

# City of Scottsdale

## 2021 International Energy Conservation Code (IECC)

### Highlights of Major Changes and Amendments

### Single Family, Multifamily and Commercial Buildings

BUILDING THERMAL ENVELOPE			
Single Family Dwellings	Expected Outcome		
<p><b>Insulation Minimum R-Values</b> (Table R402.1.3). Ceiling insulation increases from R-38 to R-49 for single family dwellings.</p>	<p>This new code change improves thermal efficiency and reduces future energy costs over the useful life of a building.</p> <p>R-38 insulation is still permitted where the full height of uncompressed insulation extends over the top plate at the roof eaves. These insulation values can also be reduced by following the U-Factor, total UA alternative, total building performance or energy rating index methods.</p> <p>This provision is consistent with the General Plan (E1&amp;2).</p>		
Single Family, Multifamily and Commercial	Expected Outcome		
<p><b>Roof solar reflectance and thermal emittance.</b> (Sec. R402.6 &amp; C402.3) Low-sloped (less than 2 in 12) roof surfaces over conditioned and unconditioned spaces shall comply with one or more of the options in Table R402.6 and C402.3.</p> <p style="text-align: center;"><b>Table R402.6 and C402.3</b> <b>Min. Roof Reflectance/ Emittance Options</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Three-year-aged solar reflectance index of 64</td> </tr> <tr> <td style="padding: 2px;">Three-year-aged solar reflectance of 0.55 and a three-year aged thermal emittance of 0.75</td> </tr> </table> <p><b>Exception:</b> Portions of roof covered by decks, vegetation, walkways, skylights, and solar energy systems are exempt from requirements.</p>	Three-year-aged solar reflectance index of 64	Three-year-aged solar reflectance of 0.55 and a three-year aged thermal emittance of 0.75	<p>This amendment will help mitigate heat island effect for roofs over both <u>conditioned and unconditioned spaces</u>.</p> <p>A cool roof uses solar reflectance and thermal emittance to help mitigate urban heat island sinks. Solar reflectance deflects sunlight and heat away from a building thereby reducing roof temperatures. Thermal emittance is the ability of a surface material to emit heat. Coupled together, these properties help roofs to absorb less heat and stay up to 50 - 60°F cooler than conventional materials during peak summer weather (EPA).</p> <p>This provision is consistent with the General Plan (EP7).</p>
Three-year-aged solar reflectance index of 64			
Three-year-aged solar reflectance of 0.55 and a three-year aged thermal emittance of 0.75			
MECHANICAL SYSTEMS			
Single Family Dwellings	Expected Outcomes		
<p><b>Duct testing</b> (Sec. R403.3.5). Ducts shall be pressure tested in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 to determine air leakage by either rough in test or postconstruction test.</p>	<p>This new code requirement removes the previous exception for ducts located inside the building thermal envelope.</p> <p>The effectiveness of ductwork is critical to efficient energy use in buildings and providing comfort to occupants. Ducted systems must transfer fresh or</p>		

	<p>conditioned air from the air-handling unit to rooms around the building.</p> <p>It is estimated that about 20 percent of the conditioned air intended for distribution in the dwelling unit does not make it to the room or space intended due to leaks, holes and poorly constructed ductwork systems.</p> <p>These losses result in higher energy bills and a lower level of occupant comfort. Duct sealing is critical regardless of duct location.</p> <p>This provision is consistent with the General Plan (E1&amp;2).</p>
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**ELECTRICAL POWER AND LIGHTING SYSTEMS**

<b>Single Family Dwellings</b>	<b>Expected Outcomes</b>
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<p><b>Lighting equipment</b> (Sec. R404.1). All permanently installed lighting fixtures, excluding kitchen appliance lighting fixtures, shall contain only high-efficacy lighting sources.</p>	<p>When lighting was predominately provided by incandescent bulbs, it accounted for roughly 12 percent of the energy used in residential buildings; thus, this requirement is a substantial energy saver. Incandescent lighting has been significantly phased out of the market and there are many high-efficacy lamp options. As the lighting industry continues to innovate, more options will be available in the future. This provision is consistent with the General Plan (E1&amp;2).</p>
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<p><b>Interior lighting controls</b> (Sec. R404.2). Permanently installed lighting fixtures shall be controlled with either a dimmer, an occupant sensor control or other control that is installed or built into the fixture.</p> <p><b>Exception:</b> Lighting controls shall not be required for the following:</p> <ol style="list-style-type: none"> <li>1. Bathrooms.</li> <li>2. Hallways.</li> <li>3. Exterior lighting fixtures.</li> <li>4. Lighting designed for safety or security.</li> </ol>	<p>While interior lighting power requirements have decreased over time and the market has evolved to higher efficiency lighting, further reduction can be gained through use of lighting controls. This provision is consistent with the General Plan (E1&amp;2).</p>
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<b>Commercial</b>	<b>Expected Outcomes</b>
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<p><b>Automatic receptacle control</b> (Sec. C405.11). Requires at least 50% of all 15- and 20-amp receptacles in enclosed offices, conference rooms, breakrooms, and classrooms to automatically power-off based on an occupant sensor or scheduled time-of-day controls.</p>	<p>This new code requirement accounts for practices common outside North America and required in the ANSI/ASHRAE/IES 90.1 national energy standard and many states around the country including Florida.</p> <p>At least 50 percent of the covered receptacles must be automatically controlled receptacles by using split wired receptacles that provide at least one controlled outlet. Energy is saved by removing phantom loads during non-business hours.</p>
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	This provision is consistent with the General Plan (E1&2).
Single Family Dwellings	Expected Outcomes
<p><b>Electric Vehicle (EV) charging infrastructure</b> (Sec. R404.4). New construction shall accommodate future installation and use of <i>Electric Vehicle Supply Equipment (EVSE)</i> in accordance with the National Electrical Code (NFPA 70).</p> <p><b>EV-capable charging spaces</b> (Sec. R404.4.1). The main electrical service panel shall have a reserved space to allow installation of a full size 2-pole circuit breaker for future EV charging and shall be labeled “Future EV Charging”.</p> <p>Where the electrical service panel is located beyond the perimeter of the garage wall, a raceway shall be installed from the electrical service panel to a location within the garage, where it shall terminate in a junction box or outlet and be labeled “Future EV Charging”.</p>	<p>This <u>amendment</u> is based on national and regional EV charging infrastructure standards. It is consistent with the General Plan (EP3.1).</p> <ol style="list-style-type: none"> <li>1) Given that transportation accounts for nearly 30% of greenhouse gas emissions, providing EV charging infrastructure for new home, multifamily and hotel construction will help accelerate the move towards net zero emissions.</li> <li>2) By 2030, US EV sales are expected to reach 30% of off all new car sales<sup>1</sup>. By 2035, GMC has committed to 100% EVs.</li> <li>3) As of June 2021, Arizona had the seventh-highest number of registered electric vehicles. When ownership is measured per 1,000 residents, Arizona inches up to sixth place, with just over 4 electric vehicles per 1,000 people<sup>2</sup>. However, Scottsdale’s number per 1,000 is much higher due to a higher end market. It’s estimated to be at least 70 EVs per 1,000 or 7% and rapidly rising. Since overall EV sales are expected to reach 50% by 2030, the number of Scottsdale registered EVs will soar.</li> <li>4) Arizona’s transportation electrification plan establishes a goal for utilities to support 1,076,000 new light duty EV’s statewide<sup>3</sup> as compared to the current number of 40,964 light-duty EVs<sup>4</sup>. In Scottsdale, that number would rise to 167,984 from the current number of 6,557.</li> <li>5) As homes are designed to last over 50 years, it’s important to equip homes with infrastructure to accommodate the charging needs of a rapidly growing population of EV users. It is estimated that the installation of EV charging infrastructure can be 3 to 4 times less expensive when installed during construction as opposed to retrofitting after the building is built.</li> <li>6) The biggest challenge in Arizona is the lack of readily available charging stations. The best location for long-term charging is at a residence whether a house, apartment, condominium, or hotel. Currently, 80% of EV charging occurs at the place of residence. The best time to charge is during the night when the car is parked for 8 to 12 hours, and off-peak electric utility rates are in effect.</li> </ol>

7) As the amount of EV's increase, the technologies will advance where the chargers will become smaller and more efficient.

Multifamily and Hotels	Expected Outcomes
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**Electric Vehicle (EV) charging infrastructure** (Sec. C405.13). New construction shall accommodate future installation and use of *Electric Vehicle Supply Equipment (EVSE)* in accordance with the National Electrical Code (NFPA 70).

**Required EV capable charging spaces** (Sec. C405.13.1). Parking shall be provided with electric vehicle charging infrastructure in accordance with Table C405.13.1.

The electrical service panel shall have reserved space(s) in the electrical service panel to allow for future EV charging circuit breaker(s) and shall be labeled "For Future EV Charging". Conduit run(s) shall be continuous and terminate within the planned *EV-capable* charging area.

**TABLE C405.13.1  
ELECTRIC VEHICLE CHARGING  
INFRASTRUCTURE REQUIREMENTS**

Occupancy	Minimum number of EV Charging Spaces <sup>a</sup>
Group R-1 (hotels, motels) and Group R-2 (apartments, condos)	20% of total parking spaces shall be EV capable  4% of total parking spaces shall be provided with EV supply equipment (EVSE)

<sup>a</sup> Parking spaces designated for other than passenger vehicles may be excluded from the total number of parking spaces.

This provision is consistent with the General Plan (EP3.1). See comments above.

ADDITIONAL EFFICIENCY PACKAGE OPTIONS	
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Single Family Dwellings	Expected Outcomes
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**On-site renewable energy** (Sec. R408.2.6). Provide an on-site renewable energy generation system that meets one of the following:

1. Provide a total rated capacity of not less than 2 watts per square foot of *conditioned floor area*.

The energy code requires additional energy efficiency measures above the minimum thermal envelope requirements for enhanced energy performance. This amendment adds a sixth option for on-site renewable energy:

Option 1 - Enhanced thermal envelope  
Option 2 - More efficient HVAC equipment

<p>- - or -</p> <p>2. Provide not less 50 percent of the estimated annual energy use within the building for mechanical, service water-heating, lighting and electric vehicle charging.</p>	<p><u>Option 3</u> - More efficient water-heating equipment</p> <p><u>Option 4</u> - More efficient duct distribution system</p> <p><u>Option 5</u> – More efficient ventilation system</p> <p><b><u>New Option 6</u></b> - On-site renewable energy</p> <p>This provision is consistent with the General Plan (E1&amp;2).</p>
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**MAINTENANCE INFORMATION AND SYSTEM COMMISSIONING**

<b>Commercial</b>	<b>Expected Outcomes</b>
<p><b>Mechanical systems and service water-heating systems commissioning and completion requirements</b> (Sec. C408.2).</p> <p><b>Exceptions:</b> The following systems are exempt:</p> <ol style="list-style-type: none"> <li>1. Mechanical systems in buildings where the total mechanical equipment capacity is less than-180,000 Btu/h (52.8 kW or 15 tons) for cooling,-300,000 Btu/h (87.9 kW) for space-heating-and 10,000 cfm for ventilation.</li> <li>2. Service water-heating systems rated under 50,000 Btu/h (14.7 kW).</li> <li>3. Water pumping and mixing systems under 5 hp (4kW).</li> <li>4. Single zone mechanical systems with stand-alone thermostats that serve individual <i>dwelling units</i> and <i>sleeping units</i>.</li> </ol>	<p>This code <u>amendment</u> lowers the threshold for commissioning of mechanical systems based on system size/capacity. It also clarifies the exception for single zone HVAC systems in dwelling units of multifamily buildings. Commissioning ensures mechanical systems are installed correctly and functions in accordance with code requirements for performance, health and safety.</p> <p>Without commissioning of mechanical and lighting systems projected energy savings and reduced carbon emissions will not be achieved.</p> <p>This provision is consistent with the General Plan (E1&amp;2).</p>

**APPENDIX RB and CB -SOLAR-READY PROVISIONS**

<b>Single Family Dwellings</b>	<b>Expected Outcomes</b>
<p><b>Solar-ready zone area</b> (Sec. RB103.3). The total solar-ready zone area shall be <u>not less than 10 percent of the roof area calculated as the horizontally projected gross roof area but not less than 300 sq. ft.</u>, exclusive of areas covered by skylights, occupied roof decks, vegetative roof areas and mandatory access or setback areas as required by the <i>International Fire Code</i>.</p> <p>New townhouses three stories or less in height above grade plane and with a total floor area less than or equal to 2,000 square feet per dwelling shall have a solar-ready zone area of not less than 150 square feet. The solar-ready zone shall be composed of areas not less than 5 feet in width and not less than 80 square feet exclusive of access or setback areas as required by the <i>International Fire Code</i>.</p>	<p>This provision is consistent with the General Plan (E1&amp;2) and Scottsdale’s existing energy code requirement for solar ready zones for new homes. An <u>amendment</u> changes the size of the solar-ready zone to 10% of the <u>gross roof area</u> (conditioned and non-conditioned) but not less than 300 sq. ft.</p> <p>The 10% is based on the <u>average solar PV system size</u> installed in Scottsdale of 10 kW</p> <ul style="list-style-type: none"> <li>• A 10kW system equates to 667 sq. ft. (based on 15 watts per sq. ft.).</li> <li>• The average <u>gross roof area</u> (conditioned and non-conditioned) of a new Scottsdale home in 2020 was <u>5,950 sf</u> (avg conditioned floor area in 2020 was <u>4,055 sf</u>) <ul style="list-style-type: none"> <li>○ 667 sf divided by 5,950 sf equates to 11% (rounded to 10%)</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• So, the solar-ready zone for a 5,950 sf house would be 595 sf (10%)</li> <li>• The solar-ready zone for a 3,500 sf house would be 350 sq. ft. (10%)</li> </ul>
Multifamily and Commercial	Expected Outcomes
<p><b>Solar-ready zone area</b> (Sec. CB103.3). The total solar-ready zone area shall be not less than <u>40 percent</u> of the gross roof area less the area covered by skylights, occupied roof decks and access or set back areas as required by the <i>International Fire Code</i>.</p>	<p>This code requirement provides accommodations for the installation of future solar energy systems by requiring a designated solar-ready that is free of roof mounted equipment, including pipes, vents and ducts. The main electrical service panel must have a reserved space to allow for the installation of a dual-pole circuit breaker for future solar electric system. An <u>amendment</u> removes the five stories or less provision, so now the solar-ready zone requirement will apply to all new commercial buildings regardless of the number of stories.</p> <p>This provision is consistent with the General Plan (E1&amp;2).</p>

Footnotes:

<sup>1</sup> EV Sales Forecasts, EV adoption (<https://evadoption.com>)

<sup>2</sup> Brooke Newman, *AZ goes EV: Rate of electric car ownership relatively high in Arizona*, Cronkite News, July 4, 2021. (<https://cronkitenews.azpbs.org/2021/07/04/az-goes-ev-rate-of-electric-car-ownership-relatively-high-in-arizona/>)

<sup>3</sup> David Wichner, *Plan to boost electric vehicles in Arizona gets regulator approval*, Arizona Daily Star, Dec. 15, 2021 ([Plan to boost electric vehicles in Arizona gets regulator approval | Business News | tucson.com](https://www.adstar.com/story/news/politics/2021/12/15/plan-to-boost-electric-vehicles-in-arizona-gets-regulator-approval/7041117002/))

<sup>4</sup> Fast Facts from ADOT, AZ Public Motor Vehicle Services ([Fast Facts from ADOT | ADOT \(azdot.gov\)](https://www.azdot.gov/press-releases/2021/07/04/fast-facts-from-adot))