Residential Thermostat Definition for the 2016 MEMD

Presentation to Energy Optimization Collaborative

Pace Goodman

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Agenda

1. Background
2. Proposed Definition
3. Next Steps

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Background

- The 2016 MEMD includes three residential thermostat measures representing savings associated with Tier 1, Tier 2, and Tier 3 thermostats

Setback thermostat – Moderate/Full setback	*Gross Savings* for Tier 1 Thermostats
	Verified Net Savings for Tier 2 Thermostats
Programmable Thermostat Tier 3	*Verified Net Savings* for Tier 3 Thermostats

- The different Tiers of residential thermostats were not clearly defined when Tiers 2 and 3 were added to the 2016 MEMD.

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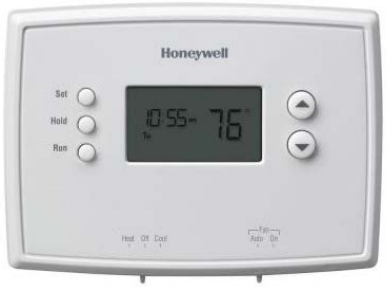
Whitepaper Thermostat Tier Definitions

Tier	Title	Definition
Tier 1	Programmable Thermostat	Customer-programmed temperature set points schedule
Tier 2	Communicating Thermostat	Tier 1 features, plus • Remote customer access to adjust set points • Remote utility control of set points for demand response (DR)
Tier 3	Analytics-Capable Thermostat	Tier 2 features, plus • Additional energy savings features through analytics • Enhanced customer engagement • Enhanced program planning and evaluation with robust customer-specific datasets

Tier 1 Characteristics

- Thermostat provides the ability to program a setpoint schedule

Tier 1 Examples



Honeywell 7 Day Programmable Thermostat

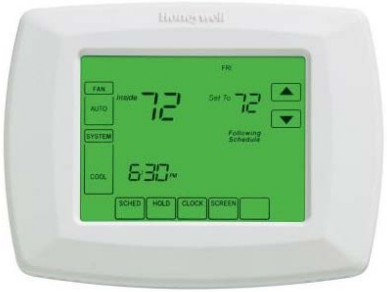
$19.88 (from Home Depot)

- 1 basic program for the entire week
- Easy to use, basic operation makes programming easy

Lux 7-Day Touchscreen Universal Application Programmable Thermostat

$68.00 (from Home Depot)

- User-friendly interface for simple programming and operation
- Energy usage monitor
- Programmable air filter life timer
- Smart recovery – enables the set temperature to be reached by programmed time



Honeywell 7-Day Universal Touchscreen Programmable Thermostat

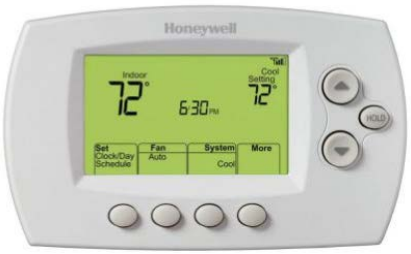
$95.99 (from Home Depot)

- Effortless menu-driven programming guides the user through the programming process, only showing necessary information and choices
- Separate programming for each day of the week – four periods per day

Tier 2 Characteristics

- Thermostat with all the capabilities of a Tier 1 thermostat, plus
- Thermostat is Wi-Fi enabled which offers two-way communication capabilities
  - Allows customers to access and adjust setpoint schedules remotely via a smartphone or web app
  - Provides utilities with the option to control customers' thermostats remotely during DR events, although this may require additional software support

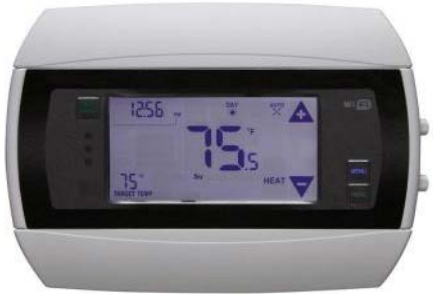
Tier 2 Examples



Honeywell Wi-Fi 7 Day Programmable Thermostat + Free App

$99.98 (from Home Depot)

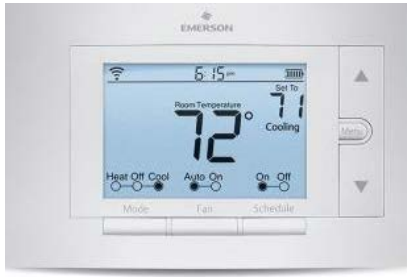
- Wi-Fi enabled thermostat allows for remote access via smartphone or computer
- Free smartphone app for iPhone, iPad, and Android operating systems
- 7 day programming with 4 program periods per day
- Pre-programmed with energy savings schedule
- Intelligent alerts
- Ability to view local weather from web portal or app



Radio Thermostat CT50 7-Day Wi-Fi Programmable Thermostat

$104.36 (from Home Depot)

- Wi-Fi enabled with free app provides remote access
- 7-day programmable thermostat with 4 independent periods per day
- Geofencing allows the thermostat to lower the temperature while away and raise it when within a specified distance
- Controls up to 2 stages of heat and 2 stages of cool



Emerson Sensi Wi-Fi Programmable Thermostat for Smart Home

$129.00 (from Home Depot)

- Wi-Fi enabled - users can control the thermostat from anywhere via free mobile app
- Easily set and control heating and cooling schedules with 7 independent day in-app programming options
- Built-in humidity sensor
- Unique cycling settings allows the thermostat to keep the room temperature within +/- 1°F

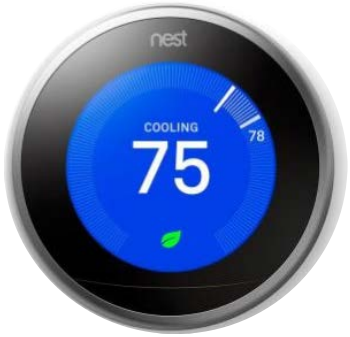
Tier 3 Characteristics

- Thermostat with all the capabilities of a Tier 2 thermostat, plus
- Thermostats are enhanced by data gathering and analytics functionalities, enabling them to use a variety of methods to optimize HVAC settings for efficient and automated energy consumption
- To qualify as Tier 3, a thermostat must have at least 3 of the following features:
  - Occupancy detection
  - Schedule learning
  - Heat pump lockout temperature control
  - Upstaging and downstaging optimization
  - Optimal humidity control/AC overcooling
  - Optimizing HVAC efficiency based on outdoor temperature and weather forecasts
  - Free cooling/economizer capabilities

Tier 3 Qualifying Features

Feature	Description
Occupancy detection	Thermostat recognizes if the occupant is home or away through the use of occupancy sensors, geofencing, etc., and automatically adjusts the temperature setpoints to an “away” setback/up.
Schedule learning	Thermostat learns occupant patterns to facilitate the use of setbacks with little to no effort from the customer.
Heat pump lockout temperature control	Thermostat adjusts the lockout temperature on heat pumps to avoid use of the auxiliary heat.
Upstaging and downstaging optimization	Thermostat engages the lowest and most efficient stage of heating or cooling as often as possible. The higher stage is engaged only when the indoor temperature is significantly different than the desired temperature and using a lower stage would not allow the home to reach the desired temperature within the given window of time.
Optimal humidity / humidity control / AC overcool	Thermostat uses the air conditioner to lower indoor humidity in the absence of a dehumidifier. Residents are less likely to adjust thermostats to inefficient setpoints at appropriate humidity levels. Additionally, humidity control can prevent frost buildup on windows when it is cold outside with high humidity indoors.
Optimizing HVAC efficiency based on outdoor temperature and weather forecasts	Thermostat uses weather predictions to operate a HVAC system at the optimal outdoor temperature.
Free cooling / economizer capability	Thermostat recognizes the indoor/outdoor temperature difference and uses the outside air instead of the air conditioner to cool down the home when possible.

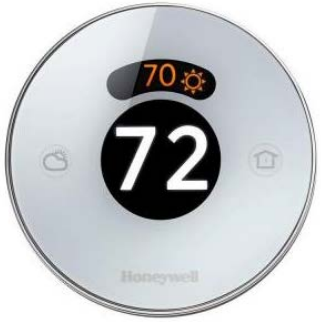
Tier 3 Top Manufacturers



Nest Learning Thermostat

$249.00 (from Home Depot)

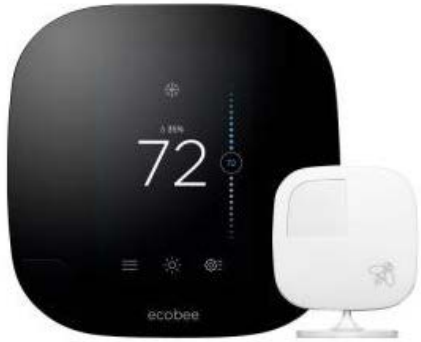
- Auto-Schedule – learns the temperature preferences and programs itself
- Auto-Away – automatically turns itself down when occupants are away to avoid heating or cooling an empty home
- Nest Leaf – guides use of efficient temperature settings
- Early-on – nest learns how the home warms up and watches the weather to provide the desired temperature
- Remote control – change the temperature from phone or computer



Honeywell Lyric Wi-Fi Programmable Thermostat

$249.99 (from Home Depot)

- Location based on/off – uses smartphone's location to determine when home is unoccupied and to prepare home for occupancy
- Smart alerts – push notifications for filter change reminders and extreme indoor temperature warnings
- Wi-Fi enabled – save energy and maintain comfort from anywhere
- Comfort – view and adjust humidity levels of Indoor Air Quality system; considers both humidity and temperature to maintain comfort



Ecobee3 Smarter Wi-Fi Thermostat with Remote Sensor

$249.00 (from Home Depot)

- Understands when to turn on HVAC equipment based on home's unique energy profile, the weather outside, and thousands of other data points
- Remote sensors detect whether anyone's home and which rooms are occupied
- Home IQ – allows users to view energy usage and compare to neighbors, and provides tips to save more energy
- Alerts and reminders – provides alerts if HVAC equipment is not working correctly

Tier 3 Top Software Providers

EcoFactor	EnergyHub	WeatherBug Home
• Uses a series of advanced algorithms alongside real-time data from programmable thermostats, weather conditions, and consumer preferences to make automatic micro-temperature adjustments to save energy • Works with utility DR programs to cool homes prior to a DR event to minimize discomfort and encourage greater DR participation	• Generates an "operational plan" designed to save energy and ensure comfort by analyzing actual usage and using additional information, like home type and weather forecasts • Periodically analyzes a home's energy status to make adjustments • Tracks HVAC performance • Provides geo-optimization services (geofencing) and thermodynamic optimization algorithms	• Uses weather, smart meter, and thermostat data to build a model of the user's home to understand how much energy it takes to attain and maintain desired temperature • Takes thermostat schedule and the next day's weather forecast to optimize daily schedule each day; this minimizes energy use while maintaining desired temperature setpoints • Compares the model's prediction of home energy use against actual energy use and temperature to continuously improve the model

Tier 3 software providers partner with Tier 2 or Tier 3 thermostat manufacturers to add functionalities consistent with the Tier 3 thermostat definition. When the device and enabled software are installed together, the pair warrant the Tier 3 savings.

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- EO Collaborative discussion to decide on definition