DENVER AMENDMENT PROPOSAL FORM
FOR PROPOSALS TO THE 2019 DENVER BUILDING CODE AMENDMENTS AND THE 2021 INTERNATIONAL CODES

2021 CODE DEVELOPMENT CYCLE

1) Name: Courtney Anderson **Date: 10/12/2021**
Email: Courtney.Anderson@denvergov.org **Representing (organization or self):**
City Staff Proposal (check box): ☒

2) One proposal per this document is to be provided with clear and concise information.

Is a separate graphic file provided ("X" to answer): ___ Yes or No

3) Highlight the code and acronym that applies to the proposal

Acronym	Code Name	Acronym	Code Name
DBC-AP	Denver Building Code–Administrative Provisions	**IPC**	International Plumbing Code
IBC	International Building Code	**IRC**	International Residential Code
IECC	International Energy Conservation Code	**IFGC**	International Fuel Gas Code
IEBC	International Existing Building Code	**IMC**	International Mechanical Code
IFC	International Fire Code	**DGC**	Denver Green Code

AMENDMENT PROPOSAL

Please provide all the following items in your amendment proposal.

Code Sections/Tables/Figures Proposed for Revision:
Instructions: If the proposal is for a new section, indicate (new), otherwise enter applicable code section.
R403.1

Proposal:
Instructions: Show the proposal using ~~strikeout~~, underline format.
Place an "X" next to the choice that best defines your proposal: _X Revision _XNew Text __ Delete/Substitute __ Deletion

Add the following sections and renumber the following equations:

Add new definitions as follows:

DEMAND RESPONSE SIGNAL. A signal that indicates a price or a request to modify electricity consumption for a limited time period.

DEMAND RESPONSIVE CONTROL. A control capable of receiving and automatically responding to a *demand response signal*.

Add new section as follows:

R403.1.1 Thermostat ~~Programmable thermostat~~. The thermostat controlling the primary heating or cooling system of the dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature setpoints at different times of the day. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures of not less than 55°F (13°C) to not greater than 85°F (29°C). The thermostat shall be programmed initially by the manufacturer with a heating

temperature setpoint of not greater than 70°F (21°C) and a cooling temperature setpoint of not less than 78°F (26°C).

R403.1.1.1 Demand responsive controls. The thermostats shall be provided with *demand responsive controls* that comply with AHRI 1380 and are capable of the following:

1. *Automatically increasing the zone operating cooling set points by a minimum of* 4°F (2.2°C)
2. *Automatically decreasing the zone operating heating set points by a minimum of* 4°F (2.2°C)
3. *Automatically decreasing the zone operating cooling set points by a minimum of* 2°F (1.1°C)
4. Automatically increasing the zone operation heating set points by a minimum of 2°F (1.1°C)
5. *Both ramp-up and ramp-down logic to prevent the building peak demand from exceeding that expected without the DR implementation.*

The thermostat shall be capable of performing all other functions provided by the control when the *demand responsive controls* are not available.

Exception: Assisted living facilities.

Supporting Information (Required):
All proposals must include a written explanation and justification as to how they address physical, environmental, and/or customary characteristics that are specific to the City and County of Denver. The following questions must be answered for a proposal to be considered.

Purpose: What does your proposal achieve?

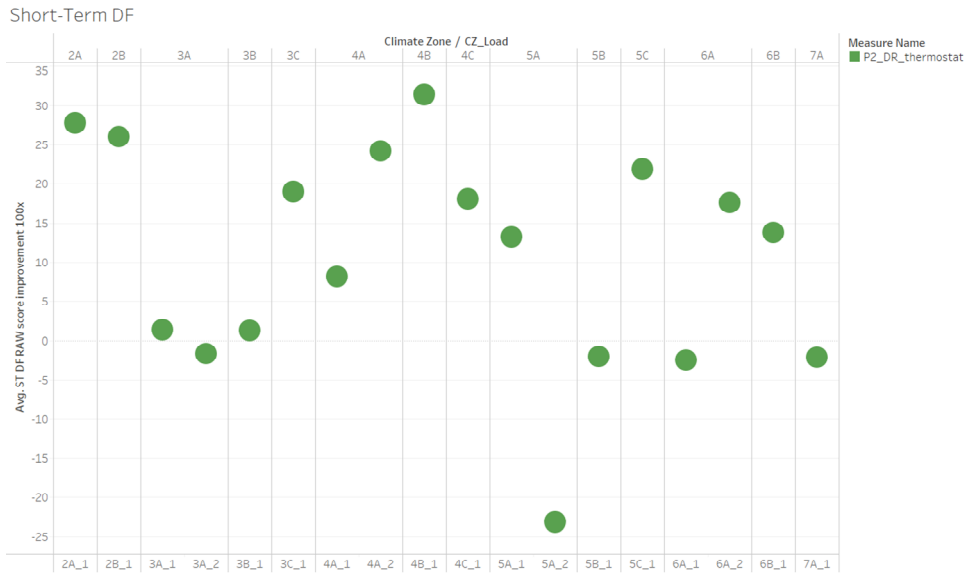
This proposal would require that most thermostats installed in residential buildings be demand response controls capable of automatically adjusting the space conditioning setpoint by no less than 4 degrees in response to a signal from a utility, electrical system operator or other demand response provider.

Reason: Why is your proposal necessary?

Grid flexibility is one of the four foundations of "Denver's Net Zero Energy (NZE) New Buildings & Homes Implementation Plan." Grid flexibility is an essential element of decarbonizing the electrical grid. Carbon free energy sources like solar and wind have varying production over the course of the day and the year. Demand responsive controls that can respond to demand response signals enable buildings to shape their loads to better align with available energy production. This could come in the form of curtailing energy use when demand is high or utilizing excess production for building tasks like pre-conditioning spaces or service hot water when demand is lower.

Smart thermostat demand response is becoming one of the most pervasive utility offerings throughout the country. In their 2019 Demand Response Market Snapshot, SEPA found that 58 utilities had smart thermostat offerings, comprising 1 GW of connected load. In their assessment of US national potential for load flexibility, Brattle found that smart thermostats were the largest single program offering in their estimated 200 GW of potential by 2030.

As shown in the figure below, LBNL modeling for the DOE GEB roadmap shows that demand response thermostats can reduce building peak demand by up to 30%. The substantial savings impact variability is because LBNL modeled impacts at times driven by typical utility peak hours based on the utility grid region but that does not necessarily align with building peak hours. If the two are aligned, the impacts are maximized; if impacts are misaligned impacts may be shown as negative. Therefore, these impacts should not be considered to be "typical" or "maximum" in each case.



Substantiation: Why is your proposal valid? (i.e. technical justification)

This proposal modifies the requirements for thermostats to add demand control functionality. Since this requirement is part of the construction code, it will not require building to participate in any demand response programs. But it will ensure that buildings are capable of participating, ensuring that Denver buildings will be able to help integrate building loads with available production.

This functionality will also present a cost-saving opportunity for buildings in the future. XCEL currently offers an optional demand response program. More and more utilities are moving beyond voluntary programs and are expanding use of time-of-use rates for electricity as a tool for shaping demand. Installing demand-responsive thermostats now will allow building tenants and owners to better control their utility costs.

The ability to adjust by 4 degrees was chosen based on demand flexibility requirements in California's energy code Title 24 Part 6. This will align the requirements with the biggest American market for demand flexible thermostats.

The proposal includes an exemption for thermostats serving health care and assisted living facilities (as can sometimes be found in low-rise R-3 and R-4 occupancies) as these are occupancies where climate control can be related to health care.

Bibliography and Access to Materials (as needed when substantiating material is associated with the amendment proposal):

Hart, Reid, Chandrasekharan Nambiar, Chitra, Tyler, Matthew T., Xie, YuLong, and Zhang, Jian. Relative Credits for Extra Efficiency Code Measures. United States: N. p., 2018. Web. doi:10.2172/1489162. (https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-28370.pdf)

SEPA, 2019 Utility Demand Response Market Snapshot (2019) https://sepapower.org/resource/2019-utility-demand-response-market-snapshot/

Brattle, The National Potential for Load Flexibility (2019) https://brattlefiles.blob.core.windows.net/files/16639_national_potential_for_load_flexibility_-_final.pdf

Other Regulations Proposed to be Affected

***For proposals to delete content from the 2019 Denver Green Code in conjunction with adding it to other mandatory Denver codes and/or regulations, only.**

Please identify which other mandatory codes or regulations are suggested to be updated (if any) to accept relocated content.

None

Referenced Standards:

List any new referenced standards that are proposed to be referenced in the code.

None

Impact:

How will this proposal impact cost and restrictiveness of code? ("X" answer for each item below)

The primary cost drivers in thermostats are not the grid-flexible controls but rather other features. Therefore, incremental costs vary. An entry-level grid-integrated thermostat currently available from www.supplyhouse.com costs about $70, while the same retailer lists a similar non-grid-integrated programmable unit for just over $35, indicating an incremental cost of about $35. This cost has dropped over the last decade or more. A 2017 study out of Vermont cited incremental costs for smart thermostats in new construction at roughly $150 – a decrease in incremental costs of $115 over just 4 years. (https://publicservice.vermont.gov/sites/dps/files/documents/2017%20Tier%20III%20TRM%20Characterizations.pdf).

Cost of construction:	___X Increase	___ Decrease	___ No Impact
Cost of design:	___ Increase	___ Decrease	__X_ No Impact
Restrictiveness:	___X Increase	___ Decrease	___ No Impact

Departmental Impact (City use only):

This amendment proposal increases/decreases/is neutral to the cost of plans review.

This amendment increases/decreases/is neutral to the cost of inspections.