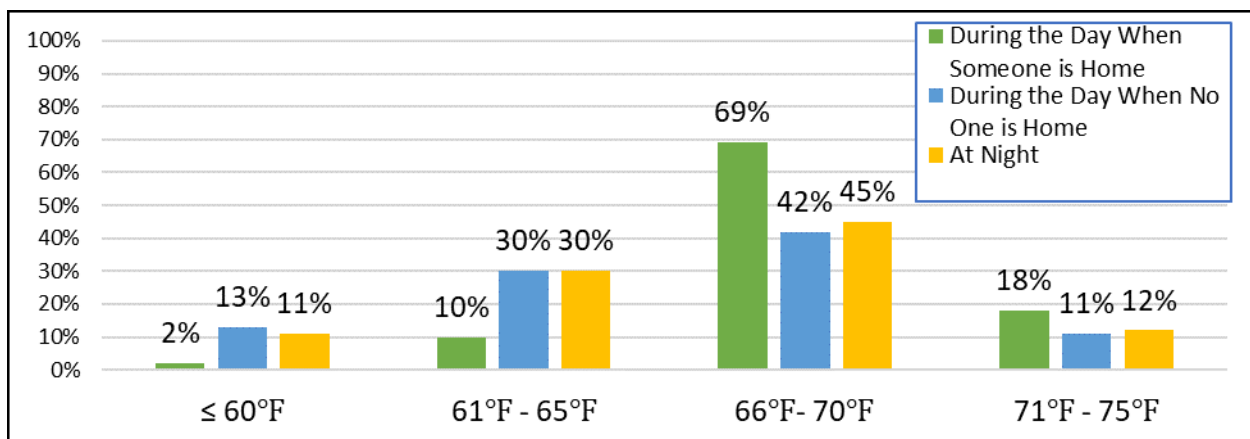


Table III-10A
Winter Heating Settings – Single-Family Home Owners

What temperature do you set your heating to during the day when someone is at home, during the day when no one is at home, and at night when everyone is sleeping in your home in the winter?			
Temperature	Timing		
	During the Day When Someone is Home	During the Day When No One is Home	At Night
Respondents	171	171	171
≤ 60°F	2%	13%	11%
61°F - 65°F	10%	30%	30%
66°F - 70°F	69%	42%	45%
71°F - 75°F	18%	11%	12%
76°F - 80°F	1%	1%	1%
Don't Know	0%	3%	1%
Total	100%	100%	100%

Chart III-1B displays how much cooler single-family homeowners set their thermostats in the winter when no one is home during the day. The chart shows that 43 percent don't change the temperature. Of those who do change the temperature, 38 percent lower the temperature by one to three degrees, and 43 percent reduce the temperature by four to six degrees. The remaining 19 percent set it back by seven or more degrees.

Chart III-1B
Winter Thermostat Degree Setback when No One is Home
Single-Family Homeowners

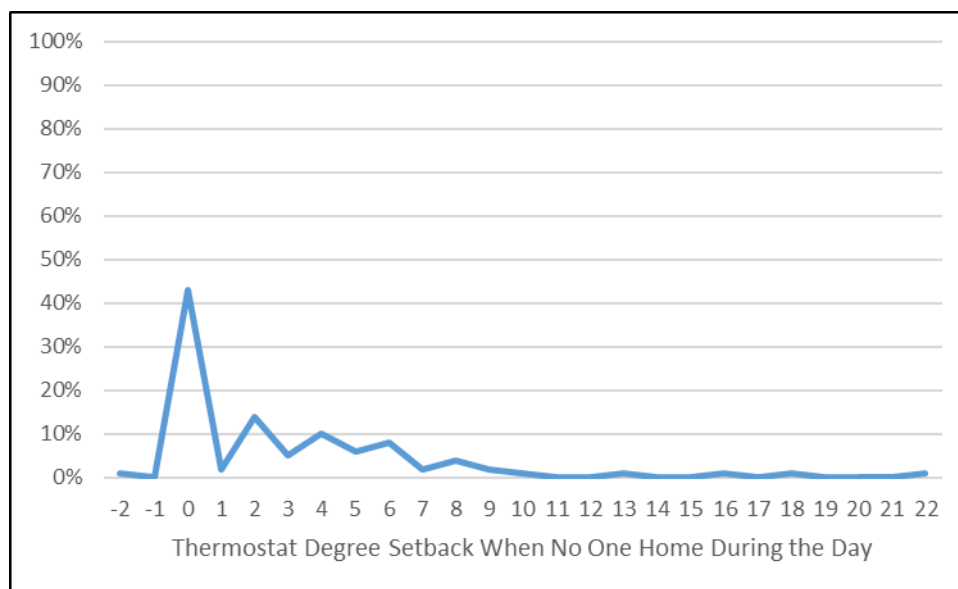


Chart III-1C displays how much cooler single-family homeowners set their thermostats in the winter at night. The chart shows that 41 percent don't change the temperature. Of those who do set back the temperature, 45 percent set it back by one to three degrees, 38 percent set it back by four to six degrees, and 17 percent set it back by more than six degrees.

Chart III-1C
Winter Thermostat Degree Setback at Night
Single-Family Homeowners

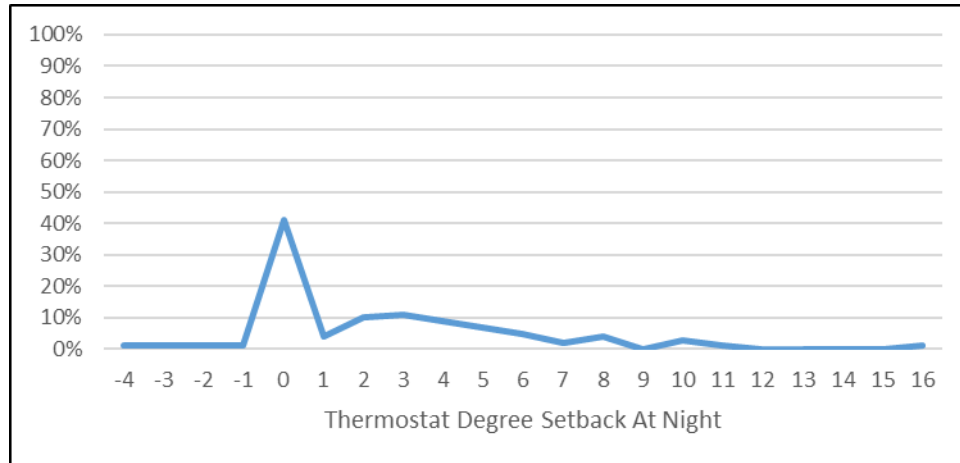
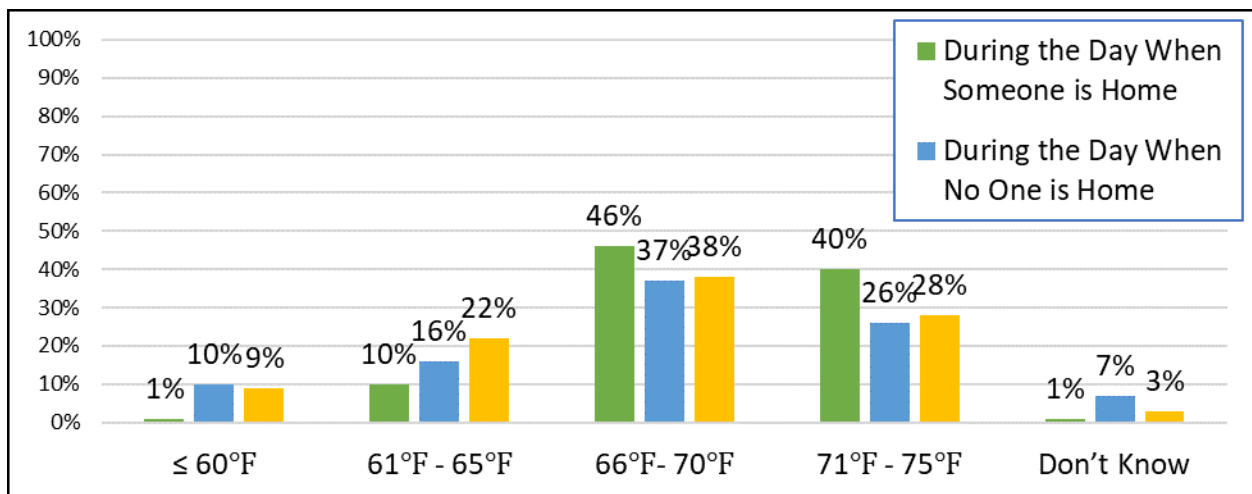


Chart III-2A displays the winter heating setting distribution for all other respondents. The chart shows that these respondents were more split between those who kept their temperature between 66 and 70 and between 71 and 75. These respondents also reported lower temperatures during the day when no one is home and at night. These results are also shown in Table III-10B. Table III-10C displays the results for all respondents.

Chart III-2A
Winter Heating Settings: Other Respondents



**Table III-10B
Winter Heating Settings – All Other Respondents**

What temperature do you set your heating to during the day when someone is at home, during the day when no one is at home, and at night when everyone is sleeping in your home in the winter?			
Temperature	Timing		
	During the Day When Someone is Home	During the Day When No One is Home	At Night
Respondents	68	68	68
≤ 60°F	1%	10%	9%
61°F - 65°F	10%	16%	22%
66°F- 70°F	46%	37%	38%
71°F - 75°F	40%	26%	28%
76°F - 80°F	1%	1%	0%
Refused	0%	1%	0%
Don't Know	1%	7%	3%
Total	100%	100%	100%

Chart III-2B displays how much cooler multi-family households, a subset of the other respondents, set their thermostats in the winter when no one is home during the day. While 62 percent don't change the temperature, 22 percent set it back by two to three degrees, and eight percent set it back by five to six degrees.

**Chart III-2B
Winter Thermostat Degree Setback when No One is Home
Multi-Family Residents**

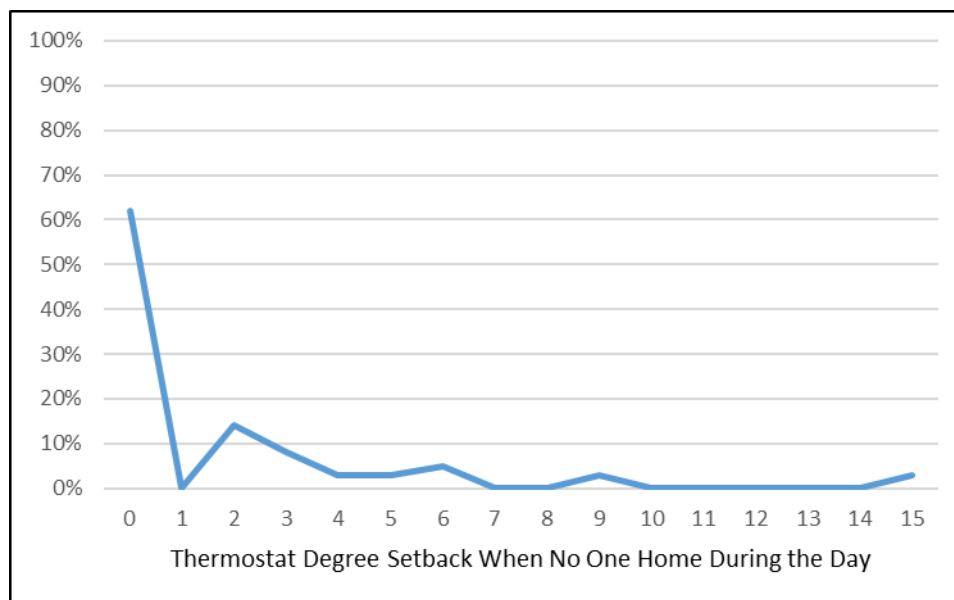
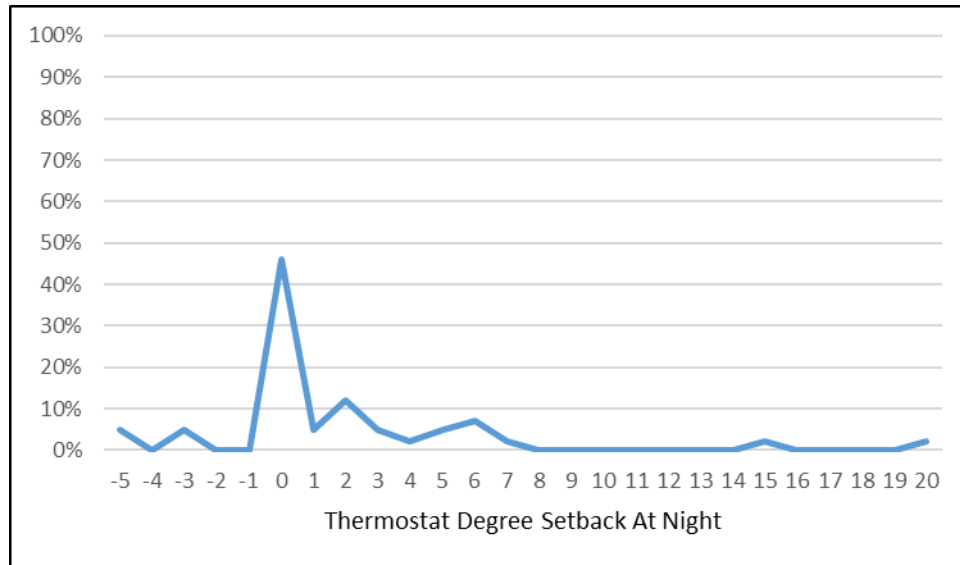


Chart III-2C displays how much cooler multi-family households set their thermostats in the winter at night. The chart shows that 44 make a setback at night. Of these, 50 percent reported that they lowered the temperature by only one to three degrees, and 33 percent reduced the temperature by four to six degrees.

**Chart II-2C
Winter Thermostat Degree Setback at Night
Multi-Family Residents**



**Table III-10C
Winter Heating Settings – All Respondents**

What temperature do you set your heating to during the day when someone is at home, during the day when no one is at home, and at night when everyone is sleeping in your home in the winter?			
Temperature	Timing		
	During the Day When Someone is Home	During the Day When No One is Home	At Night
Respondents	239	239	239
≤ 60°F	1%	10%	11%
61°F - 65°F	9%	23%	23%
66°F - 70°F	57%	38%	42%
71°F - 75°F	30%	19%	22%
76°F - 80°F	1%	1%	1%
Refused	0%	1%	0%
Don't Know	1%	7%	2%
Total	100%	100%	100%

Table III-11 shows that single-family homeowners with a household member 62 or older reported that they keep their homes at higher winter temperatures than those without elderly. While ten percent with an elderly member set their heat at or above 73 when someone is home, ten percent of those without an elderly member set their heat at or above 71 degrees.

**Table III-11
Winter Heating Settings Statistics. By Presence of Elderly Household Member
Single-Family Homeowners**

Timing		Respondents	Preferred Temperature					
			Mean	Percentile				
				P10	P25	P50	P75	P90
Daytime – Someone Home	Elderly Member	77	69°F	65°F	68°F	69°F	71°F	73°F
	No Elderly Member	94	68°F	65°F	67°F	68°F	70°F	71°F
Daytime – No One Home	Elderly Member	75	67°F	60°F	64°F	68°F	70°F	72°F
	No Elderly Member	91	65°F	60°F	62°F	65°F	68°F	70°F
Night	Elderly Member	75	66°F	61°F	64°F	67°F	70°F	72°F
	No Elderly Member	94	66°F	60°F	64°F	66°F	69°F	71°F

Charts III-3A, 3B, and 3C display winter heating settings for single-family homeowners by the presence of an elderly household member. Chart III-3A shows that households with elderly members were more likely than those without elderly members to set their heat from 71 to 75 degrees Fahrenheit when someone is home during the day. While 25 percent of households with elderly members set their homes at 71 to 75, only 13 percent of those without elderly members set their homes this warm.

**Chart III-3A
Winter Heating Settings: Single-Family Homeowners
During the Day When Someone is At Home, By Elderly Household Member**

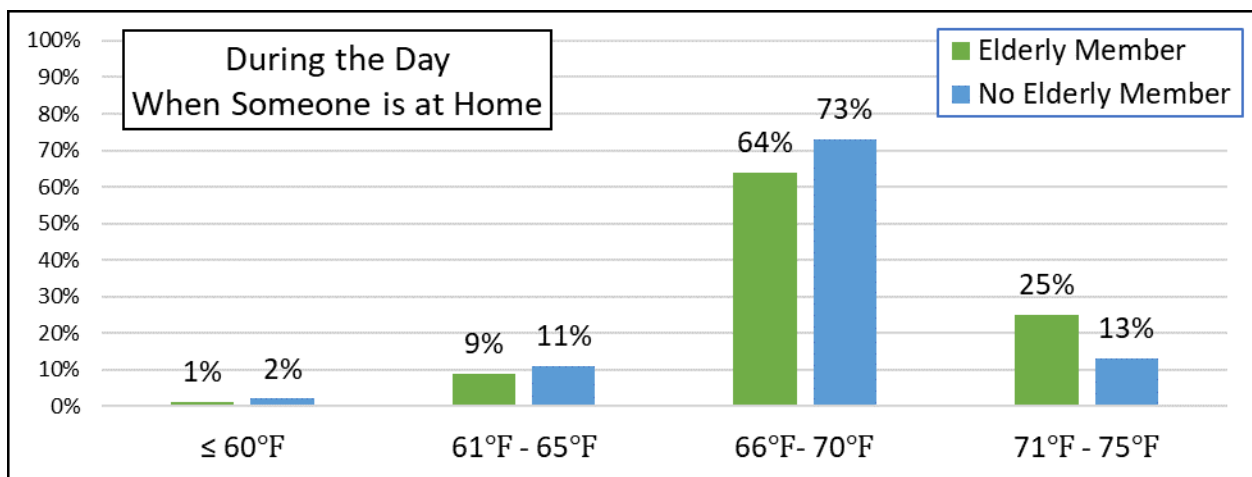


Chart III-3B shows that households with elderly members were less likely to set back their heat during their day in the winter (because there is always someone home during the day). Ten percent with an elderly member set their heat at or below 60 degrees when no one is at home compared to 16 percent without elderly members.

Chart III-3B
Winter Heating Settings: Single-Family Homeowners
During the Day When No One is At Home, By Elderly Household Member

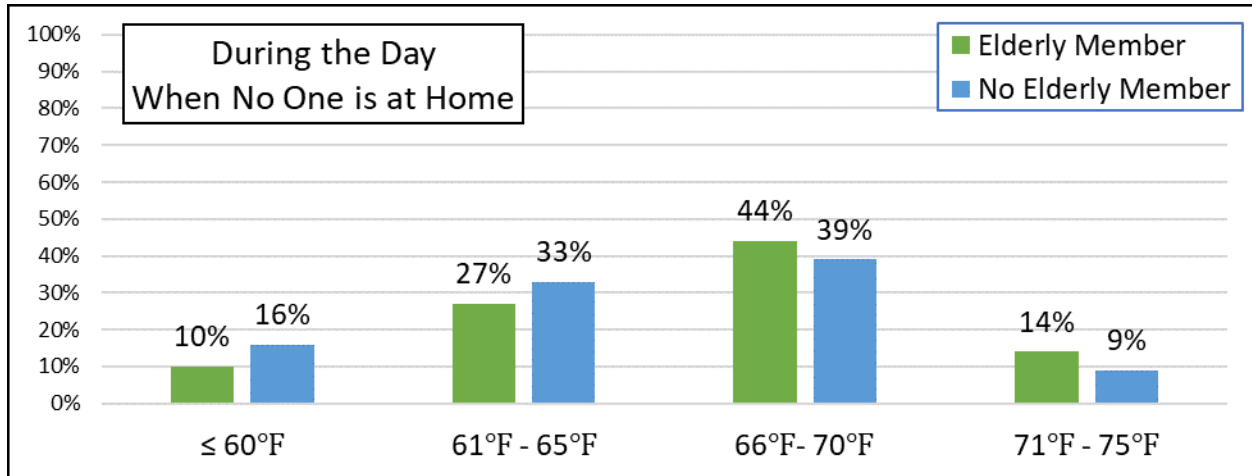


Chart III-3C shows that households with elderly members also set their homes at higher temperatures in the winter at night when everyone is asleep. Table III-12 displays the details shown in these charts.

Chart III-3C
Winter Heating Settings: Single-Family Homeowners
At Night When Everyone is Asleep
By Elderly Household Member

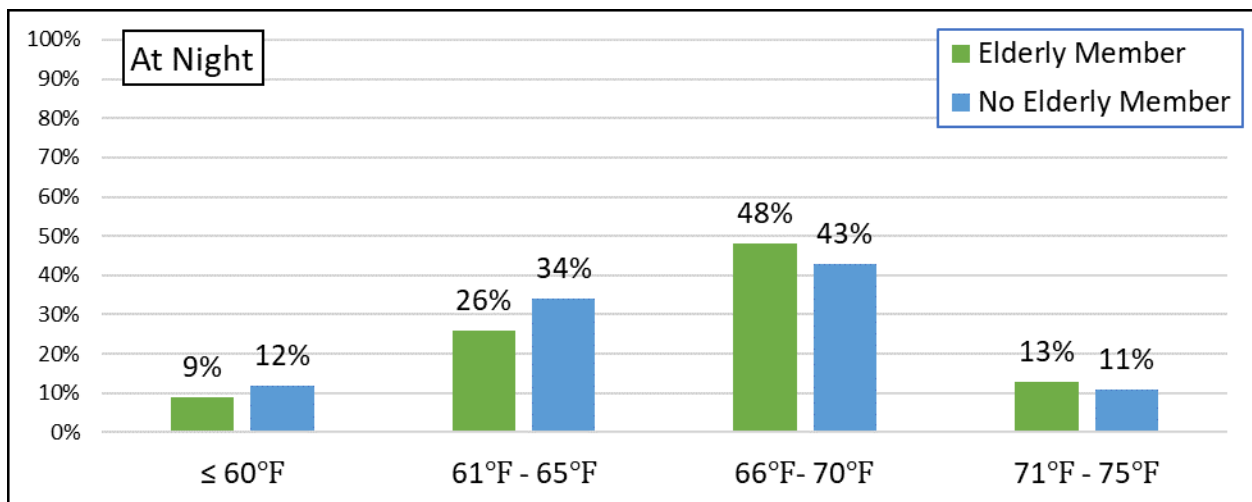


Table III-12
Winter Heating Settings By Presence of Elderly Household Member -
Single-Family Homeowners

What temperature do you set your heating to during the day when someone is at home, during the day when no one is at home, and at night when everyone is sleeping in your home in the winter?						
Temperature	Timing					
	During the Day When Someone is Home		During the Day When No One is Home		At Night	
	Elderly Member	No Elderly Member	Elderly Member	No Elderly Member	Elderly Member	No Elderly Member
Respondents	77	94	77	94	77	94
≤ 60°F	1%	2%	10%	16%	9%	12%
61°F - 65°F	9%	11%	27%	33%	26%	34%
66°F- 70°F	64%	73%	44%	39%	48%	43%
71°F - 75°F	25%	13%	14%	9%	13%	11%
76°F - 80°F	1%	1%	1%	0%	1%	1%
Don't Know	0%	0%	3%	3%	3%	0%
Total	100%	100%	100%	100%	100%	100%

Table III-13 shows that single-family homeowners reported a mean temperature of 72 degrees Fahrenheit in the summer during the day when someone is home, 74 degrees during the day when no one is home, and 72 degrees at night when everyone is sleeping.

Table III-13
Summer Air Conditioning Settings

Timing	Group	Respondents	Preferred Temperature					
			Mean	Percentile				
				P10	P25	P50	P75	P90
Daytime – Someone Home	SF Homeowners	109	72°F	68°F	70°F	72°F	74°F	76°F
	Other Respondents	39	71°F	65°F	68°F	72°F	74°F	80°F
	All Respondents	148	72°F	66°F	70°F	72°F	74°F	76°F
Daytime – No One Home	SF Homeowners	101	74°F	69°F	70°F	74°F	76°F	79°F
	Other Respondents	36	74°F	68°F	71°F	72°F	77°F	80°F
	All Respondents	137	73°F	68°F	70°F	74°F	76°F	79°F
Night	SF Homeowners	104	72°F	68°F	69°F	72°F	74°F	76°F
	Other Respondents	38	71°F	65°F	68°F	72°F	74°F	80°F
	All Respondents	142	71°F	67°F	68°F	72°F	74°F	76°F

Chart III-4A displays summer air conditioning settings for single-family homeowners. The “Always Home” have their temperature the same for when no one is home during the day. Those who “Don’t Use Their A/C” or “Don’t Have A/C” are excluded. Respondents were more likely to set their home at a higher temperature when no one is home during the day, and at a lower temperature when they are sleeping. While 65 percent keep their home at 71 or above during the day when someone is home, only 54 percent use this setting when everyone is asleep. These details are also shown in Table III-14A.

Chart III-4A
Summer Air Conditioning Settings: Single-Family Homeowners

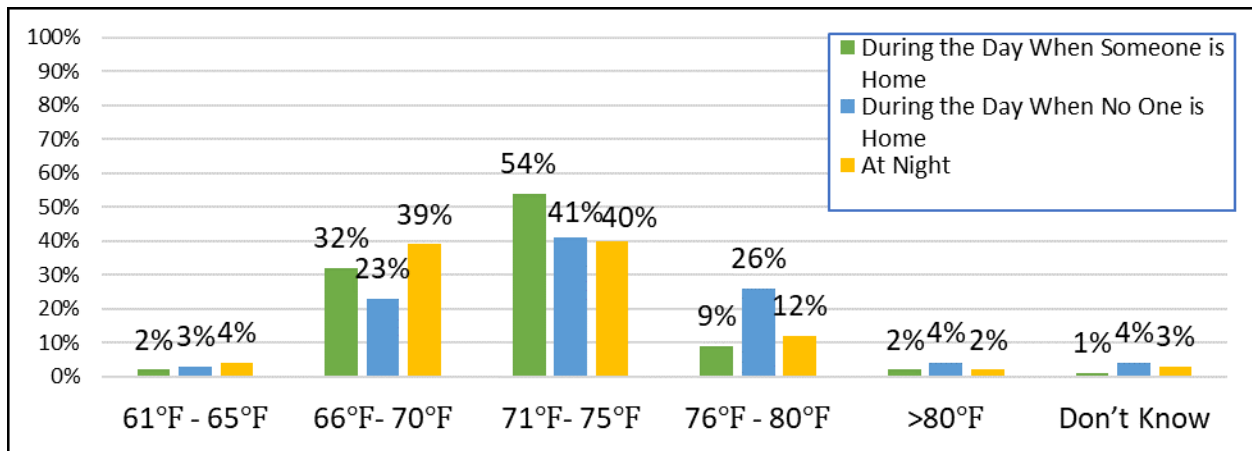


Table III-14A
Summer Air Conditioning Settings – Single-Family Homeowners

What temperature do you set your air conditioning to during the day when someone is at home, during the day when no one is at home, and at night when everyone is sleeping in your home in the summer?			
Temperature	Timing		
	During the Day When Someone is Home	During the Day When No One is Home	At Night
Respondents	110	105	107
≤ 60°F	1%	0%	0%
61°F - 65°F	2%	3%	4%
66°F - 70°F	32%	23%	39%
71°F - 75°F	54%	41%	40%
76°F - 80°F	9%	26%	12%
>80°F	2%	4%	2%
Don't Know	1%	4%	3%
Total	100%	100%	100%

Chart III-4B displays how much cooler single-family homeowners set their thermostats in the summer when no one is home during the day. While 51 percent don't change the temperature, ten percent set it two degrees warmer, 13 percent set it three degrees warmer, and nine percent set it four degrees warmer.

Chart III-4B
Summer Thermostat Degree Setback when No One is Home
Single-Family Homeowners

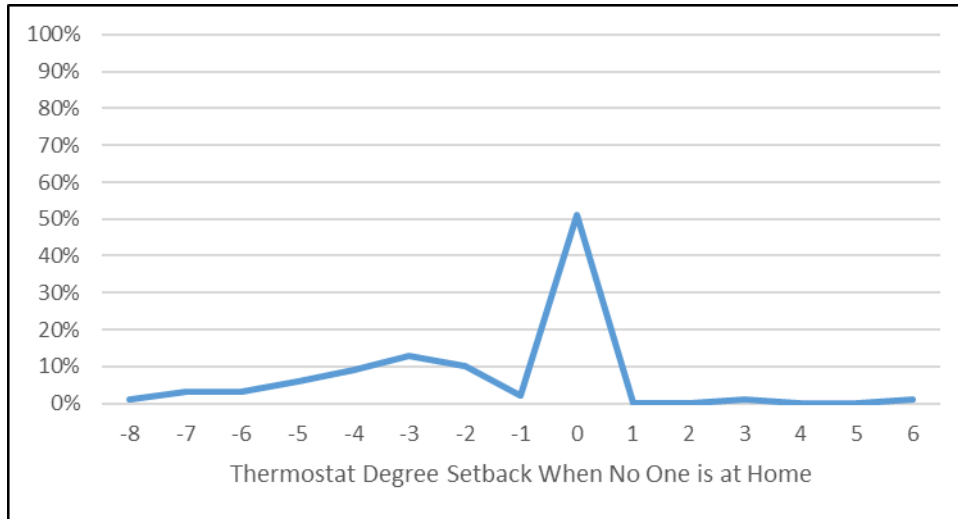


Chart III-4C displays how much cooler single-family homeowners set their thermostats in the summer at night. While 57 percent don't change the temperature, 11 percent set it two degrees cooler, six percent set it three degrees cooler, and five percent set it four degrees cooler. Fifteen percent set it one to six degrees warmer at night.

Chart III-4C
Summer Thermostat Degree Setback at Night
Single-Family Homeowners

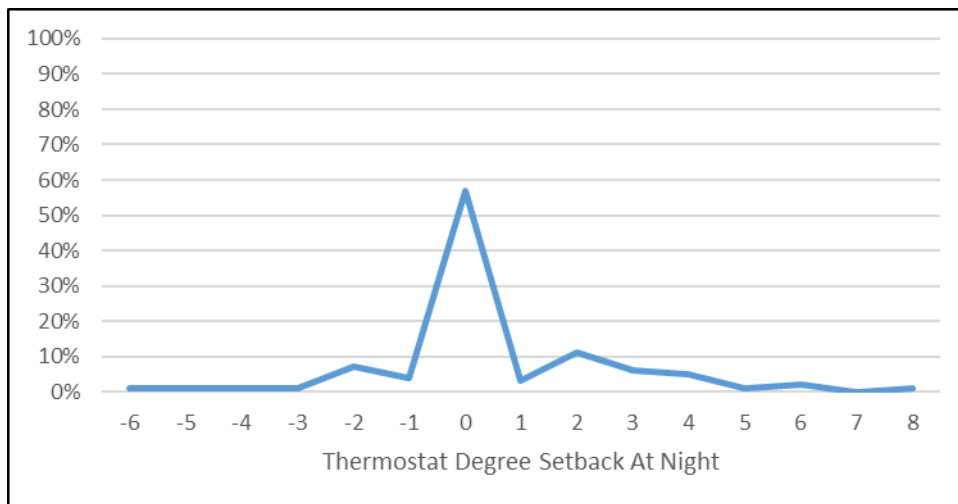


Chart III-5A displays the summer air conditioning setting distribution for all other respondents. These households also keep their settings at higher temperatures during the day when no one is home and at lower temperatures when they are sleeping. Table III-14B also displays these results and Table III-14C displays the results for all respondents.

Chart III-5A
Summer Air Conditioning Settings: Other Respondents

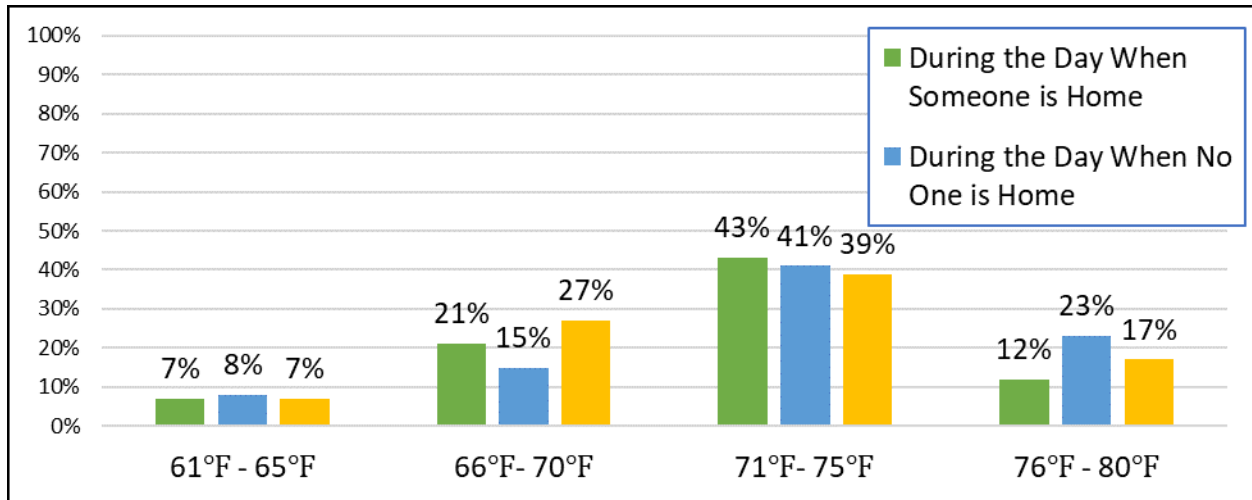


Table III-14B
Summer Air Conditioning Settings – All Other Respondents

What temperature do you set your air conditioning to during the day when someone is at home, during the day when no one is at home, and at night when everyone is sleeping in your home in the summer?			
Temperature	Timing		
	During the Day When Someone is Home	During the Day When No One is Home	At Night
Respondents	42	39	41
≤ 60°F	5%	0%	2%
61°F - 65°F	7%	8%	7%
66°F - 70°F	21%	15%	27%
71°F - 75°F	43%	41%	39%
76°F - 80°F	12%	23%	17%
>80°F	5%	5%	0%
Don't Know	7%	8%	7%
Total	100%	100%	100%

Chart III-5B displays how much cooler multi-family residents set their thermostats in the summer when no one is home during the day. While 52 percent don't change the temperature, four percent set it two degrees warmer, 13 percent set it three degrees warmer, and 13 percent set it four degrees warmer.

Chart III-5B
Summer Thermostat Degree Setback when No One is Home
Multi-Family Residents

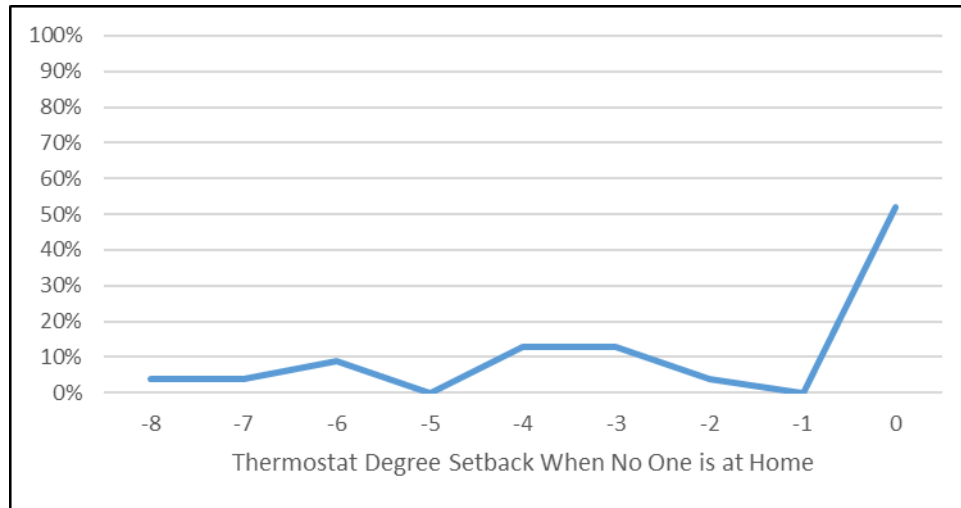
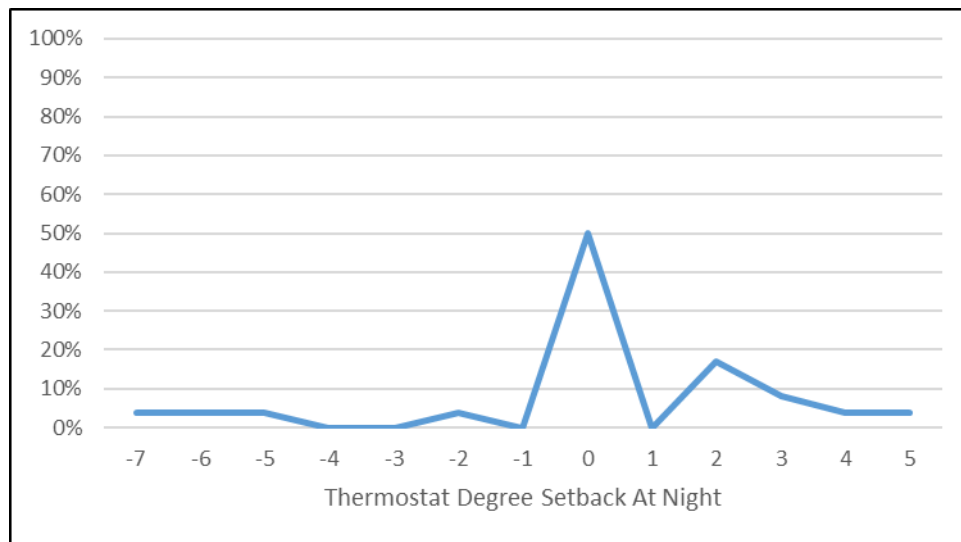


Chart III-5C displays how much cooler multi-family residents set their thermostats in the summer at night. While 50 percent don't change the temperature, 17 percent set it two degrees cooler, eight percent set it three degrees cooler, and four percent set it four degrees cooler. Sixteen percent set it two to seven degrees warmer at night.

Chart III-5C
Summer Thermostat Degree Setback at Night
Multi-Family Residents



**Table III-14C
Summer Air Conditioning Settings – All Respondents**

What temperature do you set your air conditioning to during the day when someone is at home, during the day when no one is at home, and at night when everyone is sleeping in your home in the summer?			
Temperature	Timing		
	During the Day When Someone is Home	During the Day When No One is Home	At Night
Respondents	152	144	148
≤ 60°F	3%	0%	2%
61°F - 65°F	5%	7%	6%
66°F- 70°F	26%	18%	35%
71°F- 75°F	50%	44%	38%
76°F - 80°F	8%	22%	11%
>80°F	2%	3%	1%
Don't Know	7%	7%	8%
Total	100%	100%	100%

Table III-15 shows that single-family homeowners with a household member over 62 reported that they keep their homes at higher summer temperatures than those without elderly household members. While the mean night time temperature for households with an elderly member was 73, it was 71 for those without an elderly member.

**Table III-15
Summer Air Conditioning Settings
By Presence of Elderly Household Member
Single-Family Homeowners**

Timing		Respondents	Preferred Temperature					
			Mean	Percentile				
				P10	P25	P50	P75	P90
Daytime – Someone Home	Elderly Member	45	73°F	69°F	70°F	73°F	74°F	76°F
	No Elderly Member	64	72°F	68°F	70°F	72°F	74°F	75°F
Daytime – No One Home	Elderly Member	42	74°F	70°F	70°F	74°F	76°F	80°F
	No Elderly Member	59	74°F	68°F	70°F	75°F	76°F	79°F
Night	Elderly Member	43	73°F	68°F	70°F	73°F	74°F	78°F
	No Elderly Member	61	71°F	68°F	68°F	70°F	74°F	76°F

Charts III-6A, III-6B, and III-6C display summer air conditioning settings for single-family homeowners by the presence of an elderly household member. Chart II-4A shows that households with elderly members were less likely to set the thermostat below 71 degrees when

someone is home during the day. Only 28 percent of those with an elderly household member set their thermostat at or below 70 degrees, compared to 37 percent of those without an elderly member.

Chart III-6A
Summer Air Conditioning Settings: Single-Family Homeowners
During the Day When Someone is At Home
By Elderly Household Member

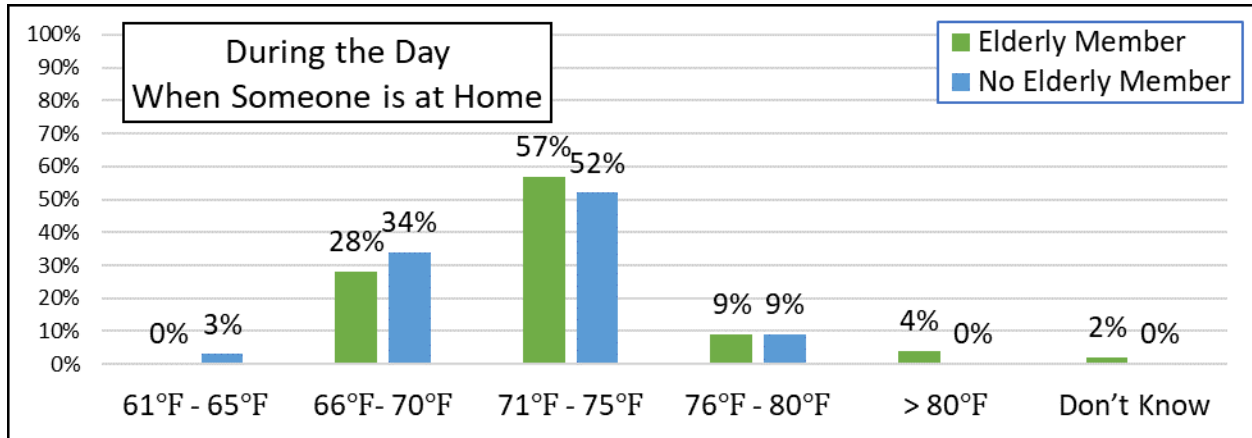


Chart III-6B shows that households without elderly members are more likely to set back their air conditioning during their day. While only nine percent of households without elderly kept their homes above 75 during the day when someone was home (shown above), 30 percent kept their homes at this temperature during the day when no one was at home.

Chart III-6B
Summer Air Conditioning Settings: Single-Family Homeowners
During the Day When No One is At Home
By Elderly Household Member

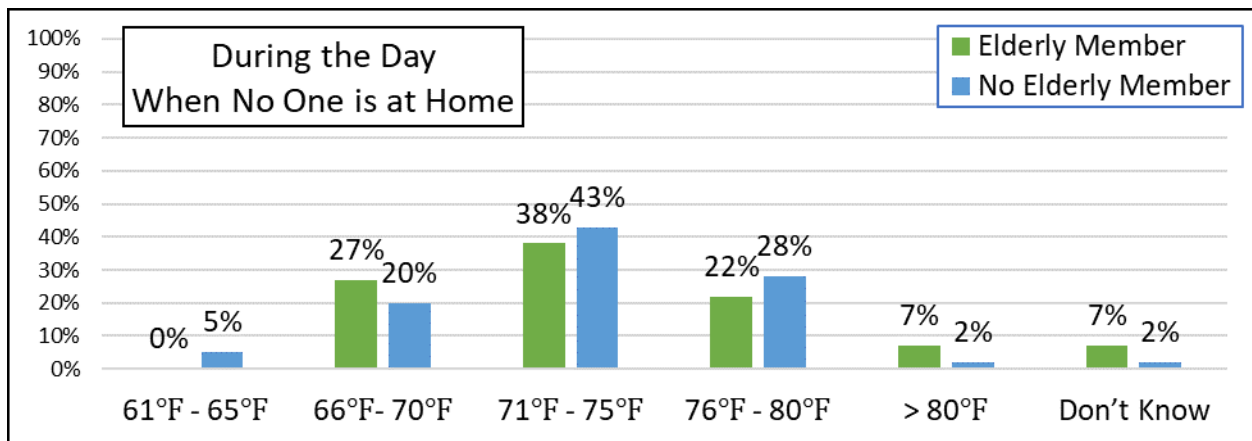


Chart III-6C shows that households with elderly members were less likely to set their homes below 70 in the summer at night when everyone is asleep. While 31 percent with elderly set their homes at or below 70 at night, 51 percent without elderly set their homes at or below 70 at night. This compares to 37 percent of non-elderly who set their homes at or below 70 when someone is home during the day (shown above). Non-elderly households set their homes at cooler temperatures while sleeping than while at home during the day. Table III-16 displays the details shown in these charts.

Chart III-6C
Summer Air Conditioning Settings: Single-Family Homeowners
At Night When Everyone is Asleep
By Elderly Household Member

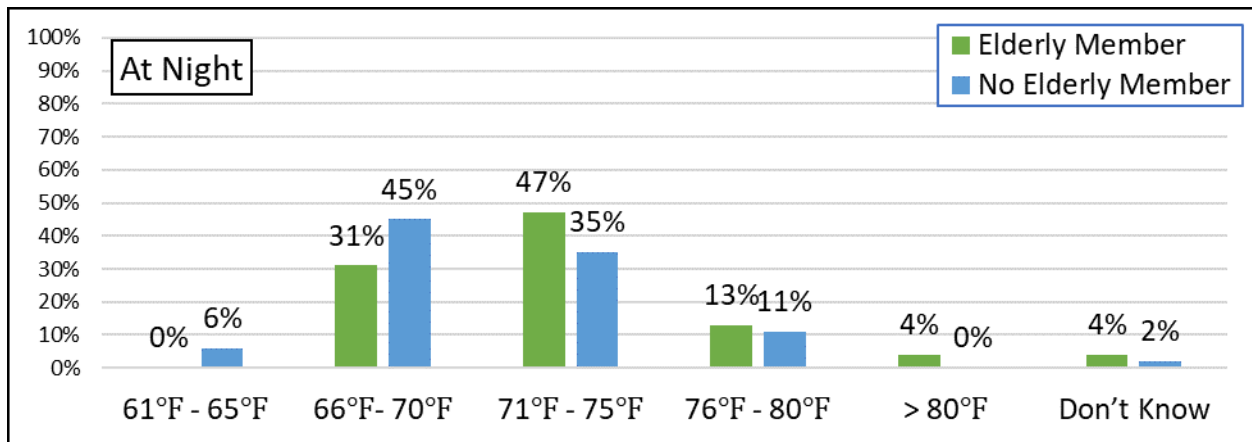


Table III-16
Summer Air Conditioning Settings By Presence of Elderly Household Member
Single-Family Homeowners

What temperature do you set your air conditioning to during the day when someone is at home, during the day when no one is at home, and at night when everyone is sleeping in your home in the summer?						
Temperature	Timing					
	During the Day When Someone is Home		During the Day When No One is Home		At Night	
	Elderly Member	No Elderly Member	Elderly Member	No Elderly Member	Elderly Member	No Elderly Member
Respondents	46	64	45	60	45	62
≤ 60°F	0%	2%	0%	0%	0%	0%
61°F - 65°F	0%	3%	0%	5%	0%	6%
66°F - 70°F	28%	34%	27%	20%	31%	45%
71°F - 75°F	57%	52%	38%	43%	47%	35%
76°F - 80°F	9%	9%	22%	28%	13%	11%
> 80°F	4%	0%	7%	2%	4%	0%

What temperature do you set your air conditioning to during the day when someone is at home, during the day when no one is at home, and at night when everyone is sleeping in your home in the summer?						
Temperature	Timing					
	During the Day When Someone is Home		During the Day When No One is Home		At Night	
	Elderly Member	No Elderly Member	Elderly Member	No Elderly Member	Elderly Member	No Elderly Member
Don't Know	2%	0%	7%	2%	4%	2%

Respondents were asked if they ever set their thermostat at a less than comfortable temperature in the winter or summer because they are trying to use less energy. Table III-17A shows that 32 percent said they set their home at less than comfortable temperature during the day in the winter and 25 percent said they set their home at a less than comfortable temperature at night in the winter. Fifteen percent of respondents said they set their home at a less than comfortable temperature during the day in the summer and 11 percent said they set their home at a less than comfortable temperature at night in the summer.

Table III-17A
Comfort Sacrifices to Reduce Energy Usage

Do you ever set your thermostat at a less than comfortable temperature during the day or at night in the winter/summer because you are trying to use less energy?						
Temperature Setting	Single-Family Owners		Other Respondents		All Respondents	
	Winter	Summer	Winter	Summer	Winter	Summer
Respondents	171	171	68	68	239	239
Less than Comfortable Temperature - Day	33%	13%	28%	18%	32%	15%
Less than Comfortable Temperature - Night	22%	9%	22%	15%	25%	11%
Never Uncomfortable Temperature	58%	58%	60%	60%	58%	58%
Refused	0%	0%	1%	1%	<1%	<1%
Don't Know	1%	1%	3%	3%	2%	2%

Table III-17B displays the winter and summer temperature settings by whether households kept their home at a less than comfortable temperature. Those who never set their thermostat at an uncomfortable temperature kept it at a warmer temperature in the winter and a cooler temperature in the summer.

**Table III-17B
Uncomfortable Temperature Settings
Single-Family Homeowners**

Timing		Respondents	Preferred Temperature					
			Mean	Percentile				
				P10	P25	P50	P75	P90
Less than Comfortable Temperature – Day	Winter	57	68°F	65°F	67°F	68°F	69°F	70°F
	Summer	23	74°F	70°F	72°F	74°F	75°F	78°F
Less than Comfortable Temperature – Night	Winter	37	65°F	60°F	64°F	65°F	68°F	70°F
	Summer	16	75°F	70°F	73°F	75°F	77°F	78°F
Never Set Uncomfortable Temperature – Day	Winter	100	69°F	66°F	68°F	69°F	71°F	72°F
	Summer	64	71°F	68°F	69°F	72°F	74°F	75°F
Never Set Uncomfortable Temperature – Night	Winter	99	67°F	62°F	64°F	67°F	70°F	72°F
	Summer	63	71°F	67°F	68°F	70°F	73°F	75°F

When asked whether their home is able to reach and stay at the temperature where they set their thermostat, seven percent reported that their home could not reach and stay at the thermostat setting. While only two percent of single-family homeowners reported this problem, ten percent of other respondents reported this issue.

**Table III-18
Ability of Home to Reach Thermostat Temperature**

Is your home able to reach and stay at the temperature where you set the thermostat?			
Ability to Reach Thermostat Temperature	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
Home Can Reach and Stay at Thermostat Setting	96%	87%	90%
Home Cannot Reach and Stay at Thermostat Setting	2%	10%	7%
Refused	0%	1%	1%
Don't Know	2%	1%	2%
Total	100%	100%	100%

C. Thermostats and Setback Behavior

The survey also collected information about the thermostat type and specific setback actions. Table III-19 shows that 49 percent reported that they have a manual thermostat, 38 percent reported that they have a programmable thermostat, and only 12 percent reported that they have a smart thermostat.

Table III-19
Thermostat Type

What type of thermostat do you have in your home?			
Thermostat Type	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
Manual	33%	47%	49%
Programmable	50%	38%	38%
Smart Thermostat	16%	12%	12%
Don't Know	1%	3%	2%
Total	100%	100%	100%

Table III-20 shows that 46 percent of respondents said that they had a Honeywell thermostat, followed by six percent who reported that they had a Nest thermostat. A full 36 percent did not know the thermostat brand. However, only 21 percent of single-family homeowners did not know their thermostat brand, compared to 40 percent of other respondents.

Table III-20
Thermostat Brand

What is the brand of the thermostat?			
Thermostat Brand	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
Honeywell	52%	41%	46%
Nest	9%	6%	6%
Ecobee	2%	3%	2%
Lux	3%	1%	2%
Carrier	4%	0%	2%
White and Rogers	1%	3%	2%
Trane	1%	3%	1%
Robertshaw	1%	0%	1%
Other	8%	0%	4%
Refused	0%	3%	1%

What is the brand of the thermostat?			
Thermostat Brand	Single-Family Homeowners	Other Respondents	All Respondents
Don't Know	21%	40%	36%
Total	100%	100%	100%

When asked who installed the thermostat, 42 percent said it was in the home when they moved in, 22 percent said that a contractor installed the thermostat, 19 percent said it was a self-install, and nine percent said the landlord installed the thermostat. There were large differences in these responses between single-family homeowners and other respondents.

Table III-21
Thermostat Installation

Who installed the thermostat?			
Thermostat Installer	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
Already in Home at Move-In	27%	49%	42%
Contractor	35%	18%	22%
Self-Installation	32%	15%	19%
Landlord	0%	10%	9%
Utility Company	2%	0%	1%
Refused	1%	1%	1%
Don't Know	4%	7%	7%
Total	100%	100%	100%

Table III-22A displays responses to direct questions about setback behavior. (The previous analysis of setback behavior compared reported temperature settings during different circumstances.) While 49 percent said that they change the temperature when no one is home in the winter, 28 percent said they did so when no one is at home in the summer. The difference is due to the 37 percent who do not have central air conditioning. Households with central air conditioning are more likely to set back their air conditioning than their heating. Of those with a central air conditioner, 47 percent reported that they set back the temperature when no one is home.

Table III-22A
Setback Behavior When No One is Home

Do you set your heating at a lower, colder temperature when no one is at home during the day in the winter?						
Do you set your air conditioning at a higher, warmer temperature when no one is at home during the day in the summer?						
Temperature Setting	Single-Family Owners		Other Respondents		All Respondents	
	Winter	Summer	Winter	Summer	Winter	Summer
Respondents	171	171	68	68	239	239
Change Temperature When No One is Home	58%	31%	44%	28%	49%	28%
Don't Change Temperature When No One is Home	27%	21%	35%	15%	33%	17%
Don't Change Temperature Settings	15%	12%	16%	21%	15%	15%
Don't Have Central Air Conditioning	-	35%	-	32%	-	37%
Don't Know	0%	1%	4%	4%	3%	3%
Total	100%	100%	100%	100%	100%	100%

Table III-22B displays the percent who set back their thermostat when no one is home by type of thermostat. The table shows that those with programmable and smart thermostats are more likely to practice setback than those with manual thermostats. Those with smart thermostats were more likely than those with manual and programmable thermostats to set back their temperature in the winter when no one is home.

Table III-22B
Winter and Summer Setbacks by Thermostat Type
Single-Family Homeowners

Do you set your heating at a lower, colder temperature when no one is at home during the day in the winter?				
Do you set your air conditioning at a higher, warmer temperature when no one is at home during the day in the summer?				
Thermostat Type	Manual	Programmable	Smart	All Single-Family Homeowners
Respondents	57	85	28	171
Winter Setback when No One is Home	51%	59%	71%	58%
Summer Setback when No One is Home	18%	38%	36%	31%

Those who change their temperature settings were asked whether or was done manually, or through another method. Table II-23 shows that 33 percent changed the temperature manually, 16 percent changed it with a programmed setting, two percent changed it with a smart phone, and two percent changed it through their smart thermostat.

Table III-23
How Setbacks are Made When No One is Home

How do you make temperature changes when no one is home?			
How Changes are Made	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
Manually	29%	35%	33%
With a Programmed Setting	24%	9%	16%
With a Smart Phone	5%	1%	2%
Smart Thermostat Auto-Detection	3%	3%	2%
Don't Change Temperature	40%	51%	46%
Total	100%	100%	100%

D. Smart Thermostats

This sections provides findings from questions that specifically addressed smart thermostats. As shown above, only 12 percent of respondents reported that they had a smart thermostat. Eight percent said that they set up the app that is associated with the smart thermostat to manage their home temperature, either when they are asleep or away from home.

Table III-24
Smart Thermostat App Set Up

Have you set up the app that is associated with your smart thermostat to manage the temperature when you are asleep or away from home?			
Smart Thermostat App	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
Set Up the App	15%	3%	8%
Did Not Set Up the App	1%	6%	4%
Do Not Have Smart Thermostat	84%	88%	88%
Refused	0%	1%	<1%
Don't Know	0%	1%	<1%
Total	100%	100%	100%

Table III-25 shows that some of those who had the app set up used it every day, and some used it less frequently than once a month.

Table III-25
Smart Thermostat App Use Frequency

Frequency of App Use	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
Every Day	4%	1%	2%
Once a Week	5%	1%	2%
Once a Month	2%	0%	1%
Less Frequently	4%	0%	2%
Do Not Have Smart Thermostat/App	85%	97%	92%
Don't Know	1%	0%	<1%
Total	100%	100%	100%

Table III-26 shows that some of those with smart thermostats made use of eco temperatures, occupancy sensing, and learning features, but more reported that they did not know if they used these features.

Table III-26
Smart Thermostat Use of Features

With your smart thermostat, do you use any of the following features?			
Smart Thermostat Features	Single-Family Homeowners	Other Respondents	All Respondents
Respondents	171	68	239
Eco Temperatures	5%	4%	3%
Occupancy Sensing	2%	3%	2%
Learning Feature	4%	1%	2%
Geofencing	1%	0%	<1%
Do Not Have Smart Thermostat	84%	88%	88%
Refused	1%	3%	1%
Don't Know	9%	4%	7%

IV. Findings and Recommendations

The survey provided important information on the temperature setting patterns of households in the Northeast.

Terminology

We first provide key terminology with respect to temperature setting because of confusion that is common in this area.

- In the winter heating season, turning the thermostat down to a lower setpoint results in the heating system activating less frequently and/or for less time, thereby saving energy. This logically associates with the term “setback” for this behavior, whether manual or automated.
- In the summer air conditioning season, turning the thermostat up to a higher setpoint results in the cooling system activating less frequently and/or for less time, thereby saving energy. Though less logical, the term “setback” is often still used for this behavior (as reflected in this report). The more accurate term “setup” is sometimes used, but may be less ubiquitously understood.
- Adding to the confusion, manufacturer and program educational materials often assume that nighttime represents the universal energy saving period, meaning cooler while sleeping in the winter and warmer while sleeping in the summer. Historically, this assumption has been reflected in operator manuals, device default settings and even ENERGY STAR required settings in its original programmable thermostat certification protocol.

Winter Temperature Settings

- Mean Winter Temperature Settings: Single-family homeowners reported a mean winter temperature setting of 69 degrees Fahrenheit in the winter during the day when someone is home, 66 degrees during the day when no one is home, and 66 degrees at night when everyone in the home is sleeping. Other respondents kept their homes at about two degrees higher on average.
- Winter Temperature Ranges: 69 percent of the single-family homeowners reported that they kept the home at 66 to 70 degrees when they are home. While only two percent reported that they keep the temperature at less than 60 degrees and ten percent at 61 to 65 degrees when someone is home during the day, 13 percent reported that they keep the temperature at less than 60 degrees and 30 percent at 61 to 65 degrees during the day when no one is home. They were also more likely to use these lower settings when everyone was sleeping.
- Winter Temperature Lack of Setbacks: While 43 percent of single-family homeowners don't change the temperature when no one is home in the winter, 41 percent do not change the temperature at night.

- Winter Daytime Setbacks: Of those who change the setpoint, 38 percent lower the temperature by one to three degrees, and 43 percent reduce the temperature by four to six degrees. The remaining 19 percent set it back by seven or more degrees.
- Winter Night Setbacks – Single-Family: Fifty-four percent of single-family homeowners set their temperature back at night in the winter and five percent set their heat to higher temperatures. Of those who set their temperature back, 45 percent set it back by one to three degrees, 38 percent set it back by four to six degrees, and 17 percent set it back by more than six degrees.
- Winter Night Setbacks – Multi-Family: Forty-four percent of multi-family households reported that they make a temperature setback at night. Of these, 50 percent reported that they lowered the temperature by only one to three degrees, and 33 percent reduced the temperature by four to six degrees.
- Elderly Households Winter Settings: Single-family homeowners with a household member 62 or older reported that they keep their homes at higher winter temperatures than those without elderly household members. While ten percent with an elderly member reported that they set their heat at or above 73 during the day when someone is home, ten percent of those without an elderly member reported that they set their heat at or above 71 degrees.
- Elderly Household Winter Setbacks: Single-family homeowners with elderly members were less likely to set back their heat during their day in the winter (because there is always someone home during the day). Ten percent with an elderly member set their heat at or below 60 degrees when no one is at home during the day compared to 16 percent without elderly members. Households with elderly members also set their homes at higher temperatures in the winter at night when everyone is asleep.
- Elderly Household Nighttime Settings: While 35 percent of elderly member single-family households reported a nighttime winter setpoint of 65 degrees or lower, only ten percent reported those setpoints during the day when someone is home, indicating that 25 percent have a lower nighttime temperature.

Summer Temperature Settings

- Mean Summer Temperature Settings: Single-family homeowners with central air conditioning reported a mean summer temperature of 72 degrees Fahrenheit during the day when someone is home, 74 degrees during the day when no one is home, and 72 degrees at night when everyone in the home is sleeping.
- Summer Temperature Ranges: Fifty-four percent of the single-family homeowners reported that they kept the home at 71 to 75 degrees when they are home during the day, while 32 percent reported that they keep the temperature between 66 and 70 degrees when someone is home during the day. A significant majority (71%) reported that they keep the temperature at 71 or above during the day when no one is home, while 43 percent reported below the 71 degree range at night.

- **Summer Temperature Lack of Setbacks:** Approximately half (51 percent) of single-family homeowners do not change setpoints during the day when no one is home, while 57 percent do not adjust the temperature at night when sleeping.
- **Summer Daytime Setbacks:** Of the 49 percent of single-family homeowners who change setpoint during the day when no one is home, 78 percent increase the temperature by two to five degrees and another 14 percent increase the setpoint by more than five degrees.
- **Summer Night Setbacks:** Of the 43 percent of single-family homeowners who change the summer setpoint at night when everyone is sleeping, about two thirds (66%) *lower* the temperature at night; 50 percent by two to four degrees. Only about one-third of those who reported that they change the setpoint at night *raise* the temperature; 25 percent by just one to two degrees.
- **Elderly Household Summer Daytime Settings:** Single-family homeowners with air conditioning and a household member 62 or older reported that they keep their homes at only slightly warmer temperatures (average 73 degrees) during the day when someone is home than those without elderly household members (average 72 degrees). While 13 percent with elderly reported that they set the temperature higher than 75 degrees, nine percent without elderly reported that they set the temperature higher than 75 degrees.
- **Elderly Household Night Summer Settings:** Single-family homeowners with air conditioning and a household member 62 or older also keep their homes at warmer summer temperatures when everyone is asleep compared with households without an elderly member. While 64 percent with an elderly member set their air conditioning at or above 71 degrees at night, 46 percent of those without an elderly member set their air conditioning at or above 71 degrees at night.
- As more than 40 percent of respondents reported that they do not set back the thermostat, this appears to be a significant energy-saving opportunity. However, setting preferences among those who are already setting back indicate that initial or default setbacks should not be overly aggressive (not more than two to three degrees).

Temperature Setpoint Recommendations

- When considering default setpoints, setbacks and schedules for device replacement and thermostat education programs, be prepared to develop different protocols for elderly and non-elderly member households, both with respect to occupancy patterns and temperature preferences for each period.
- Direct resident interaction will always be preferable for establishing the schedule and setpoints for any individual household. If programmatically infeasible, default settings should be selected carefully to maximize initial receptivity, coupled with effective educational resources and support opportunities regarding the setup and operation of the new thermostat for comfort and energy savings.

- This survey reveals two key findings with respect to nighttime “setback” behavior.
 - Households without an elderly member tend to prefer sleeping at the same or cooler temperature setpoints at night than when home during the day, both in winter and in summer (though there are some households without elderly members that sleep at warmer temperatures in the summer).
 - Households with an elderly member prefer sleeping at the same or cooler temperatures at night than when home during the day in the winter, but half who change the temperature at night in the summer sleep at cooler temperatures and half sleep at warmer temperatures.

Therefore, the two demographic groups need to be addressed *differently* when considering the starting point for setback defaults or resident discussion in any thermostat replacement or education program.

- For non-elderly households, the energy saving setback opportunity periods may most typically be nighttime/sleep in winter and daytime/home in summer.
- For a significant proportion of elderly member households, the setback opportunity period may be daytime/home in both summer and winter.
- Elderly member households are more likely to be home all day and therefore should not have a default daytime/away setback enabled without consultation. Non-elderly households, on the other hand, appear receptive to conventional wisdom assumptions of a lower setpoint when away from home in winter and a higher setpoint when away in summer.
 - For households without an elderly member, consider a default winter setting of 69 during the day with a setback of three degrees to 66 at night; and 72 degrees at night in the summer with a setup of 2 degrees to 74 during the day.
 - For households with an elderly member, consider a default winter setting of 70 degrees in the winter and 74 degrees in the summer, but without any predetermined setbacks.

Energy Conservation

- While 32 percent said they set their home at a less than comfortable temperature during the day in the winter to save energy, 25 percent said they set their home at a less than comfortable temperature at night in the winter.
- A smaller proportion (15 percent) said they set their home at a less than comfortable temperature during the day in the summer to save energy, and 11 percent at a less than comfortable temperature at night in the summer.

Energy Conservation and Education Recommendations

- If current settings are being used as the baseline for determining new energy saving setpoints, consider whether household members are already sacrificing comfort to conserve energy, as these households may have less tolerance for additional energy savings in their heating and cooling settings.
- If installing new thermostats with default settings, keep in mind that the default settings may save less energy than the current settings of some households. Existing older thermostats may also be providing inaccurate temperature readings contributing to the perceived discomfort.
- We recommend always providing the opportunity for a resident interview in combination with the installation of a new thermostat so that default settings can be modified accordingly. Similarly, providing the opportunity for “live” training empowers residents to modify default settings with an understanding of the energy and comfort implications.
- Education materials should always be provided in advance of or at the time of a new thermostat installation, providing easy to understand instructions on basic set-up, day-to-day operation and optional advanced features.

Thermostat Technology as a Catalyst for Setback Behavior

- Forty-nine percent reported that they have a manual thermostat, 38 percent reported that they have a programmable thermostat, and only 12 percent reported that they have a smart thermostat.
- When asked how they set back their thermostat when no one is home, 33 percent changed the temperature manually, 16 percent changed it with a programmed setting, two percent changed it with a smart phone, and two percent changed it directly through their smart thermostat.
- Only eight percent had a smart thermostat with an app that was set up, two-thirds of those who had a smart thermostat.

Thermostat Recommendations

- Smart thermostats represent a good opportunity for energy savings based on a number of factors evident from this survey.
 - Low existing penetration rate.
 - Many households still do not practice thermostat setbacks.
 - Of the households practicing setbacks, most are doing so manually.
- The capability of smart thermostats to adjust settings based on occupancy awareness appears to provide a significant advantage in that it obviates the need for direct interaction by the resident (other than to enable the feature).

- The fact that many respondents did not use the app in conjunction with a smart thermostat also indicates that this feature will be more effective when triggered by an on-board sensor rather than being reliant on the geofencing capabilities of a linked smart phone.