2019 EBCE Building Electrification & EV Infrastructure Reach Code Initiative Frequently Asked Questions

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A. Benefits of Electrification 1
B. Municipal Staff, Public Process, Affordable Housing 2
C. Resilience, Grid Readiness, and PG&E 2
D. Cost Effectiveness Studies 4
E. Building Technologies 6
F. Electric Vehicles, Charging & Parking 7
G. Model Code Ordinance 9

A. Benefits of Electrification

1. What are the safety and health benefits of building electrification?

Research indicates that natural gas is a major fire risk in the event of earthquake. The link between earthquakes and natural gas triggered fires is documented in the State's 2002 study: https://ssc.ca.gov/forms_pubs/cssc_2002-03_natural_gas_safety.pdf

Natural gas use in the home is linked with asthma and other health risks:

- EPA identifies indoor air quality as a significant health risk and gas appliances are listed as a point of concern: https://www.epa.gov/indoor-air-quality-iaq/inside-story-guide-indoor-air-quality
- 2019 meta research links gas stoves and asthmhttps://heetma.org/gas-cooking-and-asthma/
- 2008 Johns Hopkins study linking gas stoves and asthma https://www.sciencedaily.com/releases/2008/10/081013131530.htm
- Lawrence Berkeley Labs study linking higher concentrations of indoor air pollutants with gas cooking: https://ww2.energy.ca.gov/2019publications/CEC-500-2019-049/CEC-500-2019-049.pdf
- California Energy Commission study linking significant improvements in air quality due to electrification, which lead to substantial health benefits [1][2]: https://www.ncbi.nlm.nih.gov/pubmed/25647016
- Carbon monoxide from fuel use (a byproduct of natural gas combustion appliances such as gas heaters or stoves) has been long deemed a risk. Enough that CO sensors are required in homes that burn fossil fuels: https://www.creia.org/california-carbon-monoxide-law-takes-effect

[1] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2569107/
[2] https://homes.lbl.gov/sites/default/files/lbnl-185629.pdf

2. **What are the benefits of electric vehicles?**
   Drivers of electric vehicles identify EVs as more fun to drive in general because they are quicker, smoother and quieter than gas cars. In addition, EV drivers typically save $1,000 to $1,500 per year in reduced "fuel" and maintenance costs. And when powered by clean, renewable electricity they dramatically reduce pollution.

B. Municipal Staff, Public Process, Affordable Housing

3. **What is the impact to staff? Do Reach Codes add additional staffing burden as presented or if all electric?**
   A reach code for an all-electric requirement is very easy to permit and inspect. If exceptions are included (such as stoves), the level of effort is likely to be minor. For electric vehicle charging, the level of effort is likely equivalent to State code. The code model for "all-electric preferred" which has a mixed-fuel track does have some additional complexity for permitting and inspection of mixed-fuel homes.

4. **Is there uniformity across jurisdictions?**
   Uniformity across jurisdictions is desirable and EBCE is coordinating efforts with other regional partners to maintain consistency. However, all-electric is simple and inaction locks in future costs (such as increased retrofit costs for electrification upgrades or escalating gas rates due to a lower customer base remaining on the gas system) and risk (fire). Some variation across municipal codes is not unusual.

5. **What kind of public process was held to develop the model codes?**
   Two stakeholder (city employees, building officials and developers, public and advocates) workshops were conducted in north and south regions of East Bay Community Energy (EBCE) territory. The feedback gathered from the events were accounted for in development of model code. This is in addition to the stakeholder meetings individually organized by each city.

C. Resilience, Grid Readiness, and PG&E

6. **Doesn't having gas appliances offer more resilience?**
   Natural gas appliances in general do not support resilience as most modern gas equipment depends on electricity to operate. In emergencies gas is also shut-off.

7. **Does the code disallow: propane, diesel generators or natural gas pipe fed generators?**
   The proposed electric preferred code does not disallow propane, diesel generators or natural gas pipe fed generators. The reach code focuses on space/water heating, cooking, and clothes drying.

8. **How reliable is the electric grid as compared to natural gas?**
   The natural gas grid and electric grid both go down on occasion. In fact, during California's primary natural disaster events, wildfires and earthquakes, utilities are supposed to turn the gas off. If 100% reliability is a goal for your home or project, electrification with battery and solar backup via microgrid is the way to get there.

9. **Is the electricity on the grid "clean"?**

East Bay Community Energy purchases both carbon-free and renewable electricity on behalf of our customers. Each electricity service has a different percentage of carbon-free and renewable energy.

- 'Bright Choice' is at least 38% renewable and an additional 47% carbon-free
- 'Brilliant 100' is at least 40% renewable and an additional 60% carbon-free
- 'Renewable 100' is 100% renewable energy from California wind and solar

More details can be found at https://ebce.org/power-mix/.

10. **Will electrification require expensive transformers and distribution grid upgrades?**
Depending on the building size and the amount of EV charging some additional secondary transformers may be required. For all-electric buildings those costs have been accounted for within the overall cost-effectiveness of electrification. EV charging does represent an added cost but those costs are small relative to overall construction costs and substantially less than retrofitting.

    Additional distribution grid transformers are rare and most or all of the costs are typically the responsibility of PG&E. If there are costs to the property, they may be partially or fully offset from the savings of all-electric construction.

    The model code for EVs allows for significant use of Level 1 (low-voltage) charging and load management (i.e., systems that reduce EV peak charging demand) to minimize service and transformer costs.

11. **Do PG&E load calculations for EVs require concurrent calculation?**
The model EV code gives precedence to the National Electrical Code which allows for load management (NEC 625.42) reducing the actual load. PG&E has indicated that they calculate loads based on the information provided by the applicant on the improvement plans, single line diagram and charger equipment specifications. Load balancing equipment can be considered and when it's used, PG&E uses the current limiting amperage to determine the load for L1, L2 and L3 (DCFC). For non-residential installations the applicant will be required to provide the charger equipment specifications/cut sheets.

12. **Will transformers oversized to account for future transportation electrification lead to PG&E Deficit Billing?**
If a service upgrade is required, PG&E may be eligible for recouping certain costs if the costs are above an allowance based on past and forecasted use within 3 years. If utilization does not meet forecast, then certain costs may be recoverable. Because of the lag time between construction and when EVs will show up that could place a building in a "deficit billing" situation. There are several considerations:

    a. Designing for efficiency is very important
    b. Load management significantly reduces this risk
    c. If a deficit billing condition arises, the builder has 2 options: "lump sum" payments OR on-bill. On-bill may be attractive to amortize the costs and have beneficiaries of the installations cover the costs.

13. **Will PG&E timeframes for distribution grid upgrades slow down as a result of increased electrification?**

Turnaround times associated with PG&E and new construction are not expected to be materially different between all-electric or mixed fuel construction. Also upgrades to the distribution grid due to EV charging installations (more load than electric buildings), is rare at this point – about 3% according to our data from the CPUC. This may rise somewhat with reach codes and PG&E response times have clearly been adversely impacted by the bankruptcy. This is likely affecting both electrical and natural gas service response times. PG&E has committed to support electrification and is openly supporting all-electric reach codes due to concern about stranded natural gas assets and rising costs of maintaining the natural gas system.

D. Cost Effectiveness Studies

14. **Are the state-wide cost-effectiveness studies based on IOU utility rates or CCAs?**
    Currently, the study is based on specific IOU utility rates.

15. **For tenant/landlord situations, who is paying for the upgrades vs. who receives the benefits?**
    It depends on the metering situation (I.e. is the unit on its own utility meter or not) and the rental agreement between tenant and landlord.

16. **Are the emissions models adjusted for upstream fugitive emissions? Do they account for Renewable Portfolio Standard requirements? Is there a consideration for hydrofluorocarbons (HFC's) in GHG emission saving analysis?**
    The GHG emission factors do account for future Renewable Portfolio Standard requirements. However, the GHG emissions factors do not reflect current emissions rates which may be ahead of the RPS requirements, do not include fugitive emissions, and do not include emissions associated with HFCs.

17. **What geographical regions do the cost effectiveness results apply to?**
    The statewide IOU study covers all geographical regions in California. This initiative focuses on east bay cities covering CEC climate zone 3 and 12. The most up-to-date draft of the cost effectiveness study can be found at: http://localenergycodes.com/content/2019-local-energy-ordinances/

18. **Does the PV sizing in the analysis result in over production?**
    For most scenarios, no. The residential code allows for a slight over generation for all-electric homes with battery storage.

19. **Was there a sensitivity analysis performed on cost benefit calculations?**
    The studies were performed with a set of assumptions that the consultant teams assumed would be most realistic. Sensitivity analysis has not yet been performed.

20. **Why are different compliance margins (% above code compliance in terms of Time Dependent Valuation, or TDV) found to be cost effective between residential and nonresidential buildings?**
    The variance in compliance margins depends on occupancy type of the building and location (climate zone). These two determinants impact the energy consumption of the building, the state building code requirements, and subsequently the extent that additional energy efficiency measures are cost effective. Further information on TDV and compliance margin is available here:

https://energycodeace.com/site/custom/public/reference-ace-2016/index.html#!Documents/112performancemethoddescription.htm

21. **Did the new construction cost effectiveness study look at completely all-electric?**
    For the prototypes analyzed, yes. The residential study looked at four end uses (space heating, water heating, cooking, clothes drying). The nonresidential prototypes did not examine cooking and clothes drying.

22. **Is it truly cheaper to build all-electric? How reliable is electric equipment compared to natural gas?**
    The studies have found that for the major building end-uses all-electric appliances have a negligible impact on installation costs as compared to gas appliances. Building all-electric has substantial cost savings for avoided natural gas infrastructure. These studies examine the upfront costs, maintenance costs, and operational costs of all-electric designs and support these conclusions:
    i. Residential Building Electrification in California
    ii. 2019 Residential New Construction Cost-effectiveness Study
    iii. 2019 Nonresidential New Construction Cost-effectiveness Study

23. **What will the maintenance cost of an all-electric residential house be over the house life expectancy? Will it be more expensive in utility bills without solar panel installations?**
    The cost-effectiveness studies did not identify significantly different maintenance costs for the all-electric residences compared to mixed-fuel. Generally speaking, a minimum efficiency all-electric building operational cost was found to be slightly higher than a mixed-fuel building. However, operational costs improve dramatically with a) more efficient HVAC/DHW systems and b) more solar PV. The cost effectiveness study found that "neutral cost" all-electric homes (where gas infrastructure savings are instead invested in additional solar PV) result in on-going operational cost savings.

24. **What are the baseline PV sizing requirements for low-rise residential buildings as per 2019 Title 24 code?**
    The PV system offsets the electricity usage of a mixed-fuel home. An all-electric home is required to have a baseline PV system size equivalent to a similar mixed-fuel home.

25. **In low-rise residential buildings, 2019 Title 24 code requires Energy Design Rating (EDR) metric to demonstrate code compliance instead of compliance margin. How to explain the new metric EDR to the stakeholders?**
    0 is a 2006 IECC building, while 100 is a zero net energy building. The metric is based on CEC's Time Dependent Valuation (TDV) metric. It is a combination of the 'efficiency only' consumption of the building, and the negative EDR attributed to renewable generation and battery demand flexibility. Every building's EDR value is dependent on its specific characteristics. EnergyCodeAce also provides a good description.

26. **How is hotel prototype used as a proxy for high rise multifamily building (HRMF)? What about cooking and drying loads?**

HRMF has similar code requirements to hotels and LRMF, and similar occupancy profiles to LRMF. Both the hotel and LRMF demonstrated feasible pathways for all-electric. Nonetheless, a HRMF-specific analysis is being done currently and should be complete by this year.

27. **What about other building types not considered in the study?**
    There are many nonresidential buildings that have not yet been analyzed (e.g. laundromats, gyms, grocery stores, restaurants). In the past, the CEC has allowed extrapolating a limited set of results to other buildings. Individual jurisdictions should determine what is appropriate through their stakeholder processes. This code is not intended to apply to industrial processes.

28. **What about commercial kitchen retrofits?**
    Restaurant retrofits were not found to be cost effective. The capital cost of heat pump water heaters for restaurants is estimated to be very high. The savings corresponding to heat pump space heaters are relatively lower and do not compensate for the increase in capital costs.

E. Building Technologies

29. **What are the benefits of induction cooking? How does the induction cooking compare to gas cooking?**
    Most people are unfamiliar with induction stoves which offer superior speed, cool and safe surfaces while cooking, and better indoor air quality. For 2018 Consumer Reports' the top cooktops were electric, with induction stoves as the top two. Induction cooking has more specific temperature control, is much safer, easier to clean, and can vary heat settings faster than gas. They are also more efficient, as demonstrated by this study on Residential Cooktop Performance and Energy Comparison.
30. **Does all-electric heating use a lot of energy and can it work in our cool climate?**
    All-electric heat pumps are highly efficient and effective in weather far colder than ours. DOE studies show heat pump space heaters as highly efficient at as little as 5 degrees Fahrenheit:
    - Oak Ridge National Lab case study on cold climate heat pumps: https://www.energy.gov/eere/buildings/downloads/split-system-cold-climate-heat-pump
    - NEEA guidance on cold-climate heat pump selection: https://neea.org/img/documents/NEEA-Cold-Climate-DHP-Spec-and-Recommendations.pdf

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31. **Is the proposed equipment available in the market?**
    Heat pumps and induction stoves have a long-established history and are widely adopted in other states.[3] Also, numerous California institutions and agencies have committed to all-electric buildings which will aid scaling the know-how in California.
32. **Central water heating: Aren't central heat pump water heaters infeasible/unavailable?**
    There are multiple design options for multi-family buildings including central HPWH's in parallel, distributed HPWHs within each unit, or distributed HPWHs serving multiple units. Central HPWH it is absolutely an option with dozens of case studies and several practitioners, particularly in affordable housing. The following guide provides case studies, design insights and products: https://fossilfreebuildings.org/ElectricMFGuide.pdf

[3] https://www.synapse-energy.com/sites/default/files/Decarbonization-Heating-CA-Buildings-17-092-1.pdf

33. **Can a heat pump water heater match the performance of a gas system?**
    Yes, a heat pump water heater can equal the performance of a gas equivalent. For example, Rheem's 55 gallon unit can deliver 70 gallons of hot water in the first hour, enough for about four showers. For comparison, Rheem's gas equivalent delivers 79 gallons in the first hour. When selecting any hot water heater, no matter the fuel, make sure it is the right size for your use type.

34. **Will the heat pump water heater need to be supplemented by electric resistance?**
    Heat pump water heaters are typically designed with hybrid heating capability, including a backup electric resistance coil. This enables the heat pump to work when outside temperatures may impact the heating capacity and efficiency, and also helps the heat pump replenish its hot water supply more quickly. In most cases, particularly in mild California climates, the electric resistance coil is idle.

35. **Can the central heat pump water heater distribute adequate water supply temperature to multiple units simultaneously?**
    Yes, when designed appropriately. Many entities are supporting specific design guideline development, expected to be publicly available in early 2020. The Zero Emissions All-Electric Multifamily Construction Guide outlines demonstration projects and common implementation.

36. **With the rapid change in technologies, how soon will these all-electric technologies become irrelevant?**
    Most electrification technologies have been around for over a century. They will likely become slightly more efficient over time, but the current options available will be relevant for the life of the system.

37. **How do the costs for electric space heating and water heating compare to that of natural gas-based options?**
    The answer largely depends on the product chosen, climate, and occupant behavior. Generally, energy costs can be treated as similar. This is because while electricity is more expensive than gas per unit of energy, heat pumps are more efficient. Capital costs for new construction are lower because a building owner can avoid the high cost of a new gas meter.

38. **Are natural gas systems more efficient than all-electric?**
    In every case, all-electric systems operate more efficiently than natural gas systems.

F. Electric Vehicles, Charging & Parking

39. **EV demand: EV demand is perceived to be low raising questions about whether the proposed EV infrastructure is needed.**
    Every major automaker has announced major expansions of EVs (ex: GM: 20 new electric vehicles by 2023, Volkswagen: 50 fully electric models by 2025, Toyot10 electrified models by the end of 2020). Global purchases of vehicles are expected to be over 50% EV by 2040[4] but in California it will be much faster. In San Mateo County over 35% of residents report they are “very likely” to adopt an EV as their next vehicle.

[4] Bloomberg New Energy Finance

For our region, EV sales will likely be the majority in the next 5-6 years so the EV expansion will be well within the life of the buildings

40. **Can you explain different types of EV?**
    PEV - Plug-in Electric Vehicle, which includes both PHEV and BEV as subsets
    PHEV - Plug-in Hybrid Electric vehicle, which includes a conventional combustion engine.
    BEV - Battery electric vehicle, which does not include a conventional combustion engine.

41. **How are the electric vehicle charging spaces shared between tenants in multifamily buildings?**
    The model codes require that each parking space in a multifamily building be provided with EV infrastructure, even parking spaces that are unassigned to specific dwelling units.

42. **What are the typical costs of EVSE (Electric Vehicle Supply Equipment)?**
    Residential chargers - $400-$1200 per outlet
    Nonresidential chargers - $1000-$5000 per outlet

43. **Will a very aggressive deployment of EV readiness may put a sudden load to the electric grid?**
    Significant effort is going into planning at the infrastructure level, and smart charging capability at the EV charging station to ensure this is not an issue. Utilities are planning and preparing for increased levels of EV deployment.

44. **Do EV charging stations also count as parking spaces? If not, are cities required to separately meet minimum parking space requirements as well as minimum number of EV charging stations?**
    This initiative's intent is that an EV charging station would replace a parking space, i.e., the total number of parking spaces would remain the same even with EV reach code requirements. Our understanding is that the municipalities interpret whether an EV charging station is equivalent to a parking space. Local ordinance adoption processes should ensure that local planning and zoning interpretations do not inadvertently result in an increase in the total number of parking spaces required as a result of EV reach code adoption.

45. **Parking Stall Size: Will Requiring EV spaces make projects unviable?**
    9' x 18' is common in CA muni codes and so are larger spaces (10'x20'). Burlingame space size requirements appear to be 9' x 20' (same width, and longer than CalGreen @ 9' x 18') with an allowance for 8.5' x 18' in special circumstances. To maximize flexibility the model code removes reference to space sizes to leave space sizing up to the local jurisdiction.

46. **What is the conduit size requirement? Does it account for both Level 1 and Level 2 EV charging?**
    A 1"" conduit of the following types can adequately serve the following number of Level 2 circuits, assuming #10 THHN copper wiring:
    EMT - 4
    RNC - 3
    FMC - 3
    It appears aluminum wiring would be able to have a minimum of 2 circuits for each type of conduit.

G. Model Code Ordinance

Note: responses below related to mixed-fuel buildings are referring to the all-electric "preferred" model building code developed in part by the Building Decarbonization Coalition.[5] However, the project is also supporting many municipalities opting for all-electric codes with limited exceptions.

47. Do local governments work with public utilities on developing the ordinance?

Local governments must receive approval from the California Energy Commission before adopting local building energy ordinances. (All other ordinance types must be submitted to the Building Standards Commission). This initiative supports local governments in developing ordinances that are ready for CEC application and promote regional consistency.

48. How will the code be implemented against current standard practices?

The Statewide Utility study researched design approaches that are market ready as well as cost effective. The model codes as part of this initiative will support a flexible design approach with multiple compliance pathways.

49. Can cities directly adopt the San Francisco EV ordinance?

Yes, cities can adopt EV ordinances they feel are best for their community, subject to the constraints of their own local ordinance development process. The EBCE initiative is building upon and enhancing other EV ordinances to recommend model codes.

50. How do we apply the cost effectiveness study to develop a prescriptive approach for model ordinance?

The cost effectiveness studies determined the maximum performance level that can be achieved cost effectively through a certain set of measures. The intent was to identify a market ready performance threshold, while allowing for it to be achieved in a variety of ways. Local jurisdictions can choose to allow for an alternative prescriptive compliance path that requires this set of measures.

51. Can reach codes promote better air quality in addition to energy efficiency?

Indoor air quality impacts are not explicitly studied, though many studies have shown that avoiding indoor natural gas combustion can result in better air quality, such as:

- Results of the California Healthy Homes Indoor Air Quality Study of 2011-2013: Impact of Natural Gas Appliances on Air Pollutant Concentrations. By Nasim A. Mullen, Jina Li, Marion L. Russell, Michael Spears, Brennan D. Less, Brett C. Singer (link)
- Energy Research and Development Division FINAL PROJECT REPORT Air Quality Implications of an Energy Scenario for California Using High Levels of Electrification. By EPRI, prepared for California Energy Commission (link)
- A Longitudinal Study of Indoor Nitrogen Dioxide Levels and Respiratory Symptoms in Inner-City Children with Asthma. By Nadia N. Hansel et al. (link)

52. Are retrofits being considered in the electrification reach code?

[5] http://www.buildingdecarb.org/local-government-resources.html

Retrofits are not considered for the current scope of this initiative, except for electric-ready measures.

53. How will the Accessory Dwelling Unit (ADU)'s be addressed?

Inclusion of ADUs in model code is at the discretion of cities. Some are including ADUs in all-electric requirements, some are not.

54. How will mixed-use buildings comply?

The compliance margin percentage will be calculated as a weighted-average of the individual building results.

55. How will high-rise multifamily buildings comply?

Cost effectiveness results for high-rise multi-family building will be available in late 2019. It's likely that a compliance pathway will be available for all-electric, and a model code can be applied. In the meantime, current cost effectiveness studies have demonstrated compliance pathways for low-rise multifamily and hotel buildings, both of which are similar to high-rise multifamily buildings.

56. What building types are covered under the reach code?

Cost effectiveness studies were performed on single family, low-rise multifamily, hotel, office, and retail prototypes. At a minimum, most buildings falling under these size ranges comply with the reach code buildings. This initiative's model code applies the cost effectiveness findings to an expanded set of building types.

57. How do the proposed model reach codes affect the implementation/plan-check process?

For Performance Path - Plan check would utilize the usual compliance outputs (the CF1R report for residential, or PRF-01 for nonresidential) to review the fuel type: "Natural gas" or "All-electric," and the characteristics of the water heating and HVAC systems and whether they are gas or all-electric. Based on this information, plan check will know what compliance margins the Proposed Design will need to show compared to the 2019 code compliant Standard Design and verify that those compliance margins are achieved.

For Prescriptive Path – Plan check would need to review the plumbing drawings for the locations of natural gas piping, and which appliances are served by a natural gas pipe (if any). Plan check will then cross-reference the energy efficiency characteristics of the home as compared to the standard prescriptive requirements in Title 24 Part 6 as part of usual procedures. However, if there is natural gas piping, there will be short list of additional efficiency measures that plan check must review in addition to those required with Part 6.

Mandatory – Plan check will review the electrical drawings to ensure that adequate electrical capacity is supplied to space heating, water heating, cooking, and clothes drying end-uses.

58. Can you please advise the Energy Design Rating (EDR) equivalent to compliance margin requirement?

The proposed reach code language refers to EDR reductions from the 2019 code compliant baseline design. It is challenging to develop an exact relationship between an EDR reduction and a compliance margin because EDR includes whole-building energy use, while a compliance margin

includes only a limited set of end-uses (not including solar PV or battery, for example). The full range of compliance margins and associated EDRs are available in the residential cost effectiveness study, but as an example an efficiency-only EDR reduction of 1 is approximately equivalent to a 5% compliance margin.

59. **Please clarify the exclusion for "heavy industry and process loads" from the nonresidential portion i.e. does the nonresidential category cover warehouse or any other industrial uses?**
The energy code only lightly regulates industrial processes. The reach code doesn't cover any research into how these industrial processes could be made more efficient. Common building systems (e.g., envelope, HVAC, etc..) that must already comply with Title 24 must comply at a reach level, and the industrial processes (which are NOT part of the compliance margin) are not affected.

60. **Does 2019 Title 24 Part 6 require residential buildings to be all-electric? Will the reach code?**
Per 2019 Title 24 Part 6, all-electric construction is not a mandatory requirement, but is a compliance pathway option. There are many models of reach codes currently being adopted, with some jurisdictions allowing for mixed-fuel construction while others are looking to make all-electric mandatory. A curated list of electrification-related codes being adopted is hosted by the Building Decarbonization Coalition: http://www.buildingdecarb.org/active-code-efforts.html

61. **Can a reach code still require PV?**
Yes, cost effectiveness justification is provided for both Residential and Non-Residential buildings. We are including this in the model code.

62. **What reach code options are being adopted by other cities in California?**
The full gamut: Some are going with lower efficiency requirements for select mixed-fuel buildings (San Mateo) while others are requiring electric appliances in many cases (Menlo Park). San Luis Obispo has passed an ordinance similar to the EBCE model code.

63. **What is a 'run path'? Is it cost effective?**
"Run path" refers to CALGreen thresholds. For residential, these thresholds were not quite found to be cost-effective for the prototypes analyzed. For nonresidential, the CALGreen thresholds were found to be cost-effective for the prototypes in CZ3, but not for the 'other nonresidential' threshold in CZ4 (it was 6%).

64. **Did any city adopt ordinance with CEC approval yet? What types of codes have the cities adopted?**
Yes, the California Energy Commission approved of six very different electrification reach codes at their December 11th business meeting, including electric-preferred, all-electric and specific end-use related reach codes: https://www.energy.ca.gov/proceedings/business-meetings/2019-business-meeting. Building Decarbonization Coalition tracks reach code efforts by different cities in California here: http://www.buildingdecarb.org/active-code-efforts.html

65. **What are all-electric options for laboratory buildings?**
It depends on the context (standalone versus district system). This cost effectiveness analysis for the University Of California covers a variety of potential scenarios: https://www.ucop.edu/sustainability/_files/Carbon%20Neutral%20New%20Building%20Cost%20Study%20FinalReport.pdf

66. **Can government allow higher than federal minimum efficiencies for lighting?**
    Correspondence with CEC suggests that California was given express leave to adopt the federal lighting standards with an effective date two years ahead of the federal date, and California has done so. Thus, a simple reading would be that the standards became effective in California on Jan 1, 2018, and the current change in federal policy toward incandescent lamps has not removed California's ability to apply these standards as state standards. However, we expect there to be a lot of legal wrangling between state and federal folks once Jan 1, 2020 arrives, and it is tough to predict how things settle out.

67. **What about applying electric water heating reach code for buildings with existing PV?**
    This might work, but it depends on the existing PV system efficiency and output. The net difference for the electric water heater component would not be cost effective.

68. **What are the incremental costs for all-electric readiness during panel upgrade?**
    Costs from two contractors suggest that it is approximately $30 per breaker, and $50/pole for AFCI breakers. For 4 additional 240V breakers, this cost would be $520.

69. **Can EV charger requirement be merged with electric readiness in building code?**
    Yes, it is possible for all electric-readiness provisions to be located in Part 11 for simplicity. They do not need to be located in Part 6.

70. **What would an Energy Storage electric readiness code look like?**
    TRC is currently developing an ESS model code and hopes to have it complete in Dec 2019. The model code will be partially based on Clean Coalition's guidelines: https://clean-coalition.org/wp-content/uploads/2019/08/ECMR_-Electrification_Community-Microgrid-Ready-Guidelines_Costs-40_rf-22-Aug-2019.pdf