2022 Reach Codes Initiative

Advancing safer, healthier and more affordable buildings and vehicles

Industry Forum – February 15, 2022

BayAreaReachCodes.Org
Team Introductions

LEADERSHIP

Peninsula Clean Energy
- Rafael Reyes
- Blake Herrschaft
- Phillip Kobernick
- Zoe Elizabeth
- Peyton Parks
- Peter Mustacich
- Eryn Kim
- Beckie Menten

Silicon Valley Clean Energy

East Bay Community Energy

COLLABORATORS

Santa Clara County
- Breann Boyle
- Alero Moju

San Mateo County

CONSULTANTS

TRC
- Farhad Farahmand
- Mayra Vega

DNV
- Thor Frantz
Non-profit, locally-led electricity providers

Source
EBCE, PCE, SVCE
buy and build cleaner energy

Delivery
PG&E
deliver energy, repair lines, handle billing

Customer
YOU
benefiting from cleaner energy, local control
What are Reach Codes?

- Local enhancements to state code
- Can be adopted at any time
- Addresses:
  1. Building electrification – reduced use of methane gas
  2. Electric vehicle (EV) charging infrastructure – increased readiness
- Improves economic and energy performance of buildings

Codes are enhanced by stakeholder engagement, why we are here
Adoption of Electrification Reach Codes

- 61% of member agencies
- 57% of electrification Reach Codes statewide
- 21 of 30 also had EV infrastructure codes

Credit: Redwood Energy
2022-23 Initiative

January
Kickoff

February
Begin ongoing outreach

March-May
Cost effective studies

June
2nd draft reach codes, outreach

September-October
Local adoption

January 1, 2023
Codes take effect
Presentation Overview

Topics
• Building electrification
• Electric vehicle (EV) charging infrastructure
• New construction
• Alterations

Agenda
1. Technology and feasibility
2. Costs
3. Policy models
4. Tools and Resources
Poll Questions
Discussion

What are the benefits of going all-electric for our buildings and vehicles?
Technology and Feasibility

The all-electric Integrated Genomics Laboratory, Lawrence Berkeley Labs.

Source: Rutherford + Chekene
Global Carbon Emissions Sources

18% Commercial & Residential Buildings
12% Road transport

Source: Shayle Kann, Climate Tech VC

In CA, building emissions are overwhelmingly from methane gas uses that can be electrified.
Electrification, Compared to Fossil Fuels

- Carbon-free

Source: Peninsula Clean Energy 2021
Electrification, Compared to Fossil Fuels

- Carbon-free
- Lowest-cost, lowest-risk pathway

Sources: 1) AB3232 Decarbonization Assessment 2021  2) CA Energy Commission 2018  3) CPUC 2021
Electrification, Compared to Fossil Fuels

- Carbon-free
- Lowest-cost, lowest-risk pathway
- Healthier indoor air

[Table and chart with data on emissions and guidelines for NOx, with sources: RMI 2020, CEC 2019]
Electrification, Compared to Fossil Fuels

• Carbon-free

• Lowest-cost, lowest-risk pathway

• Healthier indoor air

• Job creation

Sources: UCLA 2019, UMass 2021
California Buildings Gas Usage

Residential
- Water Heating: 49%
- Space Heating: 37%
- Cooking: 7%
- Pool Heating: 4%
- Clothes Drying: 3%

Non-Residential
- Water Heating: 32%
- Space Heating: 36%
- Cooking: 23%
- Misc: 9%

2009 Residential Appliance Saturation Survey
2006 California Commercial End Use Survey
Electric is already the majority

Of national new construction homes:¹

- 60% use electric space heating (40% of which are heat pumps²)
- 55% use electric water heating
- 62% use electric cooking
- 75% use electric clothes drying

Sources:
1 - 2017 American Community Survey
2 - 2017 IEA Heat Pump Conference Proceedings
Energy Efficiency Comparison of Technology

Typical Energy Factors

- **Natural Gas**: 0.8
- **Heat Pump**: 3.5
- **Resistance / Induction**: 1

**Space heating, Water heating, Clothes drying**

**Cooking, High-Intensity Processes**
Summary

<table>
<thead>
<tr>
<th>All-Electric Home</th>
<th>Capital Cost of Thermal Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-Electric Home</td>
<td>$10,580 ↓</td>
</tr>
<tr>
<td>Energy</td>
<td>$7/mo ↑</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gas Meter &amp; Service Not Needed</th>
<th>Capital Cost of Thermal Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital</td>
<td>$6,000 ↓</td>
</tr>
<tr>
<td>Energy</td>
<td>$7/mo ↓</td>
</tr>
</tbody>
</table>

$191 Net Lifecycle Cost Savings per year for an all-electric home versus the mixed-fuel equivalent.

3 MT CO2e Carbon Emissions Savings per home, per year based on 2030 grid mix.
EV Charging Need and Technology
EV Charging Demand

- Increase in light-duty EV ownership
  - 250,000 EVs sold in 2021, 12.5% of all vehicles
- Sale of gas vehicles phased out by 2035
- Pervasive issues
  - Costs of electrical upgrades
  - Underserved multi-family housing occupants

Sources: California Energy Commission, EO N-79-20
Figure 1: Projected 2030 Charger Counts to Support 5 Million and 8 Million Light-Duty Zero-Emission Vehicles

Models project that California will need more than 700,000 shared private and public chargers in 2030 to support 5 million ZEVs as called for in AB 2127 and nearly 1.2 million chargers to support 8 million ZEVs to achieve the goals of the Executive Order N-79-20. Counts for chargers at workplaces, public destinations, and multiunit dwellings generally indicate the number of Level 2 chargers needed. In some cases, Level 1 chargers may be sufficient at select multiunit dwellings. These values do not include chargers at single-family homes.

Source: CEC and NREL, AB2127 (2021)
Retrofit costs shown are “best case”

- Retrofit can be much higher
  - PG&E retrofit 'cost-per-port' ave. is $18,000

- Costs include wiring, switch gear, conduit, trenching, and secondary transformer

Sources: 1) Electric Vehicle Infrastructure Cost Analysis for PCE and SVCE 2) Pacific Gas and Electric Company EV Charge Network Quarterly Report, Q2 2020
Automatic Load Management

1 car charging

2 cars charging

4 cars charging

7.2kW

3.6kW 3.6kW

1.8kW 1.8kW 1.8kW 1.8kW
Discussion

What are the pros and cons of electrification for your industry?

How will electrification affect your next project?
2022 Reach Code Policy Models

1. 2022 California Energy Code
2. Reach codes
   A. Building electrification
   B. Electric Vehicle infrastructure
3. Discussion
2022 CA Energy Code

New Construction

• Heat pumps are prescriptive baseline
  • Residential
    • Space heating in climate zone 3, 4
    • Water heating in climate zone 12
  • Nonresidential – water- and/or space-heating for most building types
  • Performance credit for all-electric design
• Residential
  • Pre-wiring required for gas appliances
  • Higher ventilation rate for gas stoves
  • Energy storage readiness
• Nonresidential - Solar PV and Battery Storage prescriptive

Existing Buildings

• Restricts newly installed electric resistance heating
• Simplified language for heat pump retrofits
Building Electrification – New Construction

All-Electric Municipal Ordinance

- All-electric construction required
  - Also restricts extension of any existing gas infrastructure

New construction definition

- If either of the below are replaced over 3 years for purposes other than repair or reinforcement
  - 50% of above-sill framing, or
  - 50% of foundation

Optional exceptions

- Infeasible to construct according to CA Energy Code
- “Public interest”
- Technology-specific exceptions expiring in 2025 (e.g., cooking, laundry)
- Electric-readiness required
  - Pre-wiring
  - Physical space

Find our codes on: BayAreaReachCodes.Org
Building Electrification – Existing Buildings

- Inequitable histories
- Financing and incentive programs
- Coordination with regional agencies (e.g., BAAQMD)
- Outreach and education strategy
- Supplier and workforce availability
- Code language
- On and on…
We Need Every Tool in the Box

Forecast of Cumulative GHG Emission Impacts from Selected Policy Options

- New Construction Reach Code
- 2. Energy Assessment
- 3. Upgrade at Equip't Replacement
- 4. Upgrade at Major Renovation
- 5. Performance Standards
- End of Flow
- Unabated Emissions
- Zero Emissions Building Goal

Source: BayREN Policy Calculator
A/C Upgrade to Heat Pump

At the Time of Permit, all-electric is required (new installation, relocation, or replacement)

**FIRST COST, PER SYSTEM**
- **Single family**
  - Cost Neutral: $2,000-$5,000 if scope was only A/C relocation

- **Multifamily In-unit**
  - Cost Neutral: $2,000-$5,000 per dwelling, if scope was only A/C relocation

- **Commercial - Single-zone**
  - Cost Neutral: up to 30 tons

- **Commercial - Multi-zone**
  - Cost Neutral: up to 30 tons

**FINANCING AVAILABLE**
- BayREN + TECH $3,000
- BayREN + TECH $2,000

**LIFE-CYCLE COST EFFECTIVE?**
- YES, with incentive.
- YES, with incentive.
- Needs efficiency or PV, i.e., Retail, Restaurant
- Needs efficiency or PV, i.e., Large Office

**ADDITIONAL FINANCING NEEDED?**
- NO
- NO
- MAYBE - costs unlikely to be major impediment
- MAYBE - costs unlikely to be major impediment

**READY TO ADOPT?**
- YES
- YES
- YES
- YES
EV Code Terminology

**Speed**

**Level 1**
3-4 miles per charging hour

**Level 2**
10-20 miles per charging hour

**Level 3**
150+ miles per charging hour

**Readiness**

**EV Capable**

**EV Ready**

**EV Charging Station**

**Number**

Percent of Parking Spaces
<table>
<thead>
<tr>
<th></th>
<th>2019 CALGreen</th>
<th>2022 CALGreen</th>
<th>Model Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family Homes and Two-Family Townhomes</td>
<td>Mandatory</td>
<td>Mandatory</td>
<td>2 EV spaces total:</td>
</tr>
<tr>
<td></td>
<td>(1) Level 2 EV Capable for one parking space per dwelling unit</td>
<td></td>
<td>• 1 Level 2 EV Ready circuit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• 1 Level 1 EV Ready circuit</td>
</tr>
</tbody>
</table>

2022 Initiative - Key Concepts

EV Infrastructure – New Construction
EV Infrastructure – New Construction

<table>
<thead>
<tr>
<th>2019 CALGreen</th>
<th>2022 CALGreen</th>
<th>Model code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory</td>
<td>Mandatory</td>
<td></td>
</tr>
</tbody>
</table>

**Multi-Family**

- **10% Level 2 EV Capable**
- **5% Level 2 EV Ready (low-power)**
- **25% Level 2 EV Capable**
- **10% Level 2 EV Capable**

**% of Parking Spaces**

**% of Dwelling Units with Parking Spaces**

- Entirely affordable housing: 15% Level 2 EVCS, 25% L2 EV Ready (low-power), 60% Level 1 EV Ready
- Other: 40% Level 2 EVCS, 60% Level 1 EV Ready

*AUTOMATIC LOAD MANAGEMENT ENCOURAGED*
100% Access Doesn’t Need to Cost More

EV Infrastructure Cost for 100-Dwelling Multifamily Building

- 2019 Reach Code: $146k
- 2022 CALGreen: $127k
- 2022 Reach Code - Market Rate: $167k
- 2022 Reach Code - Affordable Housing: $128k

Each scenario is ~0.3% of whole-building construction cost.

 Assumes $392/ft²
Source: Turner and Townsend, 2021
EV Infrastructure – New Construction

<table>
<thead>
<tr>
<th>Non-Residential</th>
<th>2019 CALGreen</th>
<th>2022 CALGreen</th>
<th>Model Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory</td>
<td>6% Level 2 EV Capable</td>
<td>5% Level 2 EVCS 15% Level 2 EV Capable</td>
<td>20% Level 2 EVCS 30% Level 2 EV Capable</td>
</tr>
<tr>
<td>Mandatory</td>
<td>10% Level 2 EV Capable</td>
<td>10% Level 2 EV Capable</td>
<td>10% Level 2 EV Capable</td>
</tr>
</tbody>
</table>

Offices: 20% Level 2 EVCS 30% Level 2 EV Capable

All other: 10% Level 2 EV Capable
EV Infrastructure – Existing Buildings

Alterations or additions

- **Single Family** – Parking additions or electrical panel upgrades must meet new construction requirements

- **Multifamily** →

- **Nonresidential** →

  When new parking facilities are added, or electrical systems or lighting of existing parking facilities are added or altered and the work requires a building permit, ten percent (10%) of the total number of parking spaces added or altered shall be EVCS.

Time certain policy

- By January 1st, 2025, multifamily and nonresidential properties shall upgrade existing EV Capable spaces required by the locally adopted codes at the time the building was permitted to a minimum of Level 1 EV Ready.
How might these codes impact your business practices?

What would you like to see in locally adopted codes?
Industry Resources

- [www.AllElectricDesign.Org](http://www.AllElectricDesign.Org) Provides free technical assistance on custom projects for practitioners or residents
- Building Electrification Technology Roadmap - Covers the technical capabilities of a variety of end-uses
- Building Decarbonization Practice Guide Guides architects and engineers towards best practices during design development
- Ecosizer Guides engineers and energy consultants for proper design of central heat pump water heating systems
<table>
<thead>
<tr>
<th>Property Category</th>
<th>Property Type</th>
<th>Port Type</th>
<th>Port Incentive</th>
<th>Applicable Cap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>Multi-Unit Dwelling</td>
<td>L1 outlet</td>
<td>$2,000</td>
<td>No cap</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L2 EVSE port</td>
<td>$4,500</td>
<td>75% of costs, up to $36k</td>
</tr>
<tr>
<td></td>
<td>Affordable Housing Multi-Unit Dwelling</td>
<td>L1 outlet</td>
<td>$2,500</td>
<td>No cap</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L2 EVSE port</td>
<td>$5,500</td>
<td>Up to $36,000</td>
</tr>
<tr>
<td></td>
<td>Workplace</td>
<td>L1 outlet</td>
<td>$2,000</td>
<td>No cap</td>
</tr>
<tr>
<td></td>
<td>Any</td>
<td>Make Ready circuit</td>
<td>$2,000</td>
<td>Up to $20,000</td>
</tr>
<tr>
<td>New</td>
<td>Market Rate Multi-Unit Dwelling (Above Code)</td>
<td>L1 outlet</td>
<td>$1,000</td>
<td>No cap</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L2 EVSE port</td>
<td>$2,000</td>
<td>Up to $40,000</td>
</tr>
<tr>
<td></td>
<td>Affordable Housing Multi-Unit Dwelling</td>
<td>L1 outlet</td>
<td>$1,500</td>
<td>No cap</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L2 EVSE port</td>
<td>$2,500</td>
<td>Up to $100,000</td>
</tr>
<tr>
<td>New or Existing</td>
<td>Any</td>
<td>Resilient L2 or DCFC port</td>
<td>$10,000</td>
<td>Up to $50,000</td>
</tr>
</tbody>
</table>

Source: Peninsula Clean Energy EV Ready Program
Please share your opinions

Please review the codes posted on BayAreaReachCodes.org and share feedback

Model Reach Codes Recommendations

The following building electrification reach code language is based on the anticipated Investor-Owned Utilities Codes and Standards Program (IOU’s C&S) cost effectiveness studies. These studies will be listed under Supporting Resources.

Do you have any feedback you would like to share on our model codes or other aspects of our initiative? We would appreciate your input!

- PROVIDE FEEDBACK

- What opportunities and challenges do you expect in 2022-23?
- Are the code concepts appropriate for your City/County?
Thank you!

Next Meetings:

**February 15** – Building Industry: Deep Dive into Model Codes

**February 16** – Community: Deep Dive into Model Codes

**March 8** – ICC Tri-Chapter briefing

**March 9** – CALBIG briefing

Visit us at: [BayAreaReachCodes.Org](http://BayAreaReachCodes.Org)
<table>
<thead>
<tr>
<th>Concern</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution grid upgrades are expensive</td>
<td>Sometimes true. Costs are offset by savings of all-electric construction.</td>
</tr>
<tr>
<td>Resilience, power-shutoffs</td>
<td>Real problem, but gas does not help. Gas appliance ignition is electric. In emergencies gas is also shut-off. State policy for grid hardening is key.</td>
</tr>
<tr>
<td>Uniformity</td>
<td>Fair Concern, but all-electric is simpler &amp; not adopting ensures future risk. PCE and regional partners are encouraging consistency. All-electric is simple and inaction locks in future cost (retrofits, rates) and risk (fire).</td>
</tr>
<tr>
<td>In multifamily, central heat pump water heating requires more design expertise and space than gas boilers.</td>
<td>True, training needed. There are scores of working systems, but best practice guidance is available.</td>
</tr>
</tbody>
</table>
### Common Concerns (2 of 2)

<table>
<thead>
<tr>
<th>Concern</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-Electric heating uses too much energy or can’t work in our cool climate</td>
<td><strong>False. All-electric heat pumps are highly efficient and effective</strong> in weather far colder than ours. DOE studies show heat pump space heaters as highly efficient at as little as 5 degrees Fahrenheit.</td>
</tr>
<tr>
<td>Energy is not clean</td>
<td><strong>False.</strong> PCE base service is 100% GHG free today</td>
</tr>
<tr>
<td>Equipment is not available</td>
<td><strong>Mostly false.</strong> Some scenarios for high-volume or steam applications are more challenging to address. Heat pumps and induction stoves have a long-established history, are widely adopted in other states, but market awareness needs to grow. PCE is addressing training needs.</td>
</tr>
</tbody>
</table>
Will Electrification Reduce Resilience?

Heat Pump Space Heating

Heat Pump Water Heating

Induction Cooking

Electric Clothes Drying

Gas furnaces require electric fans, but fireplaces still work.

Gas water heaters require electronic ignition or pumps.

Gas stoves will work without electricity, but it’s unsafe.

Gas dryers use electric motors to run tumbler.
Can the Grid Handle the Load Increase?

- California Energy Commission’s AB3232 analysis indicates that *aggressive* electrification will result in **20 percent additional summer peak load** through 2030. Winter load expected match summer peak load.*

- The electricity suppliers have a *service obligation* to meet your needs. “PG&E fully expects to meet the needs that all-electric buildings will require” -Robert S. Kenney, Vice President, PG&E

- CEC has noted **electrification as the lower cost, lower risk approach** to decarbonization

- CA-ISO has performed a 20-year study and has recommended **over $30B in transmission investments** to account for increased renewables and decommissioned gas power plants

*Represents PG&E territory. Assumes all-electric for 100% new construction, 90% replace on burnout, and 70% early retirement for remaining existing buildings.

Sources: 1) AB3232 Decarbonization Assessment 2021 2) CA Energy Commission 2018 3) CA-ISO 4) CPUC 2021
2019 Reach Code Initiative - Litigation

1. **Berkeley – Municipal all-electric ordinance**: Federal court rejected the plaintiff challenge because the ordinance does not directly regulate either energy use or energy efficiency of covered appliances. Plaintiff has appealed.

2. **Windsor – Energy Code (Part 6) amendment**: Agency repealed reach code because the Town could not sufficiently fund legal defense of all-electric reach code.

3. **Santa Rosa – Energy Code (Part 6) amendment**: CA court rejected plaintiffs claims regarding CEQA analysis for all-electric reach code. Plaintiff has appealed.

**Takeaway**: Pending appeals, both a municipal code or building code amendment seem legally defensible.

*Sources: (1) Climate Case Chart 1 January 2021 (2) CCC 2 January 2021 (3) CCC 3 June 2021)*
2022 Initiative - Key Concepts

Building Electrification – Existing Buildings

Our Approach

Summarize codes and development processes
- Point of permit
- Building performance standards
- Point of sale

Prioritize
- Stakeholder engagement
- Building stock assessment
- Financing strategy
- Policy considerations

Develop code for “low-hanging fruit”
- Air-conditioning installations, new pool permits
- “End of flow” date

Reference useful tools
- Statewide Utility Program
- Cost-effectiveness studies
- Electric-preferred retrofit ordinance
- BayREN Policy Calculator
Natural Gas Costs Climbing

CA residential natural gas prices increased 3x faster than electricity prices from 2012 to 2018

Trend expected to accelerate:

Source: EIA
https://www.eia.gov/dnav/ng/hist/n3010ca3m.htm
https://www.eia.gov/electricity/data/browser/#/topic/7?agg=2.0,1&geo=g&freq=M

CEC Workshop June 6, 2019: Draft Results from E3 study on the Future of Natural Gas Distribution in California

The AB3232 Report represents the most current CEC research supporting that Aggressive Electrification is the primary pathway to meeting GHG reduction targets.
Stoves: Consumer Reports Prefers Induction

6 of top 8 Ranges for 2020 were electric, top 2 were Induction

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Model</th>
<th>Consumer Reports Rating</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction</td>
<td>GE Profile PHS930SLSS</td>
<td>86</td>
<td>$2,432</td>
</tr>
<tr>
<td>Induction</td>
<td>Kenmore Elite 95073</td>
<td>84</td>
<td>$1,525</td>
</tr>
<tr>
<td>Gas</td>
<td>LG Signature LUTD4919SN</td>
<td>84</td>
<td>$3,000</td>
</tr>
<tr>
<td>Induction</td>
<td>LG LSE4617ST</td>
<td>82</td>
<td>$2,500</td>
</tr>
<tr>
<td>Induction</td>
<td>LG LSE4616ST</td>
<td>82</td>
<td>$1,700</td>
</tr>
<tr>
<td>Smoothtop</td>
<td>Whirlpool WGE745c0FS</td>
<td>82</td>
<td>$1,000</td>
</tr>
<tr>
<td>Gas</td>
<td>Samsung NY58J9850WS</td>
<td>81</td>
<td>$2,725</td>
</tr>
<tr>
<td>Induction</td>
<td>Frigidaire Gallery FGIF3036TF</td>
<td>81</td>
<td>$1,035</td>
</tr>
</tbody>
</table>
Biogas Can’t Get Us There

Biogas Potential vs Natural Gas and Petroleum Use in the US

Annual Energy Use or Potential (Quads per Year)

0.0  5.0  10.0  15.0  20.0  25.0  30.0  35.0

Biogas Potential

Natural Gas Use
- Residential
- Commercial
- Industrial
- Vehicles
- Power Plants

Petroleum Use
- Cars
- Trucks
- Planes

Indicates more difficult-to-electrify sectors which could most benefit from biogas

Sources
- Biogas Potential – National Renewable Energy Lab
- Annual Natural Gas Use – Energy Information Administration
- Annual Petroleum Use – Federal Highway Administration