



Re: ecobee comments on the Clean Peak Energy Portfolio Standard (CPS) DR Guidelines

Date: 8/10/2021

Thank you for the opportunity to comment on the Clean Peak Energy Portfolio Standard (CPS) DR Guidelines.

ecobee commends the Departments of Energy Resources (DOER) for hosting a robust stakeholder session for four different demand response technology types which include Electric Vehicle Chargers, Electric Water Heaters, Load Curtailment and Infrequent Demand Response, and Building Thermal Mass and Thermal Storage.

During the stakeholder sessions, the category of building thermal mass and thermal storage was defined as thermostats.

ecobee respectfully requests that the DOER specify in its final DR guidelines that the Building Thermal Mass and Thermal Storage category encompasses residential thermostats.

ecobee also respectfully requests that the DOER either remove footnote 5 from the Final DR guidelines or add the underlined portion to footnote 5 so as not to preclude residential smart thermostat participation.

5 For example, following baseline and measurement guidelines established in ASHRAE 14 Category C or established measurement guidelines using thermostat runtime data and state-specific connected load assumptions and a control group to serve as the counterfactual.

There was robust discussion during the three stakeholder meetings on thermostats on best practices for measurement and verification of existing thermostat technology, and consensus



was reached among residential thermostat manufacturers around the use of thermostat runtime data, state-specific connected load assumptions and a control group for measurement purposes for the standard. ecobee respectfully requests these edits be added to the draft DR guidelines so that the final DR guidelines reflect the stakeholder process and consensus that was reached.

For convenience, ecobee is attaching its previous comments submitted on this issue which demonstrates this follows established industry best practices.

Thank you for taking these comments into consideration.

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Massachusetts Clean Peak Standard - ecobee Proposal

Proposal Overview

The Massachusetts Department of Energy Resources (DOER) has established the Clean Peak Standard to allow generating and demand side resources to contribute to Massachusetts' electricity peak demand reduction and clean energy goals. ecobee has recently brought to market eco+, a smart thermostat feature which allow consumers to easily optimize their HVAC electricity consumption around peak demand to save costs while maintaining comfort.

ecobee believes that there is a unique and innovative opportunity to have consumers on eco+ contribute to the CPS while using detailed thermostat telemetry data to perform measurement and verification (M&V) of the savings.

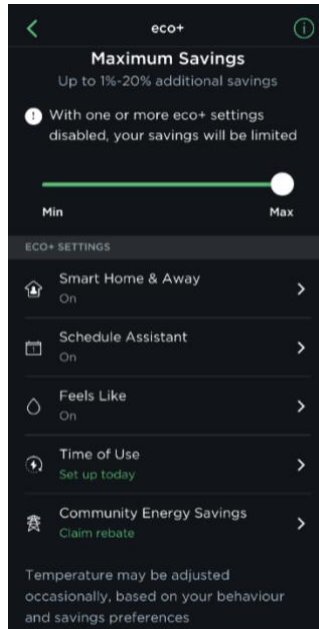
This proposal provides an overview of eco+ and its energy savings capabilities, a proposal for an M&V framework along with a pilot plan for the summer of 2020.

Introduction to eco+

ecobee recently launched eco+ (<https://www.ecobee.com/en-us/eco-plus/>), a thermostat optimization platform that is being released to all customers in the form of a free software upgrade. It uses customer comfort preferences, real-time and historical occupancy patterns and a home's specific thermodynamic properties and HVAC system performance to create personalized, real-time optimization for demand response, time-of-use and energy efficiency.

Customers are introduced to eco+ through an in-app interstitial where they are prompted to select their savings preferences using a slider and able to toggle the eco+ features on or off. The eco+ feature suite includes time-of-use and community energy savings. These features optimally precool or preheat a customer's home before the peak period, and in doing so, act as a form of energy storage that allows customers to ride out periods of high demand without sacrificing comfort. This results in reduced strain on the grid and allows customers to seamlessly contribute to the sustainability of their community. The terms and conditions for eco+ allow ecobee to share thermostat telemetry data with utilities and other bodies related to the delivery of energy programs. This allows ecobee to explore participating in the CPS using an innovative and scalable approach to M&V.

Figure 1 – eco+ settings



eco+ and the Clean Peak Standard

As a leading developer of smart thermostats, ecobee is submitting this proposal to demonstrate how its device telemetry data could be used to measure the impacts of residential HVAC load reduction through eco+ to qualify for clean peak energy certificates. eco+ exists in the market today and has been measured and verified by third party evaluation experts in the largest randomized encouragement design ever conducted to quantify the additional energy and demand savings achieved from thermostat optimization.

A summary of the evaluation report is accessible at <http://www.ecobee.com/ecoplusEMV>. The results show the impacts measured against ecobee customers that did not get the eco+ offer and show that eco+ time-of-use optimization results in additional energy, demand and bill savings on each evaluated rate.

Figure 2 – eco+ TOU optimization savings

Rate	Price Ratio (Peak: Off-Peak)	Climate Region	Average kW Savings During Peak Period	Peak Duration (hours)	Average On-Peak Percent Savings (kWh)	Average Total Energy Savings (kWh)	Percent Savings On Cooling Energy (\$)
Hydro One Res TOU	2.0	Canada	0.18	6	36%	3.4%	8%
FPL RTR-1	5.8	Hot Humid	0.22	9	13%	5.0%	10%
SMUD Res TOD	2.4	Hot Dry	0.25	3	23%	3.5%	8%
PG&E EV-A	3.7	Mixed Dry	0.18	6	28%	8.8%	19%
PG&E EV-A	3.7	Marine	0.10	6	20%	4.0%	11%

Summer 2020 would be undertaken on a trial basis to assess 1) M&V procedures 2) customer experience 3) program management process and 4) economics. Should the trial prove successful, ecobee would seek to scale its efforts significantly in Fall 2020 and beyond.

Estimated Savings Potential

Based on the evaluation report reference above, it is estimated that each eco+ customer contributes ~0.75-1 kWh per day of energy savings during the peak during the summer months.

Should the trial be successful, ecobee would seek to significantly increase the participation in Fall 2020 and beyond. ecobee currently has over 36,000 thermostats in Massachusetts which are eligible to participate in this program (an amount growing every day). The goal would be the scale the program appropriately after Summer 2020 based on the outcomes of the Summer trial.

Measurement and Verification of eco+ Impacts for Clean Peak Energy Certificates

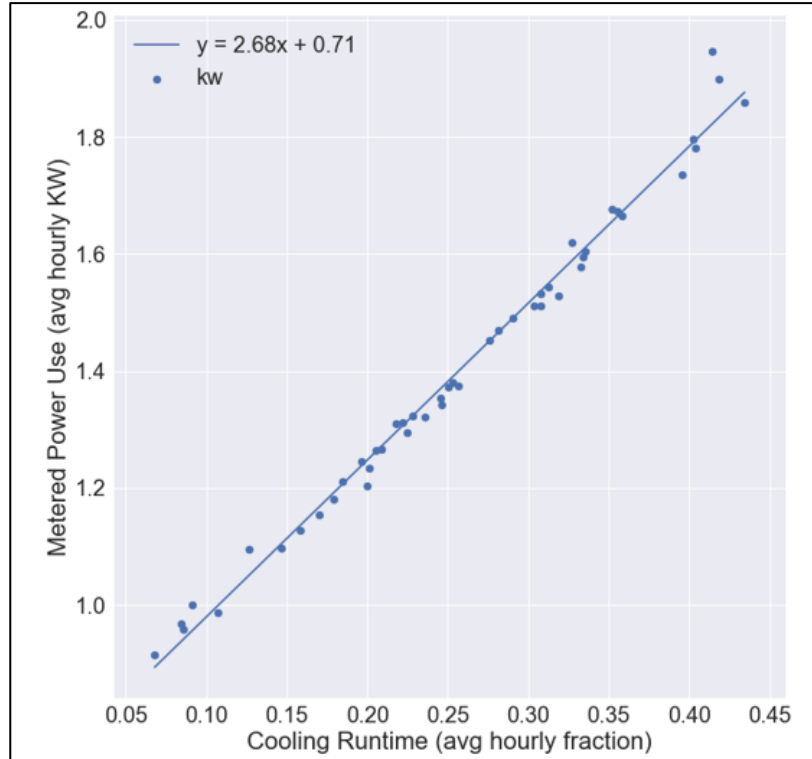
Background: Thermostat Telemetry Data for M&V

Before introducing eco+, ecobee launched the Peak Relief Pilot program in 2018 to test the customer acceptance of a combined DR- and TOU-optimization service based on customer-selected preferences for comfort and energy savings. The pilot was also meant to measure the savings impacts associated with the enhanced features to be released through eco+.

In partnership with an Ontario utility, ecobee was able to compare daily HVAC runtime data with interval utility meter data collected from 500 participating thermostats over the course

of two months. A regression analysis between these data points showed a highly significant correlation between energy consumption and HVAC runtime (with an R2 value of 98.8%).

Figure 3 – Daily Aggregated Runtime vs. kW Data



As a result of this analysis, we could conclude with confidence that thermostat telemetry data (aka: HVAC runtime data) is a suitable substitute for electrical meter data to determine energy savings.

Using runtime data as a proxy for energy savings is a process that has been used in multiple other energy programs in the U.S (some examples highlighted in Table 5 below).

Table 5. Examples of North American utility programs using a thermostat telemetry M&V approach in DR.

Utility	Program Name/Year	Link
Xcel Energy New Mexico	Saver's Stat 2017	https://www.xcelenergy.com/staticfiles/xcel-responsive/Company/Rates%20&%20Regulations/Regulatory%20Filings/NM-DSM-2017-Annual-Report-with-Attachments.pdf

Utility	Program Name/Year	Link
Xcel Energy Colorado	Smart Thermostat Pilot 2015	https://www.xcelenergy.com/staticfiles/xcel-responsive/Company/Rates%20&%20Regulations/Regulatory%20Filings/CO-Smart-Thermostat-Pilot-Evaluation.PDF
National Grid	ConnectedSolutions 2017	http://ma-eeac.org/wordpress/wp-content/uploads/2017-NGrid-DR-Eval-Final-Report-2018-03-30.pdf
CPS Energy	Nest Rush Hour Rewards Pilot Program 2014	https://www.sanantonio.gov/Portals/0/Files/Sustainability/STEP/CPS-FY2015.pdf
Vectren	Residential Smart Thermostat Pilot 2016	http://vectrened.com/assets/downloads/planning/irp/RP-2018-smart-cycle-evaluation.pdf

The U.S Department of Energy (DoE) is currently establishing a national standardized M&V protocol for energy efficiency and demand response program evaluation named the Uniform Methods Project (UMP). Thermostat telemetry data is being viewed as acceptable for M&V purposes in this standard. Specifically, in section 4 of the draft protocol (available upon request via NREL¹) the DoE supports the use of runtime data as appropriate for M&V by stating:

“As residential electricity demand for space heating and cooling often contributes significantly to peak demand, administrators of smart thermostat programs may want to estimate the peak energy savings from smart thermostats. To estimate accurately the energy savings for the utility’s peak hour(s), evaluators should collect and analyze hourly or sub-hourly electricity consumption or thermostat runtime data using the methods for thermostat replacement programs or optimization programs described previously in this chapter.” (pg. 14)

Proposed M&V Methodology

ecobee is proposing to utilize the M&V protocol used by the IESO in Ontario to verify demand response savings for residential program participants using thermostat telemetry in

¹ National Renewable Energy Laboratory (NREL). *HVAC Controls Protocol*. Retrieved from: <https://www.nrel.gov/ump/>

place of meter data. The IESO M&V requirements are as follows pursuant to Market Manual 12²:

- A “treatment” group, where contributors are activated to provide demand response upon receipt of the demand response standby and activation notice; and
- A randomized “control” group, where contributors serve as a proxy for baseline consumption; therefore, are not activated to provide demand response. There must be at least 350 control group contributors which are chosen randomly (i.e. using a process of selection in which each contributor has an equal probability of being chosen) each month by the capacity market participant from the total population of contributors under the residential HDR resource (ed: HDR is a hourly demand resource registered in Ontario which a portfolio of aggregated residential customers constituted a resource)

ecobee proposes a similar approach using instead its thermostat telemetry data on a 5-minute or hourly basis in place of meter data for both the control and treatment groups. To convert thermostat runtime savings into energy savings, ecobee proposes utilizing climate specific Technical Resource Manual values for air conditioning, electric furnace and heat pump system sizes in kW. Below are the connected load assumptions used in the third party eco+ evaluation report referenced above. ecobee suggests using the assumptions from the Cold Climate zone.

Figure 4 – Connected Load Assumptions

Table 12: Connected Load Assumption by Climate Zone

Climate Zone	Tons	SEER	kW per Device
01 Canada	2.15	10.5	2.45
02 Cold	2.75	10.5	3.10
03 Dry	3.25	10.5	3.48
04 Hot Humid	3.25	10.5	3.60
05 Mixed Humid	2.75	10.5	3.04
06 Marine	2.60	10.5	2.93

² See Chapter 12, section 5.3.2 at: <http://www.ieso.ca/en/Sector-Participants/Market-Operations/Market-Rules-And-Manuals-Library>



When constructing the control group, ecobee will select an equal proportion of thermostat customers (at least 350) who are not undergoing eco+ optimization in the state from corresponding zip codes as the treatment group (i.e. eco+ optimized customers). This will be done to match household types between control and treatment groups to the best of our abilities.

To operationalize this M&V approach, ecobee would provide a monthly report of the 5-min or hourly energy consumption of the control and treatment groups to the Production Tracking System (PTS) to calculate savings as required by the CPS market rules. ecobee would be able to identify any periods and customers who participated in a utility-initiated demand response event into order to exclude those specific periods (and savings) from ecobee's claim.

Next Steps

ecobee would be pleased to provide data samples to the DOER or third-party implementer to obtain approval for the proposed M&V methodology to receive a statement of qualification.