Colorado EV Infrastructure Happy Hour
Mondays at 3
Zoom Meeting

• Please use Chat for questions and to communicate with other participants.
• After the discussion we will open up breakout rooms. Please feel free to jump into one or more to network with each other and our speakers.
EV Infrastructure Happy Hour: EV-Ready Building Codes

AGENDA:

- **Matt Frommer**, Southwest Energy Efficiency Project (SWEEP)
- **Katrina Managan**, Denver Office of Climate Action, Sustainability, Resiliency
- **Brad Smith**, Fort Collins Energy Code Compliance Specialist
- **Jess Hoover**, Climate Action Director, High Country Conservation Center (Summit County)
Why Adopt EV Infrastructure Building Codes?
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.
The Scale of the EV Infrastructure Challenge

Source: Edison Electric Institute (2019)

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

9.6 Million Charge Ports Needed by 2030

Source: Edison Electric Institute (2019)

Charging infrastructure in 2017 as a percentage of that needed by 2025
- 1%–10%
- 11%–20%
- 21%–30%
- 31%–40%
- 41%–50%
- 51%–60%
- 61%–70%
- 71%–80%
- 81%–90%
- 91%–100%

Public & workplace charging as a percentage of chargers needed by 2025 by metro-area.
Source: ICCT: Quantifying EV charging Gap (2019)
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)

Costs modeled for the City of Oakland
Multi-Family EV Charging Challenges

- Home-charging: 92% of chargers, 77% of electricity delivered to EVs. Rest split between workplace, public Level 2, and DC Fast-chargers.

- 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
EV Infrastructure Code Specifications

1. “EV-Capable”
   Electrical panel capacity + branch circuit + raceway
   Atlanta, GA: 20% is EV-Capable (Ordinance)

2. “EV-Ready”
   EV-Capable + 240-volt outlet
   Denver, Boulder: (1) EV-Ready Space per dwelling for SFU

3. “EV-Installed”
   Install a minimum number of Level 2 charging stations
   Denver: 5% EV-Installed for MFU & Commercial
## 2019-20 Progress

<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</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>Boulder</td>
<td>CO</td>
<td>2019</td>
<td>IBC / IRC</td>
<td>1 EV-Ready Space per dwelling Unit</td>
<td>5% EV-Installed, 10% EV-Ready, 40% EV-Capable (25+ spaces)</td>
<td>5% EV-Installed, 10% EV-Ready, 10% EV-Capable (25+ spaces)</td>
</tr>
<tr>
<td>Golden</td>
<td>CO</td>
<td>2019</td>
<td>Ordinance</td>
<td></td>
<td>1 EV-Installed Space per 15 parking space, 15% EV-Capable</td>
<td></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>10% EV-Capable</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>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>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>
</tr>
<tr>
<td>2021 IECC</td>
<td>Internation</td>
<td>2021</td>
<td>IBC / IRC</td>
<td>1 EV-Ready Space per dwelling Unit</td>
<td>2 EV-Ready Spaces, 20% EV-Capable</td>
<td>2 EV-Ready Spaces, 20% EV-Capable</td>
</tr>
</tbody>
</table>
EV-ready building codes

Katrina Managan
Buildings Team Lead
May 18th, 2020
80x50 Goal: Net Zero New Construction by 2035

By 2050, ~40% of our building stock will be “new” construction

The IPCC tells us we must have net zero new construction in 2020.
**TABLE C405.10.1**

**EV SPACES IN GROUP R OCCUPANCIES**

<table>
<thead>
<tr>
<th></th>
<th>NUMBER OF EV READY SPACES</th>
<th>NUMBER OF EV CAPABLE SPACES</th>
<th>NUMBER OF EVSE INSTALLED SPACES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Space</td>
<td>1</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>2 to 9 spaces</td>
<td>1</td>
<td>20% of spaces</td>
<td>None</td>
</tr>
<tr>
<td>10 or more spaces</td>
<td>15% of spaces</td>
<td>Remainder of spaces</td>
<td>5% of spaces</td>
</tr>
</tbody>
</table>

Table C405.10.2 EV spaces in Group A, B, E, I, M and S-2 occupancies is added as follows:

**TABLE C405.10.2**

**EV SPACES IN GROUP A, B, E, I, M and S-2 OCCUPANCIES**

<table>
<thead>
<tr>
<th></th>
<th>NUMBER OF EV READY SPACES</th>
<th>NUMBER OF EV CAPABLE SPACES</th>
<th>NUMBER OF EVSE INSTALLED SPACES</th>
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<tbody>
<tr>
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<td>1</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>2 to 9 spaces</td>
<td>1</td>
<td>1</td>
<td>None</td>
</tr>
<tr>
<td>10 or more spaces</td>
<td>10% of spaces</td>
<td>10% of spaces</td>
<td>5% of spaces</td>
</tr>
</tbody>
</table>
Denver’s Path to Net Zero Energy – Commercial

Energy Use vs. Year

Trajectory for New Buildings ZE by 2030

© New Buildings Institute
Denver’s Path to Net Zero Energy – Residential

- 2006 IECC
- 2009 IECC
- 2012 IECC
- 2015 IECC
- 2018 IECC

- Denver Energy Code - 2019
- Denver Green Code - 2019

Trajectory for New Buildings ZE by 2030

© New Buildings Institute
2019 Code Adoption Process

Amendment Proposal Development • Jan-April

Code Committee Meetings • April-August

Code Adoption – City Council Process • Fall 2019

Base Code: IECC 2018 (with strong efficiency amendments)

Voluntary Green/Stretch Code: IgCC 2018
City of Fort Collins
EV Ready Building Codes

Brad Smith
Energy Code Specialist
FORT COLLINS ELECTRIC VEHICLE READINESS
Strategies

Ongoing
- Outreach & Education
  - Target education and outreach to key audiences
  - Maintain a comprehensive electric vehicle (EV) website

- City Planning & Regional Coordination
  - Incorporate EV readiness in local and regional planning
  - Coordinate and advocate regionally

- Emerging Technologies
  - Track emerging technologies and market developments

Short-Term (within 1-2 years)
- Policies
  - Clarify City policy related to EV charging
  - Allow right-of-way locations for EV charging station installations
  - Establish and enforce EV parking rules

- Incentives
  - Support public charging station installation
  - Recognize local businesses with workplace charging

Medium-Term (within 3-5 years)
- Policies
  - Revise building codes to require EV-ready developments

- Incentives
  - Incentivize consumer EV purchases

- Utilities
  - Support smart grid operations for EVs
  - Increase renewable electricity for EV charging
  - Assess and adjust utility rate structures for EV drivers
City Plan & Transportation Master Plan

- Strategy T-3i. Support the purchase of EV’s by revising building codes to incorporate EV charging...

2018 IRC – local amendment

Section E3401.5 Electrical Vehicle Ready. All new single-family dwellings with an attached garage or carport shall be provided with an empty conduit of 3/4 inch minimum, installed from the dwellings electrical panel board to a junction box in readily accessible location in the garage or carport, capable of supporting a 50 ampere 220 volt outlet.

2018 IBC – local amendment

Section 3605 Electrical Vehicle Ready. All new R-1 & R-2 occupancy buildings that provide on-site parking, 10 percent of total parking spaces shall provide an empty conduit of 3/4 inch minimum, installed from the building electrical panel board to a junction box or capped pipe in a readily accessible location near/at the parking space, capable of supporting a 50 ampere 208/220 volt outlet.
**EV code considerations:**

- Fort Collins updated code to 50 amp to accommodate the 50-80 amp charger we were seeing.
- Townhomes - Not an issue to run off sub-panel in attached garage. If detached garage may be best to red-line this on F & F plans.
- If installing outlet & breaker for EV this must be GFI protected. Not in all 2017 NEC books but is online. It is in the 2020 NEC.

**Future EV code considerations**

- EV chargers (instead of conduit) for new Multi-Family developments.
- EV chargers for new commercial & industrial developments.
Electrical plans for Multi-family parking garage

TAGGED NOTES - THIS SHEET

1. NOT USED.
2. SEE ENLARGEMENT ON SHEET E101A FOR WORK IN THIS AREA.
3. PROVIDE POWER FOR UNIT HEATER, PROVIDE LOCKABLE BREAKER AT PANEL, SEE PANEL SCHEDULES.
4. LIGHT FIXTURE TO BE WIRED VIA CENTRAL INVERTER WITH BATTERY BACK-UP FOR EMERGENCY OPERATION, SEE RISERS, PANEL SCHEDULES, AND DETAIL.
5. PROVIDE POWER FOR PARKING GARAGE POWERED GATE, COORDINATE EXACT LOCATION W/ G.C.
6. DOOR TO BE EQUIPPED WITH PANIC HARDWARE.
7. PROVIDE EMPTY 3" CONDUIT FROM EXTERIOR DISCONNECT INTO TENANT SPACE, COORDINATE Stub LOCATION WITH G.C.
8. NEW 400A METER BASE AND DISCONNECT FOR EMPTY TENANT SPACE.
9. PROVIDE JUNCTION BOX AND EMPTY 3/4" CONDUIT FOR FUTURE ELECTRIC VEHICLE CHARGER, CONDUIT TO BE ROUTED BACK TO FUTURE LOCATION OF PANEL "EV".
10. PROVIDE JUNCTION BOX AND EMPTY 3/4" CONDUIT FOR FUTURE ELECTRIC VEHICLE CHARGER, CONDUIT TO BE ROUTED BACK TO AREA OF PANEL "GM", DO NOT CONNECT TO PANEL.
11. PROVIDE WEATHERPROOF GR POWER RECEPTACLE AT CEILING FOR ELEVATOR SUMP PUMP, "ALARM."
Minimal additional materials and expense
Summit County’s EV Ready Building Codes

Jess Hoover
Climate Action Director
High Country Conservation Center
Climate Action Goals

Reduce countywide emissions...

50% by 2030
80% by 2050

Increase share of EVs on Summit county roads to...

30% of all LDV by 2030
Community Coordination

- Stakeholder engagement
- Shared minimum standards
- Policy vs. incentives
C405.11.1 Group R occupancies. Group R occupancies with three or more dwelling units and/or sleeping units shall be provided with EV charging in accordance with Table C405.11.1. Calculations for the number of spaces shall be rounded up to the nearest whole number.

<table>
<thead>
<tr>
<th>Total Number of Parking Spaces</th>
<th>Number of EVSE Installed Spaces</th>
<th>Number of EV Ready Spaces</th>
<th>Number of EV Capable Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>None</td>
<td>1</td>
<td>None</td>
</tr>
<tr>
<td>2 – 9</td>
<td>None</td>
<td>1</td>
<td>20% of spaces</td>
</tr>
<tr>
<td>&gt; 10</td>
<td>5% of spaces (minimum one dual-port charging station)</td>
<td>10% of spaces</td>
<td>40% of remaining spaces</td>
</tr>
</tbody>
</table>

C405.11.2 Group A, B, E, I, M and S-2 occupancies. Group A, B, E, I, M and open or enclosed parking garages under S-2 occupancy shall be provided with electric vehicle charging in accordance with Table C405.11.2. Calculations for the number of spaces shall be rounded up to the nearest whole number.

**Exception:** The number of electric vehicle supply equipment (EVSE) installed spaces may be reduced by up to five provided that the building includes not less than one parking space equipped with an EV fast charger and not less than one EV ready space.

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<th>Number of EVSE Installed Spaces</th>
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<tbody>
<tr>
<td>1</td>
<td>None</td>
<td>1</td>
<td>None</td>
</tr>
<tr>
<td>2 – 25</td>
<td>None</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&gt; 25</td>
<td>5% of spaces (minimum one dual-port charging station)</td>
<td>10% of spaces</td>
<td>40% of remaining spaces</td>
</tr>
</tbody>
</table>
Future Implementation Challenges

- Multi-family buildings...
  - charging access?
  - who pays?
- What comes first...the cars or the infrastructure?

Summit County only has 49 electric vehicles currently registered
Questions?

Speaker Contact Information:

● Matt Frommer, SWEEP – mfrommer@swenergy.org

● Katrina Managan, Denver – Katrina.Managan@denvergov.org

● Brad Smith, Fort Collins – brsmith@fcgov.com

● Jess Hoover, HC3 – jess@highcountryconservation.org
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Mondays at 3

Upcoming Mondays

June 1  |  Funding Your Infrastructure and Chargers
June 8  |  EVSE Hardware & Software
June 15 |  Grid Considerations
June 22 |  Electric Fleets
June 29 |  Charging Infrastructure - What's Next

More being planned for July...