

Supplementary Information on the 2024 International Energy Conservation Code (IECC) and Radon Mitigation Amendments

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Overview of the 2024 International Energy Conservation Code (IECC)

1. 2024 IECC Compliance Options

The 2024 Residential and Commercial IECC provide multiple ways that builders can meet code requirements, thereby increasing flexibility and allowing builders to pick what works best for them:

1. Prescriptive Compliance Path – Sets specific standards that builders need to meet.
2. Simulated Building Performance Path – Uses energy modeling to compare estimated energy costs of the proposed home with energy costs of a reference home.
3. Energy Rating Index Path (Residential Only) – Uses energy modeling to calculate an energy rating index (ERI). The ERI must be less than the maximum allowed for that climate zone.

2. Key IECC Changes from the 2018 IECC to the 2024 IECC

The Pacific Northwest National Laboratory found the 2024 IECC base code improves energy efficiency, lowers utility costs, and reduces greenhouse gas (GHG) emissions over the 2018 IECC base code in Flagstaff's Climate Zone (Zone 5).

Table 1: Pacific Northwest National Laboratory (PNNL) findings on the 2024 IECC vs. the 2018 IECC

2024 Residential IECC	2024 Commercial IECC*
• 15% improvement in energy efficiency • 13% reduction in energy costs • 12% reduction in greenhouse gas (GHG) emissions	• 22% improvement in energy efficiency • 20% reduction in energy costs • 20% reduction in GHG emissions

**Commercial code estimates do not include savings from on-site renewable energy (solar) because there is a proposed amendment to make on-site solar requirements (Commercial IECC only) optional.*

3. 2024 Residential IECC

The 2024 Residential IECC is available here: [Chapter Re 1 Scope And Administration - International Energy Conservation Code \(IECC\)](#). It impacts the design of individual building systems (and the building as a whole) that could affect energy use, including:

1. Wall, roof, and floor insulation
2. Windows and skylights
3. Space cooling and heating equipment (air conditioners, furnaces, heat pumps)
4. Air distribution systems
5. Air sealing and ventilation
6. Water heaters
7. Electrical power and lighting systems
8. Appliance efficiency

The 2024 Residential IECC improves energy efficiency over the 2018 IECC through:

1. Inspections for air barriers and insulation
2. Higher efficiency windows
3. Higher efficiency skylights

4. Higher insulation values for wood frame walls
5. Additional options for floor insulation
6. Increased depth for slab edge insulation
7. Expanded ductwork design requirements to size HVAC equipment
8. Required testing of 100% of ductwork (provides for flexibility to meet standards, especially for large and smaller homes)
9. Increased insulation for hot water pipes
10. Controller added to bathroom exhaust fans (such as a timer or sensor)
11. Limits the amount of electric resistance heating to 2 kW unless a heat pump is installed
12. Increased controls for ice melt systems to prevent use when not necessary
13. Gas fireplace systems cannot be equipped with a continuous pilot light
14. Minimum efficiency for vented gas fireplace heaters
15. Minimum efficiency standards for permanent lighting
16. Automatic lighting shutoff requirements
17. Homes that choose the Prescriptive Compliance Path must earn additional energy efficiency credits (they can choose from over 50 options)

The National Association of Homebuilders provides a detailed analysis on key code changes from the 2018 to the 2024 Residential IECC: [Microsoft Word - 2024 IECC Major Changes for Tool Kit V6 Draft](#).

4. 2024 Commercial IECC

The 2024 Commercial IECC is available here: [CHAPTER CE 1 SCOPE AND ADMINISTRATION - 2024 INTERNATIONAL ENERGY CONSERVATION CODE \(IECC\)](#). It impacts the design of individual building systems (and the building as a whole) that could affect energy use, including:

- Wall, roof, and floor insulation
- Windows and skylights
- Cooling equipment (air conditioners, chillers, and cooling towers)
- Heating equipment (boilers, furnaces, and heat pumps)
- Pumps, piping, and liquid circulation systems
- Heat rejection equipment (fan cooling towers, air-cooled condensers)
- Service water heating (kitchens, lavatories, and pools)
- Electrical power and lighting systems (lighting types, densities, zones, and controls)
- Energy-using equipment (walk-in coolers and freezers, electric transformers and motors, elevators and escalators)

The 2024 Commercial IECC improves energy efficiency over the 2018 IECC through:

1. Requirements for additional information on construction documents:
 - a. Identifying the energy code compliance path
 - b. Documentation confirming air sealing
 - c. Location of pathways for routing raceways or cables from on-site renewable energy systems to electrical distribution equipment
 - d. Location and layout of designated areas for an energy storage system (ESS) and specify the rated energy and power capacity of an installed or planned ESS.

2. A thermal envelope certificate to be completed by an approved party and posted in an approved location (includes insulation values for ceilings, roofs, walls, foundations, and slabs, U-factors, solar heat gain coefficients for windows, and air leakage test results)
3. Additional insulation for metal-frame buildings
4. Alternatives for energy code compliance for balancing aesthetics and performance while maintaining key energy efficiency measures
5. Clarity in roof and ceiling insulation for projects that use the Prescriptive Compliance path
6. Requirements specifying where perimeter insulation must be installed for slab-on-grade and heated slab floors
7. Higher efficiency windows
8. Additional required items for air barrier design and documentation
9. Specific air sealing requirements for electrical and communication boxes
10. Mandatory whole-building air leakage testing for commercial buildings, raising the standard for envelope airtightness and accountability
11. Buildings that choose the Prescriptive Compliance Path must earn additional energy efficiency credits (they can choose from 40 options).

Summary of Energy Code Outreach and Engagement

Since presenting potential Energy Code options to City Council in January 2026, staff conducted community outreach and engagement to interested groups and individuals on the Energy Code. Staff gave 16 presentations and solicited feedback on the potential Energy Code updates from interested groups and City Commissions, including:

- City of Flagstaff Building and Fire Code Board of Appeals (*4 meetings*)
- City of Flagstaff 2024 Building and Fire Codes Open Houses (*2 meetings*)
- City of Flagstaff Equity Climate Advisory Group (ECAG) (*2 meetings*)
- City of Flagstaff Housing Commission
- City of Flagstaff Sustainability Commission
- Economic Collaborative of Northern Arizona (ECONA)
- Flagstaff Chamber of Commerce (*2 meetings*)
- Flagstaff First
- Friends of Flagstaff's Future (F3)
- Northern Arizona Association of Realtors (NAAR)
- Northern Arizona Climate Change Alliance (NAZCCA)
- Northern Arizona Home Builders and Remodelers Association (NAHBRA)

Staff also contacted 56 experts to provide technical expertise and solicit feedback on potential Energy Code updates. They include:

- Flagstaff and national HVAC installers and experts (5)
- Flagstaff builders, contractors, and developers (27)
- Flagstaff energy raters (3)
- Flagstaff lenders, mortgage, and insurance experts (4)
- Flagstaff radon testers and installers (3)
- Flagstaff solar installers (2)
- Local, state, and national energy policy and energy code experts (8)

- State housing advocates (2)
- Utility representatives (2)

Summary of Energy Code Feedback

- The interested groups and City Commissions that staff presented to provided a **diversity of opinions**: they tended to prefer either Energy Code option 1 (keep Flagstaff's current Energy Code) or option 3 (adopt the 2024 Energy Code with an appendix to increase energy efficiency beyond the base code).
- There were widespread **concerns about increasing housing construction costs**. As such, there was support for incentivizing instead of requiring higher energy efficiency. There were also concerns about the readiness appendices and if future residents will install solar, charge an EV, or install electric appliances.
- Staff presented calculations comparing estimated additional mortgage costs from adopting the 2024 Energy Code to estimated utility cost savings from greater energy efficiency.
 - For these calculations, staff used the:
 - 10-year average mortgage rate from Freddie Mac
 - Average downpayment rate from 2023 - 2025 from National Association of Realtor data
 - APS electric and Unisource gas rates
 - Estimated electricity and natural gas usage estimates for Flagstaff, from the recent [Flagstaff Energy Efficiency and Electrification Study](#)
 - Pacific Northwest National Laboratory energy efficiency savings estimates from the 2024 IECC compared to the 2018 IECC.
 - Estimates were presented for single family homes (2,000 – 2,500 square feet), and multifamily apartments (1,000 square feet).
 - Staff received feedback that initial cost estimates should include a 15% builder markup (in addition to simple construction costs)
 - Staff received feedback mortgage rate used in the calculations was too low (since the 10 year average is lower than current rates).
- There were concerns that **cost estimates are too low for Flagstaff**. Staff sought but could not obtain additional local data to support this claim.
- The **strongest support was for updating the energy code if other development code changes reduce overall development costs**.
- There was lots of **support to make it easier to build smaller, more affordable units**.
- There were **very few comments on radon mitigation** requirements.

In response to this feedback, City staff:

- **Contacted** the following groups:
 - Additional local builders and the Central Arizona Home Builders Association to get more Flagstaff and Arizona cost estimate data
 - Financial and insurance experts, regarding how additional construction costs impact housing costs

- Flagstaff contractors, regarding costs of readiness appendices and HVAC efficiency amendments
- **Adjusted cost estimates to:**
 - Account for inflation since reports were published, and for higher costs in Flagstaff (20% higher than Phoenix)
 - Match the unit sizes evaluated in the final LASS/CAP Code Recommendations Report (single family: 2,000 and 1,250 square feet; multifamily: 800 square feet) to better understand the wholistic cost impacts of all potential development code changes in the Building Code as well as the Zoning and Engineering Codes.
 - Include a 15% builder markup to upfront cost estimates
 - Use 7 year average mortgage rate, since that approximately is how long Flagstaff's current energy code has been in place (it was adopted in June 2019)
- Propose to **reduce insulation requirements** to lower upfront construction costs by \$350 - \$2,000+ per unit for buildings that use the prescriptive compliance path
- **Propose to adopt Energy Code Option 2 as part of the 2024 Suite of Building and Fire Codes Update, and revisit options 3 and 4 as part of broader development code updates**

Recommended amendments and appendices to the 2024 IECC

Residential IECC

Code Section	Recommended Code Change	Purpose of Adopting this Code Change	Estimated Cost Impacts from this Code Change
R202 General Definitions	Recommended Action: - Adopt an amendment to the 2024 IECC base code to expand the definition of “residential building” to allow residential buildings taller than 3 stories to opt into the Residential IECC instead of the Commercial IECC. Comparison to Flagstaff’s current code: - Apartments taller than 3 stories are required to follow the Commercial IECC.	Reduce design, construction, and operational costs (the Residential IECC offers costs savings over the Commercial IECC due to a slightly lower minimum energy efficiency standard, and fewer design and operational requirements).	<i>Estimated to provide substantial cost savings from avoided design, construction, and operational costs (exact amount is unknown).</i>
R403.7 Equipment sizing and efficiency rating	Recommended Action: - Adopt an amendment to the 2024 IECC base code to add minimum efficiency standards for gas furnaces and air source heat pumps, when installed in new construction. - Gas furnaces must be $\geq 95\%$ efficient - Air source heat pumps must be cold climate heat pumps (must operate efficiently at cold temperatures) Comparison to Flagstaff’s current code: - Gas furnaces in new construction must be $\geq 90\%$ efficient. - No current efficiency standards for air source heat pumps.	Improve energy efficiency and occupant comfort in new homes by ensuring gas furnaces and air source heat pumps are highly efficient and appropriate for Flagstaff’s cold temperatures.	- A 95% efficient gas furnaces costs approx. \$250 more than a 90% efficient furnace. - The cost of the gas furnace and cold climate heat pump are already included in the 2024 IECC base code costs estimates
R404 Lighting controls	Recommended Action: - Adopt an amendment to the 2024 IECC base code to delete requirements for dimmer switches and automatic lighting controls for indoor and outdoor lighting in new construction. Comparison to Flagstaff’s current code: - These standards are not in Flagstaff’s current code.	- Reduce construction costs to removing requirements to install more costly lighting types that provide very small energy efficiency gains.	<i>Reduce construction costs by approx. \$100 per unit</i>
R402.1.2, Insulation and fenestration criteria	Climate Zone 5, Wood frame wall R-value: 15 high density in existing 2x4 framed walls in remodel work only. Footnote b, Exception: Windows used for the installation of glazing for approved passive solar design.	Clarify insulation requirements in existing buildings apply to new construction only.	Reduces construction costs compared to the base energy code.

R402.1.3 Minimum R- Values and Fenestration Requirements by Components	Recommended Action: • Adopt an amendment to the 2024 IECC base code to reduce the required insulation in new construction from R-30 to: ○ R-21 cavity insulation ○ or R-13 + R-5 continuous insulation ○ or R-15 continuous insulation <i>This amendment only applies to buildings that choose the prescriptive compliance path to meet IECC standards.</i> <u>Comparison to Flagstaff's current code:</u> • Flagstaff's current code requires R-19 insulation for buildings that choose the prescriptive compliance path.	• Maintains current, standard construction methods • Simplifies construction and inspections • Reduces construction costs • Balances energy efficiency goals with practical construction realities (R-21 insulation is higher than Flagstaff's current code and will still provide strong thermal performance for Flagstaff's climate).	<i>Reduce construction costs by \$350 - \$2,000+ per unit, depending on unit size for buildings that use the prescriptive path only. However, less insulation may also reduce utility cost savings compared to the adopting 2024 IECC without this amendment.</i>
Appendix NB/RB: Solar- ready provisions – detached one- and two-family dwellings and townhouses	Recommended Action: Adopt these appendices with amendments to continue current requirements for single family homes and duplexes to: • Show solar-readiness on construction plans and reserved space on the electrical service panel. • Include an amendment to delete requirements to install capped roof penetrations. <u>Comparison to Flagstaff's current code:</u> Flagstaff adopted these appendices in 2019 with similar amendments. <u>Direct link to this appendix:</u> APPENDIX RB SOLAR READY PROVISIONS DETACHED ONE AND TWO FAMILY DWELLINGS AND TOWNHOUSES - 2024 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)	• Make it easier for residents in single family homes, townhomes, and duplexes to install solar panels or solar thermal systems in the future. • Avoid thousands in costly future retrofits by ensuring there is room on the roof and the electrical panel to support future solar panels.	<i>No additional construction costs (already in Flagstaff's current code; existing costs are \$100 - \$150 per unit).</i>
Appendix NK/RK: Electric- Ready Residential Construction	Recommended Action: Adopt this appendix with amendments to add requirements to install outlets close to the dryer, stove, and water heater, and leaving room on the electrical panel for future electric appliances. <u>Comparison to Flagstaff's current code:</u> This appendix did not exist in 2019. Adopting this appendix would add new standards to Flagstaff's code. <u>Direct link to this appendix:</u> • Appendix Rk Electric Ready Residential Building Provisions - International Energy Conservation Code (IECC)	• Enhance customer choice by making it easier to switch to electric appliances in the future.	• <i>Increase construction costs by \$1,100 - \$1,500 per unit.</i> • <i>Save \$1,500+ per outlet (\$4,500+ total) on costly and difficult future retrofits.</i>

Appendix NE/RE: Electric Vehicle Charging Infrastructure. See the *Electric Vehicle (EV) Charging Infrastructure* section on page 12 for more information.

Appendix RL: Renewable Energy Infrastructure	Recommended Action: • Adopt these appendices with amendments to continue current requirements for multifamily residential buildings to show solar-readiness on construction plans and provide reserved space on the electrical service panel. Comparison to Flagstaff's current code: • This appendix did not exist in 2019. However, Flagstaff adopted the commercial solar-ready appendix, which requires multifamily residential to meet solar-readiness requirements. Direct link to this appendix: • Appendix RL Renewable Energy Infrastructure - International Energy Conservation Code (IECC)	• Extend Flagstaff's current solar-ready requirements to multifamily buildings to make it easier install solar panels and/or solar thermal systems in the future.	<i>No additional construction costs (already in Flagstaff's current code; existing costs are \$100 - \$150 per unit).</i>
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Commercial IECC

Code Section	Recommended Code Change	Purpose of Adopting this Code Change	Estimated Cost Impacts from this Code Change
-C101.2 Scope -C101.4 Compliance -C202 General Definitions	Recommended Action: Adopt an amendment to the 2024 IECC base code to expand the definition of “residential building” to allow residential buildings taller than 3 stories to opt into the Residential IECC instead of the Commercial IECC. Comparison to Flagstaff’s current code: Apartments taller than 3 stories are required to follow the Commercial IECC.	Reduce design, construction, and operational costs (the Residential IECC offers costs savings over the Commercial IECC due to a slightly lower minimum energy efficiency standard, and fewer design and operational requirements).	<i>Substantial cost savings from avoided design, construction, and operational costs (exact amount is unknown).</i>
Table C402.1.3 Opaque Building Thermal Envelope Insulation Component Minimum Requirements	Recommended Action: Reduce the required insulation in new construction from R-30 to: - R-0 cavity insulation + R-16 continuous insulation (ci); or - R-13+R-7.5ci; - or R20+R3.8ci; - or R-21 These requirements only apply to buildings meet Energy Code standards using the prescriptive compliance path. Comparison to Flagstaff’s current code: Flagstaff’s current code requires: - R-13 + R-3.8 ci; or - R-20	This amendment maintains standard 2x6 wall construction methods, which: - Simplifies construction methods and inspections - Reduces construction costs - Balances energy efficiency goals with practical construction realities (R-21 insulation is higher than Flagstaff’s current code and will still provide strong thermal performance for Flagstaff’s climate).	<i>Substantially reduce construction costs (exact costs unknown) but also reduce utility cost savings from improved energy efficiency.</i>
C405.12 Automatic Receptacle Control	Recommended Action: Delete requirements for outlets that shut off automatically. Comparison to Flagstaff’s current code: These standards are not in Flagstaff’s current code.	Reduce construction costs	<i>Reduce construction costs</i>
R405.13 Energy Monitoring	Recommended Action: Make it optional for buildings to provide energy monitoring equipment. Comparison to Flagstaff’s current code: These standards are not in Flagstaff’s current code.	Reduce design, construction, and operational costs	<i>Reduce design, construction, and operational costs</i>
R405.15 Renewable Energy	Recommended Action:	Reduce design and construction costs	<i>Reduce design and construction costs</i>

	Make it optional for buildings to provide renewable energy (solar). <u>Comparison to Flagstaff's current code:</u> These standards are not in Flagstaff's current code.		
Appendix CB: Solar Energy Zone-- Commercial	<u>Recommended Action:</u> Show solar-readiness on construction plans and reserve space on the electrical service panel to support future solar photovoltaic panels and solar thermal systems. <u>Comparison to Flagstaff's current code:</u> Flagstaff adopted this appendix in 2019.	• Make it easier for building owners to install solar panels or solar thermal systems in the future. • Avoid thousands in costly future retrofits by ensuring there is room on the roof and the electrical panel to support future solar panels.	<i>Save thousands on costly and difficult future retrofits.</i>
Appendix CG: Electric Vehicle Charging Infrastructure	<u>Recommended Action:</u> • Require a 240-volt outlet in garages in new construction • Reduce the number of required EV parking spaces in new development from 100% (original appendix text) to 1% - 45%, depending on building type • Allow requirements to be met with EV capable, EV-ready, and full EV spaces. • Allow for substitutions in EV space types to provide greater flexibility to meet standards. • Developments with fewer than 15 parking spaces (excluding apartments) are exempt from EV charging requirements. <u>Comparison to Flagstaff's current code:</u> • Flagstaff currently requires a 240 volt outlet in garages and up to 3 EV capable spaces in new parking lots. Adopting this appendix would expand EV charging standards over Flagstaff's current code.	Ensure residents in new single- and multifamily developments have access to EV charging at home (at-home charging is the least costly way to charge and multifamily residents usually have less access to at-home charging. In Arizona 1 in 12 new cars are electric, and ADOT anticipates there will be more than 1 million EVs in Arizona by 2030).	<i>Add to construction costs:</i> • <i>EV capable spaces: \$0 - \$300*</i> • <i>Level 2 EV charger: \$3,000 - \$12,000 per charger</i> <i>Avoid costly future retrofits for EV parking space (\$5,500 per space; excluding the cost of the charger)</i> <i>*Flagstaff's code already requires some EV capable spaces.</i>
Appendix CH: Electric-Ready Commercial Building Provisions	<u>Recommended Action:</u> • Show locations of future electric space heating equipment on construction plans • Provide infrastructure to support future electric space heating • Install outlets close to the dryer, stove, and water heater • Provide electrical panel capacity for future electric appliances <i>*Does not require the installation of a specific appliance type*</i> <u>Comparison to Flagstaff's current code:</u>	• Enhance customer choice by making it easier to switch to electric appliances in the future,	<i>Add to construction costs (exact costs are unknown) but save thousands on costly future retrofits.</i>

	This appendix did not exist in 2019. Adopting this appendix would add new standards to Flagstaff's code.		
Appendix CI: Demand Responsive Controls	Recommended Action: • In new construction, water and space heating systems must be able to receive a demand response signal from APS, such as through a smart thermostat • Delete requirements for demand responsive controls for lighting. Comparison to Flagstaff's current code: • This appendix did not exist in 2019. Adopting this appendix would add new standards to Flagstaff's code.	• Installs infrastructure that enables building owners and tenants to opt into demand response programs, such as the APS Cool Rewards program, in exchange for lower utility bills • Avoids costly future retrofits	<i>Add to construction costs (exact costs are unknown) but save thousands on costly future retrofits.</i>

Electric Vehicle (EV) Charging Infrastructure Appendices

Residential Appendices

Code Section: Appendix RE/NE: Electric Vehicle Charging Infrastructure

Recommended Action:

- Adopt this appendix with amendments to **continue** current requirements for homes with garages and **expand** requirements to install EV charging infrastructure in parking lots.

Single-family homes and duplexes:

- Install a 240-volt outlet (EV ready space) in the garage or next to the parking space for the unit
- For duplexes, both units can share 1 outlet if no garage is provided,

Multifamily development (3+ units):

- Install a 240-volt outlet (EV ready space) in the garage (if a garage is provided)
- If no garage is provided, install EV charging infrastructure according to the table below:

Building Type	Level 2 EVSE spaces	EV capable or EV ready spaces
Apartments 3 stories or less with 15 or fewer parking spaces	0%	20%
Apartments 3 stories or less with more than 15 fewer parking spaces	5%	15%
Apartments greater than 3 stories	5%	25%
Group homes 3 stories or less with more than 15 parking spaces	0%	7%

Note: staff propose to reduce the minimum requirement for EV parking spaces from 40% in the original appendix text to 0% - 25% depending on building type, size and number of parking spaces provided.

- EV charging infrastructure space types:
 - EV capable spaces:** Electrical infrastructure is present (in the wall or ground), but the outlet is not installed.
 - EV ready spaces:** Electrical infrastructure is installed near the parking space (a 240-volt outlet in garages), but no dedicated EV charger is present.
 - Electric vehicle supply equipment (EVSE) or EV installed spaces:** EV charger is fully installed.



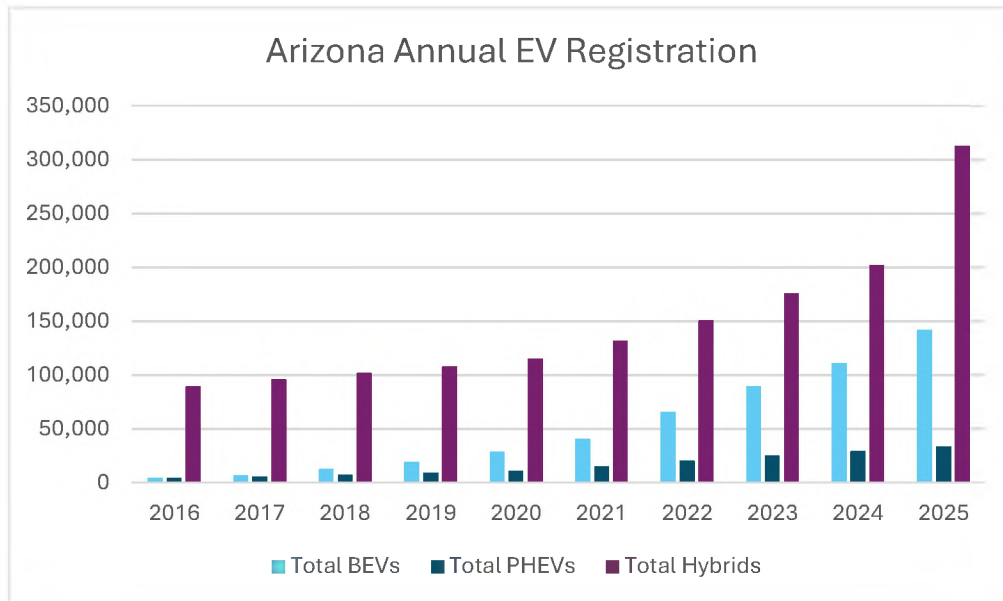
- Other amendments:
 - Allow for substitutions in EV space types, including charger types, to provide greater flexibility for developers to meet standards.
 - Include exceptions to waive EV charging infrastructure requirements if electric distribution capacity is not available, or if costs are prohibitive

Comparison to Flagstaff's current code:

- Flagstaff currently requires homes with garages to install a 240-volt outlet (EV ready space) in the garage. Adopting this appendix would continue these requirements.
- Flagstaff currently requires up to 3 EV capable spaces to be installed in new parking lots. Adopting this appendix would expand EV charging infrastructure requirements.

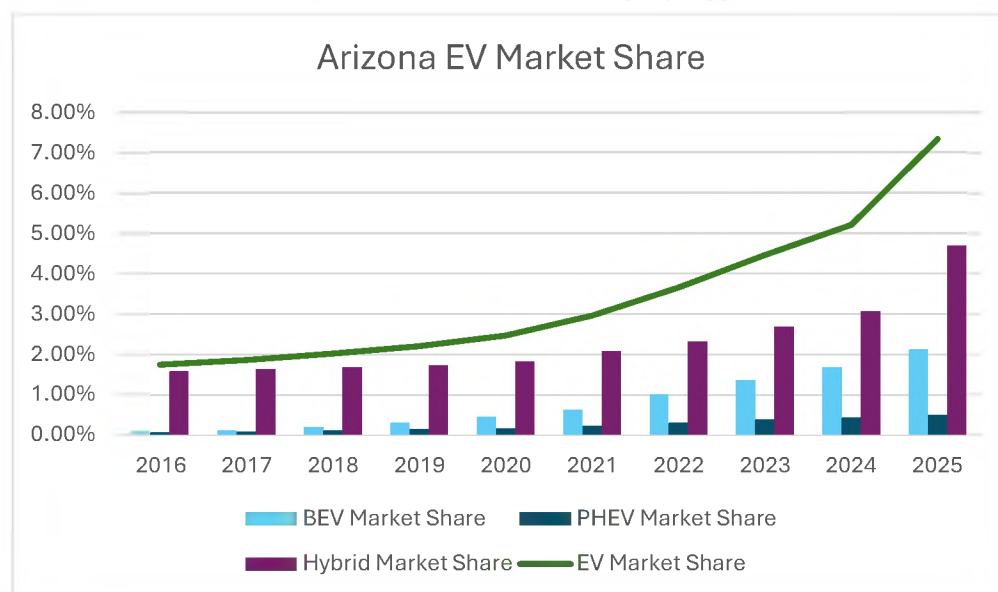
Purpose of adopting this code change:

- Support at-home EV charging.
 - EV adoption is growing: the **number of fully electric vehicles has increased 30 times since 2016**. In Arizona 1 in 12 new cars are electric, and ADOT anticipates there will be more than 1 million EVs in Arizona by 2030.



Source: Arizona Department of Motor Vehicles (2026).

Note: BEV = battery electric vehicle (fully electric), PHEV = Plug-in Hybrid Electric Vehicle, and total hybrids = PHEVs + other hybrid vehicles that do not get plugged in.



Source: Arizona Department of Motor Vehicles (2026).

- On average, EVs are less costly to operate and maintain than vehicles powered by gasoline.
 - In Arizona, households spend more on gasoline than electricity. As prices increase, models estimate switching to electricity from gasoline as a fuel source can lower transportation costs. Source: <https://energywallet.epri.com/en/map.html>.
- 90% of EV charging occurs at home:
 - This appendix ensures residents in new single- and multifamily developments have access to EV charging at-home (at-home charging is the least costly way to charge).
 - Multifamily residents usually have less access to at-home charging; this “charging gap” creates equity issues by reducing access to EV’s - a less expensive form of transportation.
- Avoid costly future retrofits:
 - 240-volt outlet: \$1,500+ (*note: a 240-volt outlet also supports other high-energy appliances, such as a clothes dryer, power washer, welder, etc.*)
 - EV parking space: \$5,500

Estimated Cost Impacts

- *Residential buildings with individual garages: \$0 in additional construction costs (cost are already in Flagstaff’s code)*
- *Single family and duplex buildings with no garage: \$325 - \$650 in additional construction costs per unit.*
- *Multifamily buildings (3+ units) without individual garages:*
 - *\$0 to \$850 per unit, depending on development size, the number of EV spaces required, and the level of EV infrastructure required.*

Commercial Appendix

Code Section: Appendix CG: Electric Vehicle Charging Infrastructure

Recommended Action:

- Adopt this appendix with amendments to **expand** requirements to install EV charging infrastructure in parking lots.
 - Allow for substitutions in EV space types, including charger types, to provide greater flexibility for developers to meet standards.
 - Include exceptions to waive EV charging infrastructure requirements if electric distribution capacity is not available, or if costs are prohibitive
 - Require the installation of EV spaces in new development according to the table below:

OCCUPANCY	LEVEL 2 EVSE SPACES	EV READY SPACES	EV CAPABLE SPACES
Group A (assembly)	5%	0%	10%
Group B (business)	5%	5%	10%
Group E (educational)	5%	5%	10%
Group F (factory)	2%	0%	5%
Group H (high-hazard)	1%	0%	0%
Group I (institutional)	5%	0%	10%

Group M (mercantile)	5%	0%	10%
Group R-1 (hotels)	5%	10%	15%
Group R-2 (residential)	5%	10%	15%
Groups R-3 and R-4 (residential)	0%	2%	5%
Group S (storage) exclusive of parking garages	1%	0%	0%
Group S-2 (storage, moderate-hazard) parking garages	15%	0%	30%

Comparison to Flagstaff's current code:

- Flagstaff currently requires homes with garages to install a 240-volt outlet (EV ready space) in the garage. Adopting this appendix would continue these requirements.
- Flagstaff currently requires up to 3 EV capable spaces to be installed in new parking lots. Adopting this appendix would expand EV charging infrastructure requirements.

Purpose of adopting this code change:

- Support at-home EV charging.
 - EV adoption is growing: in Arizona 1 in 12 new cars are electric, and ADOT anticipates there will be more than 1 million EVs in Arizona by 2030.
- 90% of EV charging occurs at home:
 - This appendix ensures residents in new single- and multifamily developments have access to EV charging at-home (at-home charging is the least costly way to charge).
 - Multifamily residents usually have less access to at-home charging; this “charging gap” creates equity issues by reducing access to EV's - a less expensive form of transportation.
- Avoid costly future retrofits:
 - 240-volt outlet: \$1,500+ (note: a 240-volt outlet also supports other high-energy appliances, such as a clothes dryer, power washer, welder, etc.)
 - EV parking space: \$5,500

Estimated Cost Impacts

- Residential buildings with individual garages: \$0 in additional construction costs (cost are already in Flagstaff's code)
- Single family and duplex buildings with no garage: \$325 - \$650 in additional construction costs per unit.
- Multifamily buildings (3+ units) without individual garages:
 - \$0 to \$850 per unit, depending on development size, the number of EV spaces required, and the level of EV infrastructure required.

Cost Estimates (Residential Energy Code)

Upfront cost estimates

Cost estimates are presented for the 2024 Residential IECC because more data are available (very little data are available for commercial buildings because there are so many different types). These cost estimates are based on local and national data sources, including:

- American Gas Association
- Bipartisan Policy Center
- Bureau of Labor Statistics
- Capstone Homes
- Central Arizona Association of Homebuilders
- CoolCalc
- Electric Power Research Institute
- The 13 local builders, contractors, and designers that participated in the [Flagstaff Energy Efficiency Study](#)
- FreddieMac
- Miramonte Homes
- National Association of Homebuilders
- National Association of Realtors
- NerdWallet
- Rocky Mountain Institute (RMI)
- Realtor.com
- Utility Dive
- U.S. Department of Energy
 - Energy Information Administration
 - Pacific Northwest National Laboratory
 - Lawrence Berkeley National Laboratory
 - National Renewable Energy Laboratory (NREL) Building Energy Optimization Tool (BEopt)
- Zillow.com

These estimates include costs from local amendments, including cost savings from a reduction in required insulation amounts for buildings that choose the prescriptive compliance path. They also assume a 5.26% mortgage rate, which is the average mortgage rate for the past 7 years (Flagstaff's current energy code was adopted approximately 7 years ago, in June 2019). Energy usage and cost estimates from the U.S. Department of Energy and the [Flagstaff Energy Efficiency Study](#). Utility costs are estimated to increase 4.39% annually, based on projected local utility rate increases and broader inflation.

Single-Family Homes and Duplexes

Code Section	Upfront Cost 2,000 sf	Upfront Cost 1,250 sf	Cost Savings
2024 IECC Base Code	~\$7,000 ~\$1,100 – 15,700	~\$5,600 ~\$800 – 12,300	~13% reduction in energy costs
Electric-Ready Appendix	~\$1,200 ~\$1,010 – \$1,500	~\$1,200 ~\$1,010 – \$1,500	Avoids future retrofits ~\$1,500+ per appliance ~\$4,500+ total
Solar-Ready Appendix	~\$150*	~\$150*	Avoids future retrofits ~\$1,000+
EV Charging Appendix	~\$650*	~\$650*	Avoids future retrofits ~\$1,500+

* Already included in Flagstaff's current code. These numbers represent average cost estimates based on the best available data.

Multifamily Apartments and Condos (buildings with 3+ housing units)

Code Section	Upfront Cost Per unit (800 sf)	Cost Savings
2024 IECC Base Code	~\$2,300 ~\$0 - 5,400	~13% reduction in energy costs
Electric-Ready Appendix	~\$1,200 ~\$1,010 – \$1,500	Avoids future retrofits ~\$1,500+ per appliance ~\$4,500+ total
Solar-Ready Appendix	~\$150*	Avoids future retrofits ~\$1,000+
EV Charging Appendix	~\$450 ~\$0 – 850	Avoids future retrofits ~\$1,500+

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*Already included in Flagstaff’s current code. These numbers represent average cost estimates based on the best available data.

Mortgage costs compared to utility cost savings

These cost estimates are based on adopting the 2024 IECC base code with the proposed local amendment to reduce insulation amounts for buildings that take the prescriptive compliance path.

2,000 square-foot single-family home

Energy cost savings	13%*
Additional up-front cost	\$7,000

	Monthly	Annual	Over 30 years
Additional mortgage cost	\$32	\$379	\$11,376
Utility savings	\$38	\$451	\$13,533

	With a mortgage	Without a mortgage
Savings over 30 years	\$2,156	\$6,519
ROI	19%	93%

*Due to the proposed local amendment to reduce the required insulation amount, homes that use the prescriptive compliance path may experience lower energy cost savings in line with a lower upfront investment. Note that most builders use the performance or energy rating index (ERI) paths, not the prescriptive path.

800 square-foot multi-family home

Energy cost savings	13%*
Additional up-front cost	\$2,300

	Monthly	Annual	Over 30 years
Additional mortgage cost	\$10	\$123	\$3,686
Average utility savings	\$31	\$371	\$11,116

	With a mortgage	Without a mortgage
Savings over 30 years	\$7,430	\$8,844
ROI	318%	416%

*Due to the proposed local amendment to reduce the required insulation amount, homes that use the prescriptive compliance path may experience lower energy cost savings in line with a lower upfront investment. Note that most builders use the performance or energy rating index (ERI) paths, not the prescriptive path.

Radon Mitigation Amendments and Appendices

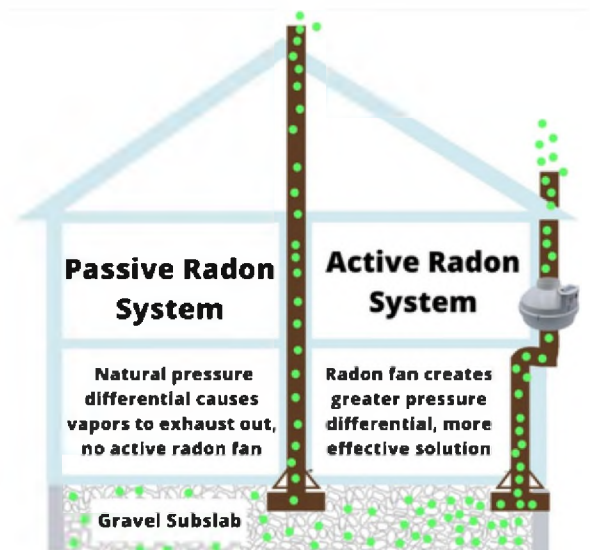
Code Sections:

- 2024 International Residential Code (IRC) Appendix BE Radon Control Methods
- 2024 International Mechanical Code (IMC): Section 511 Sub-Slab Soil Exhaust Systems

Recommended Code Change:

Recommended Action:

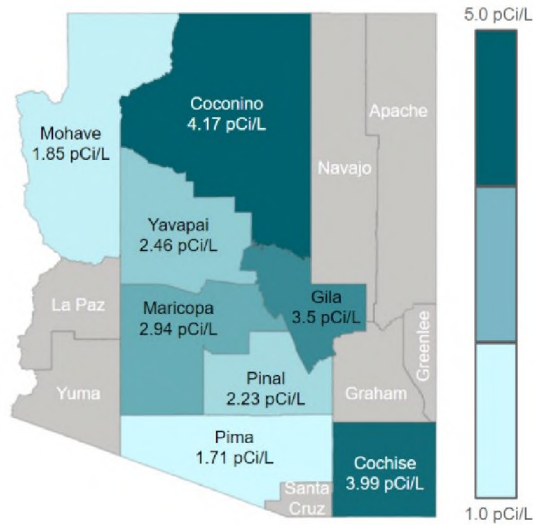
- Adopt Appendix BE: Radon Control Methods with an amendment to make radon control standards mandatory for all new construction of single-family homes and duplexes, including:
 - Install a passive radon mitigation system in new residential construction, including:
 - Material under floor systems is permeable
 - Vapor barrier in the floor
 - Sealing potential radon entry routes
 - Passive vents in crawl spaces
 - Provide an electrical circuit to support a future radon fan
 - Conduct post-construction radon testing
 - Install a radon fan (active mitigation) if the home tests greater than 4 pCi/L
- Adopt an amendment to the 2024 IMC to require a subslab soil exhaust system (an air duct system that vents above the building roof) for all other new construction where the building foundation is in contact with the ground.



Purpose of adopting this code change

- Radon is an odorless, colorless gas created by the breakdown of uranium in the soil. It concentrates in buildings without radon mitigation systems.
- Radon is the leading cause of lung cancer in non-smokers (the U.S. Environmental Protection Agency estimates 21,000 die in the U.S. annually from lung cancer caused by radon exposure)
- The EPA maximum recommended exposure level is 4.0 picocuries per liter (pCi/L) (this is equivalent to 200 chest x-rays annually). There is no safe level of radon exposure, but risk decreases as radon concentration decreases.
- Radon is present in Flagstaff and Coconino County (*see graphic on next page for more information*)
 - Per the State of Arizona: the average tested indoor radon concentration in Coconino County is 4.17 pCi/L
 - Per local radon testers: 70% of Flagstaff homes test greater than 2 pCi/L and 45% of homes test greater than 4 pCi/L
- Radon mitigation can reduce radon exposure for people who live and work in new buildings
- Radon mitigation at construction is easier, less costly, and more effective than installing a radon mitigation system (radon fan) as a retrofits

Average Radon Test Result by AZ County



Source: Arizona Department of Health Services, Radon Surveillance

Comparison to current code:

- Flagstaff adopted Appendix BE in 2019 with optional radon mitigation standards. Adopting this appendix with the proposed amendment would make these standards required for all new single-family and duplex homes.
- Adopting the recommended amendment to the IMC would add new radon mitigation standards to new residential buildings with more than 3 units, and commercial buildings.

Estimated Cost Impacts

Cost estimates: Radon mitigation (residential)

Code Section	Upfront Cost Per Housing Unit	Cost Savings
Passive radon mitigation	~\$700 ~\$300 – 1,500	Minimizes the need to install a radon mitigation system later
Radon testing	~\$170 ~\$135 – 200	Testing at construction is less costly
Radon fan (active mitigation) <i>only if needed</i>	~\$2,250 ~\$2,200 – 2,300	

These numbers represent average cost estimates based on the best available data.

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