EV-Ready Building Codes

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Electric Vehicle Market Projections

There are currently 1.3 million EVs in the US, with a 2.2% nationwide EV market share.
Electric Vehicle Benefits

- **Economic Savings:**
  - Equivalent of paying $1.08 per gallon in Nebraska
  - Only 20 moving parts in an EV compared to 2,000+ in an ICE vehicle – 35% lower costs

- **Environmental Savings:**
  - Zero tailpipe emissions
  - 66% fewer GHG emissions – gets cleaner each year the grid transitions toward Renewables

- **Efficiency Savings:**
  - ICE vehicles are 17-21% efficient vs an electric motor, which is 90-95% energy efficient
  - Level 2 chargers are 6% more efficient than Level 1

### POPULAR EVs AND THEIR RANGE

<table>
<thead>
<tr>
<th>VEHICLE MAKE/ MODEL</th>
<th>EPA-RATED DRIVING RANGE ON SINGLE CHARGE (MILES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tesla Model 3</td>
<td>240-310</td>
</tr>
<tr>
<td>Hyundai Kona EV</td>
<td>258</td>
</tr>
<tr>
<td>Kia Niro EV</td>
<td>239</td>
</tr>
<tr>
<td>Chevrolet Bolt</td>
<td>238</td>
</tr>
<tr>
<td>Nissan Leaf Plus</td>
<td>226</td>
</tr>
<tr>
<td>Audi E-Tron</td>
<td>204</td>
</tr>
<tr>
<td>Volkswagen eGolf</td>
<td>125</td>
</tr>
<tr>
<td>Hyundai Ioniq PHEV</td>
<td>32 electric (520 total)</td>
</tr>
<tr>
<td>Chrysler Pacifica Hybrid</td>
<td>29 electric (630 total)</td>
</tr>
<tr>
<td>Toyota Prius Prime</td>
<td>25 electric (640 total)</td>
</tr>
</tbody>
</table>

Source: Plug-in America
<table>
<thead>
<tr>
<th>Automaker</th>
<th>Electrification Commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audi</td>
<td>20 new EV models by 2025</td>
</tr>
<tr>
<td>BMW</td>
<td>12 EVs by 2025</td>
</tr>
<tr>
<td>Volvo</td>
<td>50% of sales are electric by 2025 (5 new BEVs by 2021)</td>
</tr>
<tr>
<td>GM</td>
<td>20 electric cars by 2023</td>
</tr>
<tr>
<td>Jeep</td>
<td>10 PHEVs and 4 BEVs by 2022</td>
</tr>
<tr>
<td>Renault-Nissan-Mitsubishi</td>
<td>Sell 1 million EVs per year by 2022 (12 new BEVs)</td>
</tr>
<tr>
<td>Ford</td>
<td>40 EV models by 2022: 16 BEVs, 24 PHEVs</td>
</tr>
<tr>
<td>Honda</td>
<td>2/3 of all sales to be electric by 2030</td>
</tr>
<tr>
<td>Hyundai-Kia</td>
<td>8 new EVs by 2022</td>
</tr>
<tr>
<td>Jaguar - Land Rover</td>
<td>Pledge to manufacturer only EVs and hybrids after 2020</td>
</tr>
<tr>
<td>Toyota</td>
<td>10 BEVs by early 2020s</td>
</tr>
</tbody>
</table>
The Scale of the EV Infrastructure Challenge

EV Charging Infrastructure by Location (2030)

- 1% Public DC Fast Charging
  - 100,000 Ports
- 8% Public Level 2 Charging
  - 800,000 Ports
- 13% Workplace Level 2 Charging
  - 1,200,000 Ports

9.6 Million Charge Ports Needed by 2030

- 78% Home Level 2 Charging
  - 7,500,000 Ports

Charging infrastructure in 2017 as a percentage of that needed by 2025

Figure ES-1. Public and workplace charging infrastructure in place in 2017 as a percentage of infrastructure needed by 2025 by metropolitan area

- 1%-10%
- 11%-20%
- 21%-30%
- 31%-40%
- 41%-50%
- 51%-60%
- 61%-70
- 61%-70
- 81%-90%
- 91%-100%
EV Charging 101

**LEVEL 1** STANDARD OUTLET
- Connector provided with every EV
- Plug into a standard **120V wall outlet**
- Great for overnight or workplace charging
- Ideal for daily **commutes under 40 miles**

**LEVEL 2** 240 VOLT OUTLET
- Available for both home and stations
- Provides a full charge for most EVs in:
  - 4-8 hours to full charge
  - 1-2 hours to full charge

**DC FAST CHARGE**
- Faster charging rates at commercial locations.
- 3 different connectors depending on vehicle:
  - 200 miles in 1-2 hours
Why Adopt EV Infrastructure Building Codes?

1- Help overcome a critical barrier to EV adoption by facilitating EV charging infrastructure

2- Avoid EV charging infrastructure retrofit costs including:

- Electrical system retrofits
- Breakage and repair of hardscapes
- Soft Costs: permitting, inspection, HOA or landlord approvals, etc.
“Installing EV capable parking spaces in stand-alone retrofits is typically 4 to 6 times more expensive compared to installing EV capable parking spaces during new construction. If EV capable parking spaces are installed during new construction, $2,040 - $4,635 per parking space is saved over the retrofit scenario.”

- Energy Solutions (2019)
Multi-family challenges

- 50% of Americans do not have access to a dedicated off-street parking space at their residence

- Logistical barriers of installation:
  - HOA rules
  - Shared or non-deeded parking spaces
  - Split incentive for renters
Residential: EV Infrastructure Options

1. **EV-Capable**
   
   Install electrical panel capacity with a dedicated branch circuit and a continuous raceway from the panel to the future EV parking spot.

   **Sample Code: Denver, CO**

2. **EV-Ready Outlet**
   
   Install electrical panel capacity and raceway with conduit to terminate in a junction box or 240-volt charging outlet.

   **Sample Code: Boulder, CO**
Commercial: EV Infrastructure Options

1. **EV-Capable**
   Electrical panel capacity + branch circuit + raceway
   - Aspen, CO: 3% of parking is EV-Capable (IBC)
   - Atlanta, GA: 20% is EV-Capable (Ordinance)

2. **EV-Ready**
   EV-Capable + 240-volt outlet
   - Boulder, CO: 10% of parking is EV-Ready Outlet

3. **EV-Installed**
   Install a minimum number of Level 2 charging stations
   - Palo Alto, CA: 5-10% of parking is EV-Installed
## 2019 Progress on EV building codes

<table>
<thead>
<tr>
<th>Municipality</th>
<th>State</th>
<th>Year</th>
<th>Location</th>
<th>Single-family</th>
<th>Multi-family</th>
<th>Commercial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denver (pending)</td>
<td>CO</td>
<td>2019</td>
<td>IBC / IRC</td>
<td>1 EV-Ready Space per dwelling Unit</td>
<td>5% EV-Installed, 15% EV-Ready, 80% EV-Capable</td>
<td>5% EV-Installed, 10% EV-Ready, 10% EV-Capable</td>
</tr>
<tr>
<td>Salt Lake City</td>
<td>UT</td>
<td>2019</td>
<td>IBC / IRC + Zoning Ordinance</td>
<td>1 EV-Installed Space for every 25 parking spaces</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seattle</td>
<td>WA</td>
<td>2019</td>
<td>Ordinance</td>
<td>1 EV-Ready Space per dwelling Unit</td>
<td>100% EV-Ready up to 6 space, 20% EV-Capable for 7+ spaces</td>
<td>10% EV-Ready</td>
</tr>
<tr>
<td>Sedona</td>
<td>AZ</td>
<td>2019</td>
<td>Appendix</td>
<td>1 EV-Capable Space per dwelling Unit</td>
<td></td>
<td>5% EV-Capable</td>
</tr>
<tr>
<td>Golden</td>
<td>CO</td>
<td>2019</td>
<td>Ordinance</td>
<td>1 EV-Ready Space per dwelling Unit</td>
<td>1 EV-Installed Space per 15 parking space, 15% EV-Capable</td>
<td></td>
</tr>
<tr>
<td>San Jose</td>
<td>CA</td>
<td>2019</td>
<td>Ordinance</td>
<td>1 EV-Ready Space per dwelling Unit</td>
<td>10% EV-Installed, 20% EV-Ready, 70% EV-Capable</td>
<td>10% EV-Installed, 40% EV-Capable</td>
</tr>
<tr>
<td>Fort Collins</td>
<td>CO</td>
<td>2019</td>
<td>IBC / IRC</td>
<td>1 EV-Capable Space per dwelling Unit</td>
<td></td>
<td>10% EV-Capable</td>
</tr>
<tr>
<td>Vancouver</td>
<td>BC</td>
<td>2019</td>
<td>IBC / IRC</td>
<td>1 EV-Ready Space per dwelling Unit</td>
<td>100% EV-Ready</td>
<td>10% EV-Ready</td>
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EV Building Code Resources

www.swenergy.org

Residential Building Code:
- EV Building Codes: Residential IRC 1-pager
- Sample Residential Code Amendment

Commercial Building Code:
- EV Building Codes: Commercial IBC 1-pager
- IBC Sample Building Code Amendment
- EV Infrastructure Cost-Effectiveness

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Ford Electric Crossover (coming Nov. 17)
Who is Adopting EV Infrastructure Building Codes?

Map of the United States showing various cities and towns, highlighting different regions with symbols: Multi-Family, Non-Residential, and Single Family. Notable cities include Berkeley, Contra Costa County, Cupertino, Emeryville, Fremont, Marin County, Menlo Park, Mountain View, Oakland, Palo Alto, San Mateo, San Francisco, San Rafael, Santa Clara County, Santa Cruz, Santa Rosa, Sunnyvale, and others. The map also shows states like California, Oregon, Washington, and New York City with additional metropolitan areas.