ENERGY STAR

Programmable Thermostats

Proposal Industry

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Overview

The programmable thermostat proposal is organized into a framework consisting of two tiers. The first is meant to recognize programmable thermostat features and functions that already exist in the marketplace, or can be easily retooled. The second builds on the criterion of the first. Tier II is designed to be more challenging and reflect features, settings, and interfaces which ensures significant energy savings, user friendliness, and ease of use. This proposal is intended to foster additional discussion among manufacturers and other industry stakeholders. From this proposal, EPA hopes to generate innovative ideas and lay the groundwork for future technical discussions regarding drafting of a new and improved ENERGY STAR specification.

Tier I

Tier I of this proposal identifies core elements for programmable thermostats that EPA would like to highlight and possibly include in a future specification. Elements include: (1) Core Features, (2) Feature Requirements, (3) Setting Requirements, and (4) Interface Requirements. Please note that the last section of the proposal addresses product testing. As a general matter, this testing applies to both the Tier 1 and Tier II sections.

1. Core Features of a Thermostat

EPA believes that a programmable thermostat earning the ENERGY STAR should possess the following core features:

- **Two different** programming schedules (one for weekdays and a second for weekend programming)
- **At least four possible** programming events for each programming period (i.e., wake, leave, return, and sleep settings). See Tables 1 and 2 for suggested setpoint temperatures.
- Each setback/setup period should be at least eight hours long
- These schedules must be shipped as the default program

Note: zoning systems, home automation, and building control systems will not be covered in the future specification. Currently, EPA is focusing on the residential market; however, it may choose to address commercial products future versions of the specification.

2. Feature Requirements

Proposed Requirements for ENERGY STAR Qualified Programmable Thermostats.
Features with a check mark are under consideration for requirements under the new specification. Features with a "--" are either (1) not under consideration or (2) do not have a requirement.

	Requirements Tier I			**Requirements Tier 2**		
Feature Description	Feature	Setting	Interface	Feature	Setting	Interface
Pre-programmed settings including four settings per day, a setting for weekend, and one for weekday	✓	✓	--	✓	✓	✓
A conventional recovery system. Multistage heat pumps shall have a heat pump pre-comfort recovery system (see definitions)	✓	✓	✓	✓	✓	✓
A long-term hold and short-term hold feature	✓	✓	✓	✓	✓	✓*
A backup battery function or a method to burn the program in the thermostat's memory	✓	✓	✓	✓	✓	✓
An easy method by which to set the cycle rate	✓	✓	--	✓	✓	✓
Accuracy within +/- 2 degrees	✓	✓	--	✓	✓	--
Simple instructions	✓	--	✓	✓	✓	✓**
Customer support number	✓	--	✓	✓	--	✓**
Filter change default run-time	✓	✓	✓	✓	✓	✓
Adjustable deadband	✓	✓	--	✓	✓	--
Indicator for Auxiliary/Emergency heat	✓	✓	✓	✓	✓	✓
Display Size	--	--	--	✓	--	✓
Backlighting	--	--	--	✓	--	✓
Copy key (for programmable thermostats with 7-day programming)	--	--	--	✓	--	✓
Fan run-time	--	--	--	✓	✓	--
Standardization of controls/icons	--	--	--	✓	--	✓
Features Not Addressed in the ENERGY STAR for Programmable Thermostats Proposal*						
Arm-chair programming	--	--	--	--	--	--
Programming dial/touch pad screen	--	--	--	--	--	--
Off-the-wall programming	--	--	--	--	--	--
Humidity control/outdoor temperature display	--	--	--	--	--	--
Key board lock	--	--	--	--	--	--
Energy Monitor	--	--	--	--	--	--
Adjustable deadband	--	--	--	--	--	--
Voice activated/paging capability	--	--	--	--	--	--
Intelligent recovery systems	--	--	--	--	--	--
Voice activated/paging thermostats	--	--	--	--	--	--
Intelligent recovery systems	--	--	--	--	--	--

***Note:** At this time, EPA has not addressed these features for one or more of the following reasons: (1) manufacturers would need additional time to design these features into new or existing products; (2) requirements for some features could only be achieved by using proprietary technology; or (3) the feature does not have energy-efficiency potential.*

3. Setting Requirements

Setting requirements denote the adjustments that would need to be implemented by the manufacturer with no input required from the consumer at the time of purchase and installation.

Default Program. At this time, EPA believes that 4 events provide a basic framework for most consumer needs while providing reasonable levels to attain savings. The setbacks and setups are required to **meet or exceed** 8 hours. The 4 event requirements provide an appropriate performance level that all qualified programmable thermostats should provide; however, partners may choose to add additional setbacks and/or setups (e.g., some thermostats offer 6 events) as long as the setback/setup period is an 8-hour minimum. Below, please find the suggested events, with setbacks/setups and appropriate temperatures.

Table 1: Programmable Thermostat Setpoint Temperatures

Setting	Setpoint Temperature (Heat)	Setpoint Temperature (Cool)
Wake	≤ 70°F (≤ 21.1°C)	≥ 78°F (≤ 25.6°C)
Leave	setback at least 8°F (4.4°C)	setup at least 7°F (3.8°C)
Return	≤ 70°F (≤ 21.1°C)	≥ 78°F (≤ 25.6°C)
Sleep	setback at least 8°F (4.4°C)	setup at least 4°F (2.2°C)

Table 2: Acceptable <u>Weekday</u> Setpoint Times and Temperature Settings

Setting	Time	Setpoint Temperature (Heat)	Setpoint Temperature (Cool)
Wake	6 a.m.	≤ 70°F (21.1°C)	≤ 78°F (25.6°C)
Leave	8 a.m.	62°F (16.7°C)	85°F (29.4°C)
Return	6 p.m.	≤ 70°F (21.1°C)	≤ 78°F (25.6°C)
Sleep	10 p.m.	62°F (16.7°C)	82°F (27.8°C)

Table 3: Acceptable Weekend Setpoint Times and Temperature Settings			
Setting	**Time**	**Setpoint Temperature (Heat)**	**Setpoint Temperature (Cool)**
Wake	8 a.m.	≤ 70°F (≤ 21.1°C)	≥ 78°F (≤ 25.6°C)
Leave	10 a.m.	62°F (≤ 16.7°C)	85°F (≤ 29.4°C)
Return	6 p.m.	≤ 70°F (≤ 21.1°C)	≥ 78°F (≤ 25.6°C)
Sleep	10 p.m.	62°F (≤ 16.7°C)	82°F (≤ 27.8°C)

Recovery System. All programmable thermostat models shall be equipped with a conventional recovery system. Programmable thermostat models marketed and sold for use with multistage heat pump systems shall be equipped with a multistage heat pump recovery system. ***Note:*** *Partners have submitted comments on the pre-comfort recovery definition. At this time, EPA has not received sufficient information to confirm that Intelligent Recovery Systems are more energy-efficient than conventional recovery systems. Through discussions with manufacturers, EPA has learned that consumers would need to be knowledgeable about the heating and cooling load to correctly program this feature. In addition, EPA is concerned that Intelligent Recovery Systems may be based on proprietary technology and thus used by a handful of manufacturers.*

Hold Feature. Programmable thermostats will have a hold feature that allows the user to temporarily override the program for a specified period, such as a vacation, without deleting the program. The programmable thermostat will have more than one way to override the program. For instance, a long term hold (vacation) and short term hold (override to the next setpoint, such as “up” and “down” arrows) is recommended.

Battery Backup. Programmable thermostats without a **battery backup** must have technology that stores the ENERGY STAR default settings permanently. There are no required settings for programmable thermostats with battery backup for Tier I. ENERGY STAR programmable thermostat partners agree that addressing battery backup systems in this specification was important.

Cycle Rate and Anticipator. The cycle rate and heating/cooling anticipator setting shall be easy for installer/consumer to adjust and must remain at the installed setting in the case of an external power outage or battery failure that causes the programmable thermostat to be de-

programmed. ***Note:*** *From discussions with industry, EPA has decided to strike the following requirement in the existing specification: "programmable thermostat shall be capable of cycling the heating/cooling equipment at the cycle rates required by all ENERGY STAR qualified heating and cooling equipment."*

Swing. Programmable thermostat shall be capable of maintaining room temperature swings within ± 2°F of the setpoint temperature.

Filter. If the programmable thermostat has a "change" or "check" filter feature it must provide a default setting, so that the consumer and/or contractor could easily set this feature.

4. **Interface Requirements**.

For Tier I, many features and settings mentioned above will not have a corresponding interface requirement. However, additional interface requirements will be addressed in more detail in Tier II.

Indicator for Auxiliary/Emergency Heat. Heat pump programmable thermostats will have "back up heat" LED or similar technology light or other indicator (e.g., "back up heat" on the LCD or similar technology screen) to notify the consumer of emergency heat or auxiliary heat in use. EPA believes that this indicator can inform the consumer that (1) have an equipment failure or (2) must change the programmable thermostat settings. Both situations will ensure that consumers realize the savings that ENERGY STAR and manufacturers claim. Utility groups have mentioned that having a light on the programmable thermostat could aid in protecting savings for the consumer.

Hold/Manual Setting. According to industry research and published studies, consumers are not using the programming feature of their programmable thermostat. It is EPA's hope that through this process, a specification can be developed that spurs the introduction of products that consumers will use. Therefore, if the programmable thermostat has a permanent "hold" button or "manual" setting, the manufacturer must include an indicator that the thermostat is in the "hold" or "manual" mode (e.g., flashing "hold" on the LCD display or a LED light on the thermostat). It is recommended that programmable thermostat models should not have button/feature called "hold" or setting called "manual." If the programmable thermostat has "up" and "down" arrows or buttons for temporary adjustment, the arrows must be on the outside of

the thermostat to allow the user to temporarily override the program without changing the default program.

Battery Powered Thermostats. Programmable thermostats that rely on batteries will have a "low battery" LED light or other indicator (e.g., "low battery" on the LCD screen, etc.) to protect against thermostat outage.

Simple Instructions. Partner will be required to provide simple instructions in the product packaging. EPA recommends that the partner provide permanent simple instructions on the programmable thermostat itself.

Customer Support Number. Partner shall provide a customer support number on the programmable thermostat and in the directions for installation, programming, or other locations, as appropriate.

Filter Indicator. If the programmable thermostat has a "change" or "check" filter indicator, it must be shipped with a default program that indicates when the filter needs to be changed.

Tier II

Tier I reflects products with features, interfaces, and settings that, to a large degree exist in the marketplace today. Tier II builds upon the criteria in Tier I, by adding additional suggestions that support ease of use. The suggestions for Tier II include the following:

1. **Core Features.** *Same as Tier I (page 1).*

2. **Feature Requirements**. *Same as Tier I (page 2).*

3. **Setting Requirements**

Permanent Simple Instructions. Manufacturer should provide easy access to permanent simple instructions. These instructions are intended to instruct the user as to how to take advantage of the "core" energy savings features and should be in the packaging and on the product.

Customer Hotline Number. Manufacturer should provide easy access to a permanent customer hotline number and /or Internet web site to help customers with questions.

4. **Interface Requirements**

Hold Feature. The programmable thermostat should no longer have a long-term hold feature, designated as hold. Thermostat manufacturers may denote the long-term hold feature using other terms like "vacation," or other designation. In addition, this feature must offer a user setting requirement that includes a finite number of hours for a long-term hold period. This suggestion is intended to convince users to not use the hold/vacation feature as the means to manage the day-to-day temperature settings. Programmable thermostats should also have a temporary hold feature, which will return to the program at the next event; using "up" and "down" arrows to achieve this. However, this feature should be distinguishable from the long-term hold feature.

Permanent Expanded Instructions. Manufacturer will provide permanent expanded instructions on the programmable thermostat. These instructions may include how to take full advantage of additional energy saving features beyond the core energy savings program in the simple instructions. Manufacturer should be provided flexibility as to how to best integrate these instructions into the packaging and on the product. Acceptable methods may include: (1) affixing instructions on the inner side of the door; (2) providing a pull-out card from the programmable thermostat (e.g., also found used on phones and home security systems); or other easily accessible electronic means; (3) other methods that the manufacturer can implement to permanently secure directions to the programmable thermostat.

Change Filter Indicator. If the programmable thermostat has the means to indicate the need to change the filter, it must be activated in the default program shipped from the factory. Ideally, when the filter requires changing, this status would be displayed on the product screen or via an indicator light.

Screen Size. The programmable thermostat's screen shall be large enough to show the full program including heating and cooling, as well as for both weekend and weekday settings. The user shall be able to simply scroll through each setting and use the "up" and "down" buttons to change each setting. The default ENERGY STAR program must be easily identifiable, so that the consumer can simply choose to run the program without any inputs, other than defining time

and day. The programmable thermostat's screen will also include a menu that allows the user to set the program, heat or cool, day/time, and fan. The partner shall make it easy for the consumer to scroll through the program with a use of a "select" button or by some other simple means. The manufacturer will also include a "home" button to make it easy for the consumer to return to the main menu.

Backlighting. The programmable thermostat will provide backlighting for the screen for ease of programming in low-light settings. Backlighting should be set so it is operational when the user touches any key.

Copy Button. For programmable thermostats with 7-day programming, manufacturer must provide a copy button or other function key to assist in ease in programming. It is EPA's understanding that many thermostats already have this feature, and believes that the feature helps to ensure quick and easy programming for the user.

Holiday Key. The programmable thermostat will have a holiday key, so that the user may enter a short-term program with setbacks/setups and be able to designate a select number of days for the feature. This will allow the user added flexibility in continuing to save energy, while not having the user change his or her current energy savings program to do so.

Other Requirements

Consumer/Contractor Energy Saving Information Requirements. To better educate consumers and contractors about the energy saving benefits of programmable thermostats, EPA proposes the following requirements for a partner's product packaging, customer hotline, and/or web site:

- Provide clear information on the front of product packaging regarding whether the programmable thermostat is intended for use with a heat pump or conventional system.
- Partner will provide its customer service staff with on ENERGY STAR and energy-savings program and features.
- This training will address the following:
  - Educate consumers on how energy savings are achieved and what ENERGY STAR means.
  - Explain that savings are not lost from having to ramp up/down the temperature.
  - Educate consumers that they must setback/setup for a minimum of eight hours to realize savings.

  - Explain the disclaimer on the front of product packaging to associate setbacks and setups with saving money. For example, partner can say "this programmable thermostat will save between x-x%* (these numbers to be determined by EPA) on your utility bill if you use the ENERGY STAR energy-savings program, which is default in this thermostat."
  - Educate consumers that ENERGY STAR qualified heat pump programmable thermostats minimize auxiliary and emergency heat, thereby ensuring that consumers save money by avoiding expensive secondary heat modes.
  - Explain to consumers that programmable thermostats are designed to match a particular heating and cooling system (i.e., conventional vs. heat pump). Educating consumers on how to identify the type of system they have.
  - Define 7-day programming, 5/2 programming, and 5/1/1 programming for the consumer and providing information on how each would work for different lifestyles on packaging and in the product literature.
  - Market programmable thermostats over mercury-based mechanical thermostats. EPA notes that programmable thermostat manufacturers are offering mechanical thermostats without mercury to meet the growing demand for mercury-free products. However, programmable thermostats are not only mercury-free, but are also energy savers, which help to reduce carbon emissions and protect the environment.
  - Provide Web site tutorials (recommended).

- Partner shall use an educational information box insert template to be developed by EPA. The box insert will address similar educational issues as to what will be incorporated into partner's Web sites.

- It is recommended that the Partner shall conduct consumer focus groups to ensure consumer-friendly operation and to address ease of use issues with programmable thermostats.

Product Testing

EPA feels that product testing is extremely important in maintaining the credibility of the ENERGY STAR mark and to delivering performance consumers expect. EPA expects to employ testing requirements for programmable thermostats to ensure accurate results for the qualification of products.

EPA is proposing that manufacturers use NEMA's DC-3 test procedure to determine if a model is ENERGY STAR compliant. The manufacturer would provide those results to EPA when submitting a model to EPA as "qualified." In response to manufacturers' concerns regarding the accuracy of ENERGY STAR qualified programmable thermostats, EPA would like to suggest two ways to maintain the integrity of the label:

- Allow manufacturers to self-certify product models, but require manufacturers to submit additional data to EPA to verify accuracy. This additional data is yet to be determined.
- Provide on-going feedback on testing and determine additional methods of addressing product accuracy.

Note: Additional options that should be discussed further include the following:

- Encourage all Partners/manufacturers to participate in NEMA rulemaking.
- Work with a test laboratory to build a third-party testing facility for programmable thermostats where each manufacturer would be required to have third-party testing prior to qualifying products to EPA.
- Writing and adopting a new test procedure to replace NEMA's DC-3 testing guideline.

Other Partner Commitments

In 2001, most ENERGY STAR partners rolled over to the new Partnership Agreement, which phased out the previous Memorandum of Understanding (MOU). The Partnership Agreement has standardized commitments for ENERGY STAR partners over all product areas, when appropriate. Some current ENERGY STAR programmable thermostats partners have already signed a Partnership Agreement. However, there are a number of partners who have participated in ENERGY STAR for Programmable Thermostats in the past number of years and have not yet signed a Partnership Agreement, and yet continue to qualify products under the previous Memorandum of Understanding (MOU).

With the new Partnership Agreement, there are some new commitments. The first is that partners must identify their compliant products on their web site, on product packaging, and the product itself. Also, partners are required to submit products and shipment data once a year. This shipment data may be masked to protect the identity of the Partner. Lastly, there is to be no grandfathering of products. To earn the ENERGY STAR, a product model must meet the ENERGY STAR specification in effect on the model's date of manufacture.