

2022 Denver Energy Code Highlights for Commercial and Multifamily Buildings

Community Planning and Development
Office of Climate Action, Sustainability and Resiliency

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2022 Denver Energy Code Highlights

- This is a high-level summary of changes to the **commercial provisions** of the 2022 Denver Energy Code.
- Does not include all changes to the 2022 Denver Energy Code. Please refer to the 2022 Denver Energy Code for specific code language. [Denvergov.org/BuildingCode](https://denvergov.org/BuildingCode)
- For additional resources visit [Denvergov.org/NetZero](https://denvergov.org/NetZero)

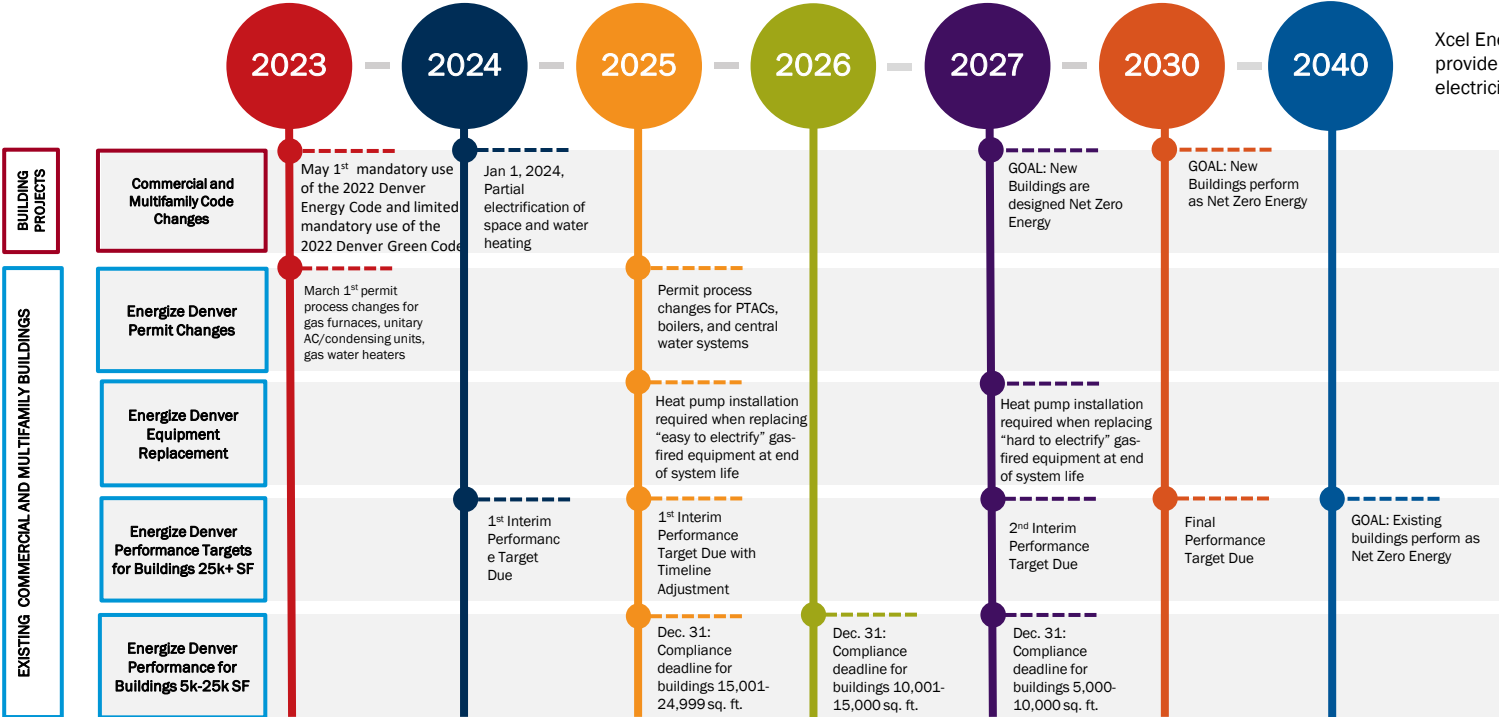


= Prescriptive provision



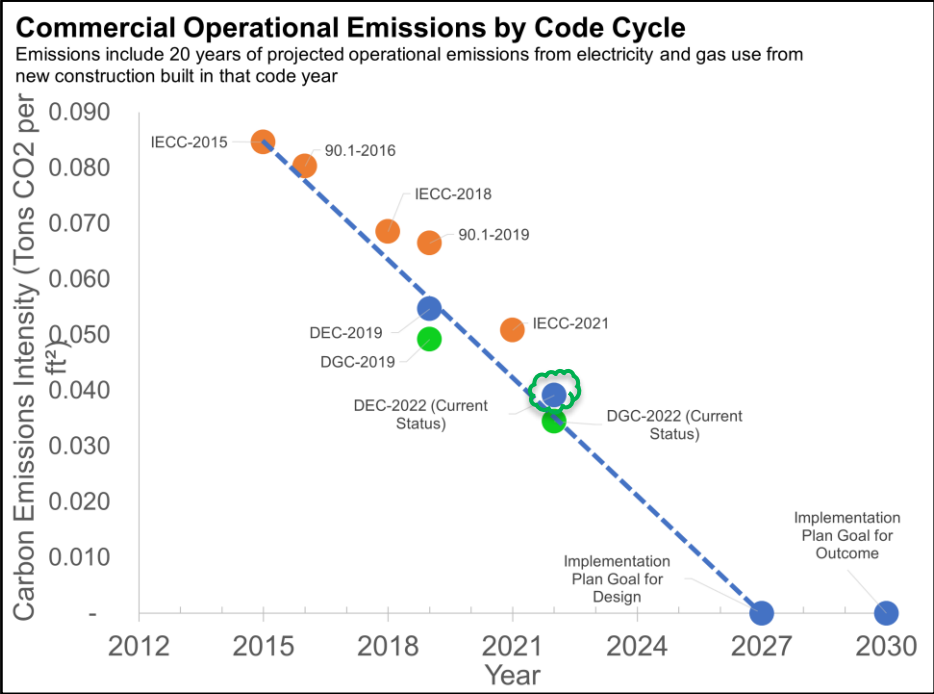
= Mandatory requirement

Timeline - Commercial Electrification and Performance Requirements



Xcel Energy required to provide 80% renewable electricity by 2030

2022 Denver Energy Code Progress - Commercial



2022 Denver Energy Code Highlights

1. Minimum Insulation Requirements (C402.1.5)
2. Air Barrier and Air Leakage Testing Update (C402.5)
3. Mechanical Ventilation Requirements (IMC 401.2 & 403.1)
4. HVAC Fault Detection & Diagnostics (C403.2.3)
5. Prescriptive Economizer Requirements (C403.5)
6. Partial Electrification for Space Heating & Water Heating – New Construction (C403.2.4 & C404.10)
7. Partial Electrification for Space Heating & Water Heating for Equipment Replacement (C503.3.3 and C503.4.1)
8. Lighting Power Allowance for Sleeping and Dwelling Units (C405.3.2)
9. Electrical Energy Monitoring (C405.12)
10. Electric Vehicles Update (C405.13)
11. Electric Ready Infrastructure (C405.15)
12. Prescriptive Path (C401.2.1 Option 1)
13. Performance Path: 1) Energy Cost, 2) Site Energy, 3) Performance Target (C401.2.1 Option 2)

Minimum Insulation Requirements



C402.1.5 Minimum Insulation Requirements for Proposed Design

- Mandatory requirement
- All conditioned areas are insulated
 - Cores (i.e. stair/elevator in an unconditioned parking garage)
 - Back of house spaces
- Can exclude spandrel and up to 5% of remaining envelope

Component	NEW Maximum U-Factor	C402.1.3 R-Value	C402.1.4 U-Factor	2019 DEC R-Value	2019 DEC U-Factor
Roof insulation above deck	U-0.048	R-30	U-0.032	No change	No change
Roof metal building	U-0.055	R-19+R-11 LS	U-0.035	No change	No change
Roof attic and other	U-0.027	R-49	U-0.021	Group R: R-38	Group R: U-0.027
Wall mass	U-0.090	All Other: R-11.4ci Group R: R-13.3ci	All Other: U-0.090 Group R: U-0.080	No change	No change
Wall metal building	U-0.069	R-13+R-14ci	U-0.050	R-13+R-7.5ci	U-0.064
Wall metal framed	U-0.064	R-13+R-10ci	U-0.055	R13+R-13ci	U-0.052
Wall wood framed and other	U-0.064	R-13+R-7.5ci OR R-20+R-3.8ci	U-0.051	All Other: R-13+R-3.8ci or R-20 Group R: R-13.3+ R-7.5 or R-20+R-3.8ci	All Other: U-0.064 Group R: U-0.055
Above grade floors mass	U-0.074	All Other: R-14.6ci Group R: R-16.7ci	All Other: U-0.057 Group R: U-0.051	All Other: R-10ci Group R: R-12.5ci	All Other: U-0.074 Group R: U-0.064
Above grade floors framed	U-0.074	R-30	U-0.033	R-30	U-0.033

Air Barrier and Air Leakage Testing Update



C402.5 Air leakage – thermal envelope

- Mandatory requirement
- Continuous air barrier required, verified at installation, AND tested with corrective action until measured air leakage is
 - 1) At or below target-OR-
 - 2) At or below the maximum limit (from exceptions) plus
 - Conduct a diagnostic evaluation using smoke tracer or infrared imaging along with a visual inspection of the air barrier
 - Any leaks noted shall be sealed
 - Submit additional report identifying corrective actions taken
- How to prepare for this?
 - Pay close attention to air sealing details in drawings and materials in specifications and conduct the air barrier review early enough in design to make updates in drawings and specifications
 - Identify the entity doing inspection and the entity doing air leakage testing

Measured Air Leakage	C402.5.2 Dwelling and Sleeping Units	C402.5.3 All Other
Pressure Differential	50 Pa	75 Pa
Target	0.3 CFM/SF	0.4 CFM/SF
Maximum Limit	0.45 CFM/SF	0.6 CFM/SF

Multifamily Mechanical Ventilation Requirements



Denver Mechanical Code Section 401.2 – Ventilation Required

- Occupied spaces (other than R) must provide natural or mechanical ventilation
- Dwelling units must provide balanced mechanical ventilation
 - **Natural ventilation is NOT allowed in dwelling units** due to 2022 Denver Energy Code air leakage requirements

Denver Mechanical Code Section 403.1 – Ventilation System

- Mechanical ventilation must be balanced with supply air approximately equal return or exhaust air
- **Exhaust-only ventilation is NOT allowed**
- The system can produce a space with negative or positive pressure

Why?

- Building envelopes are getting tighter (air leakage requirements) therefore reducing infiltration and rendering natural ventilation or exhaust-only not effective multifamily ventilation methods

HVAC Fault Detection & Diagnostics



C403.2.3 – Fault Detection and Diagnostics

- Mandatory requirement
- New buildings with an HVAC system serving a conditioned floor area of **25,000 SF or larger** are required to include a fault detection and diagnostics (FDD) system
- Exceptions: warehouse buildings with heating-only systems AND R1 and R2 occupancies

Economizer Requirements



C403.5 – Economizers - Air or water economizers are required for the following cooling systems for prescriptive compliance:

Chilled water systems – chilled-water capacity less capacity of cooling units with air economizers

- Local water-cooled systems: cooling capacity > 1,320,000 Btu/h
- Air-cooled or district systems: cooling capacity > 1,720,000 Btu/h

Individual Fan Systems

- *Group R: total cooling capacity greater than 270,000 Btu/h*
- Other than Group R: total cooling capacity greater than 33,000 Btu/h

Partial Electrification for Space Heating



C403.2.4 – Space heating equipment

- Effective date of **January 1st, 2024**
 - Fossil-fuel warm air furnaces and electric resistance space heating equipment are not permitted for space heating
 - Focus on systems with design, technology, and equipment that is currently available
 - Aligns with Energize Denver requirements
- **Exceptions:**
 - Emergency power or standby power, as approved by building official
 - Makeup air systems where ERV is prohibited by Denver Mechanical Code
 - Electric resistance used for heat pump supplementary heat
 - Electric resistance up to 5 W/sf
 - Gas furnaces or electric resistance in heated plenums or freeze protection
 - Electric resistance in buildings that [use a performance path for compliance](#)
 - Replacement furnaces that comply with Alterations C503.3.3

Partial Electrification for Water Heating



C404.10 Water heaters.

- Effective date of **January 1st, 2024**
- Fossil fuel and electric resistance instantaneous and storage water heaters are not be permitted to provide potable hot water
- Focus on systems with design, technology, and equipment that is currently available
- Aligns with Energize Denver requirements

• Exceptions:

- Electric resistance elements in heat pumps
- Electric resistance elements for recirculation loop temperature maintenance
- Electric storage water heaters with a volume ≤ 20 gallons
- Instantaneous electric water heaters within 10 feet of point of use
- Hot water storage tanks without electric resistance or fossil-fuel heating elements
- Water heating systems that require water temperature ≥ 141 °F
- Electric resistance equipment where on-site renewables serves 100% the annual service water heating requirement
- Electric resistance storage water heating equipment where solar thermal serves 75% of the annual service water heating requirement
- Electric resistance in buildings that [use a performance path for compliance](#)
- Replacements of gas-fired storage water heaters or instantaneous water heaters that comply with Alterations C503.4.1

Partial Electrification for Space and Water Heating – Equipment Replacement



C503.3.3 - Partial Electrification for Space Heating

- Gas-fired warm-air furnace replacements choose (2) and unitary air-conditioner/condensing unit replacements choose (1) of:

- [Electrification Retrofit Feasibility Report](#)
- Size equipment to meet C403.3.1
- Test gas-piping

C503.4.1 - Partial Electrification for Water heating

- Gas-fired storage or instantaneous water heaters choose (1) of:

- [Electrification Retrofit Feasibility Report](#)
- Test gas-piping

- Requirements set forth by the Energize Denver Ordinance

Interior Lighting for Sleeping & Dwelling Units



- C405.3.2 – Interior lighting power allowance
 - Sleeping units and dwelling units are to be included in the interior lighting power density calculations for the building area method (include both wattage and area of these units).
 - Maximum allowed installed lighting power of sleeping and dwelling units is reduced from 2019 Denver Energy Code to
 - Hospital: 0.96 W/SF
 - Hotel / Motel: 0.56 W/SF
 - Multifamily dwelling units (i.e., apartments): 0.45 W/SF
 - Sleeping Units (i.e. dorms): 0.53 W/SF

Electrical Energy Monitoring



C405.12 – Energy Monitoring

- New buildings 25,000 sf or larger shall be equipped to measure, monitor, record and report electricity consumption data for all end uses in Table C405.12.2 separately
- Exemptions:
 - HVAC/DHW equipment serving individual dwelling units
 - Tenant spaces less than 5,000 sf

Energy Use Load Categories

Total HVAC system

Interior lighting

Exterior lighting

Plug loads

Process loads

Building operations and other miscellaneous loads

Commercial EV Requirements



C405.13 Electric Vehicle

- Changes from 2019 Denver Energy Code:
 - Updated the language and definitions to align with national level code language
 - New requirements for minimum charging rate and minimum circuit capacity
 - Energy load management systems for EVs are now allowed without admin modification
 - Increased the percent of *installed* charging stations for commercial and multifamily buildings
 - Multifamily:
 - Decreased the code-required number of EV capable spaces (conduit only) 80% to 40%
 - Decreased EV infrastructure from 100% of spaces to 60%

Occupancy	EVSE Installed Spaces	EV Ready Spaces	EV Capable Spaces
Group A, B, E, M	10%	5%	10%
Group I	5%	0%	5%
Group R-1 and R-2	15%	5%	40%
Group R-3 and R-4	2%	0%	5%
Group S-2 Parking Garages	10%	5%	0%

- EVSE installed spaces are required to meet the accessible / universal requirements in accordance with DCBC (amended IBC) section 1107
- Where all (100%) parking serving R-2 occupancies are EV ready spaces, requirement for EVSE spaces for R-2 occupancies shall not apply

Electric Ready Infrastructure



C405.15 Additional Electric Infrastructure

- Certain fossil fuel appliances and equipment or connections serving new buildings shall be installed in accordance with the following requirements:
 - Provide a junction box within same space as fossil fuel appliance/equipment connected to an electrical panel by continuous raceways
 - The junction box, raceway, and bus bar in the electric panel and conductors serving the electric panel shall be sized to accommodate electric equipment sized to serve the same load as the fossil fuel appliance or equipment
 - The panel shall have reserved physical space for a three-pole circuit breaker
 - The junction box and electrical panel directory entry for the dedicated circuit breaker space shall have labels stating, “For future electric equipment”

Applicable fossil fuel appliances/equipment

Water heating equipment with input capacity less than 300,000 Btu/h

Warm air furnaces service spaces without space cooling

Fireplaces, ranges, and stoves not defined as commercial cooking appliances

Commercial cooking appliances

Fossil fuel appliances and equipment serving dwelling units or sleeping units

Prescriptive Path



Prescriptive Path - C401.2.1 Option 1

- Comply with C402 through C406 and C408
- C406 Additional Efficiency Credits dependent on building type and if it is All-Electric or not
- Fewer credits required for All-Electric Properties to [incentivize electrification](#)
- New C406.1 Planning Tool in the Prescriptive Checklist
- More information can be found on compliance pathways under [Design Phase Resources](#)

Building Type	Credit Requirement for All-Electric Properties	Credit Requirement for All Other Buildings
Multifamily	10	40
Healthcare/Hospital	10	40
Hotel/Motel	10	36
Office	10	31
Retail	10	35
School	10	24
Warehouse	10	48
All Other	10	40

Prescriptive Path - Additional Efficiency Credits (C406)



Sub-section	Group B	Group R & I	Group E	Group M	Other Occupancies ^a
C406.2.1: 5% Heating eff imprv.	1	1	1	2	1
C406.2.2: 5% Cooling eff imprv.	2	1	1	1	1
C406.2.3: 10% Heating eff imprv.	2	2	3	3	3
C406.2.4: 10% Cooling eff imprv.	4	1	2	2	2
C406.2.5: >10% Heating eff imprv.	See Section				
C406.2.6: >10% Cooling eff imprv.	See Section				
C406.3: Reduced light power	7	2	8	12	7
C406.3.2: Reduced light power by 15%	11	3	12	18	11
C406.3.2: Reduced light power by >15%	See Section				
C406.4: Enhanced digital light control	2	N/A	2	3	2
C406.5.1: Basic renewable credit	9	7	6	7	2
C406.5.2 Enhanced renewable credit	9-18	7-14	6-12	7-14	7-14
C406.6 Dedicated OA sys (DOAS)	5	8	N/A	2	5
C406.7.2: Recovered/renew SWH _b	N/A	14	1	N/A	14

Prescriptive Path - Additional Efficiency Credits (C406)(continued)



Sub-section	Group B	Group R & I	Group E	Group M	Other ^a
C406.7.3: Eff fossil fuel SWH _b	N/A	9	2	N/A	6
C406.7.4: Heat pump SWH _b	N/A	5	1	N/A	5
C406.8.1: Reduced envelope UA	10	4	2	4	5
C406.8.2: Further reduced envelope UA	15	6	3	6	8
C406.9.1: Reduced air infiltration	4	5	N/A	2	4
C406.9.2: Further reduced air infiltration	7	8	N/A	3	7
C406.10: Energy monitoring	2	1	2	3	2
C406.11: Fault detection	1	1	1	1	1
C406.12: Efficient kitchen equipment	See Section				
C406.13: All-electric space heating	4	6	6	9	6
C406.14: Cold climate heat pumps	4	5	5	9	6
C406.15: All-electric water heating	9	13	13	4	9
C406.16: Demand responsive thermostats	1	1	1	1	1
C406.17.1: Reduced fan power	2	N/A	6	7	3
F406.17.2: Further reduced fan power	4	N/A	11	14	6

Performance Paths

Performance Paths - C401.2.1 (option 2)

- Compliance with [ALL mandatory provisions](#) is required + whole-building energy analysis
- Can claim up to [10% of savings from on-site renewables](#)
- Calibrated towards Denver's NZE goals
- [Incentives all-electric buildings](#)
- Energy modeling pathways do not guarantee compliance with Energize Denver performance targets, but are intended to set the building up for success
- Energy modeler must hold ASHRAE Building Energy Modeling Professional certification
- More information can be found on compliance pathways under [Design Phase Resources](#)

Compliance Path	Energy Cost	Site Energy	Compares to Baseline Building	Compares to Performance Target
Modified C407 Energy Cost	X		X	
Appendix SE Site Energy		X	X	
Appendix PT Performance Target		X		X

Performance Paths – Modified C407 & App SE

Performance Paths - C401.2.1 (option 2)

Energy Cost (Modified C407) and Site Energy (Appendix SE)

- Uses ASHRAE 90.1-2019 Appendix G Performance Rating Method
- Uses natural gas for heating energy in the baseline
- Building performance factor (BPF) **incentivizes all-electric properties** with higher BPF than mixed fuel
- Proposed design must be less than target

$$\text{Target} = \frac{[\text{Baseline Unregulated} + (\text{BPF} \times \text{Baseline Regulated})]}{\text{Total Baseline}}$$

Performance Paths – Appendix PT

Performance Paths - C401.2.1 (Option 2)

Appendix PT – Performance Target

- Limited building types
- Mixed-use projects use a weighted average of the floor area of each occupancy type
- Simulation is proposed building only, no baseline building
- Uses energy use intensity (EUI in kBtu/SF) like Energize Denver reporting requirements for operating buildings
- Uses “Denver Modeling Rules and Procedures” for compliance (not predictive modeling)

Building Type	Modeled Performance Target (kBtu/SF)
Apartment (Multifamily)	38
Hotel (Motel)	55
Office	43
Retail	39
Restaurant/Bar	175
Parking Garages	3

Mandatory Requirements



Mandatory Requirements - C407.2

- All performance paths AND prescriptive path projects must meet 2022 DEC mandatory requirements
- All performance paths must meet 90.1-2019 mandatory provisions

Standard & Section	Title
C408 (in lieu of ASHRAE 90.1-2019 Section 4.2.5)	System Commissioning
ASHRAE 90.1-2019 Section 5.2.1	Building Envelope
Table C402.1.5	Component Performance Alternative
C402.5 (in lieu of ASHRAE 90.1 section 5.4.3)	Air Leakage Testing
ASHRAE 90.1-2019 Section 6.2.1	Heating, Ventilation, and Air Conditioning
C403.1.2	Data Centers
C403.2.3	Fault Detection Diagnostics
C403.2.4	Space Heating Equipment
C403.4.1.1	Heat Pump Supplementary Heat
ASHRAE 90.1-2019 Section 7.2.1	Service Water Heating

Mandatory Requirements (continued)



Mandatory Requirements - C407.2

- All performance paths AND prescriptive path projects must meet 2022 DEC mandatory requirements
- All performance paths must meet 90.1-2019 mandatory provisions

Standard & Section	Title
C404.10	Water Heaters
C404.11	Demand Responsive Water Heating
C404.12	Water Heater Equipment Location
ASHRAE 90.1-2019 Section 8.2.1	Power
C405.12 (in lieu of ASHRAE 90.1 section 8.4.3)	Energy Monitoring
C405.13	Electric Vehicle Supply Equipment
C405.14	Solar Access Requirement
C405.15	Electric Infrastructure
ASHRAE 90.1-2019 Section 9.2.1	Lighting
C405.4	Lighting for Plant Growth
ASHRAE 90.1-2019 Section 10.2.1	Other Equipment

Thank you!

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