



# City of Palo Alto

## City Council Staff Report

(ID # 10538)

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**Report Type: Action Items**

**Meeting Date: 11/4/2019**

**Summary Title: Energy Reach Code for Building Construction**

**Title: PUBLIC HEARING: Adoption of an Ordinance Repealing Chapter 16.17 of Title 16 (Building Regulations) Related to the California Energy Code and Adopting a New Chapter 16.17 Incorporating the 2019 California Energy Code With Local Amendments and Amendments to Title 24, Chapter 6 of the California Code of Regulations. The Subject Ordinance is Exempt From the California Environmental Quality Act (CEQA) in Accordance with CEQA Guidelines Sections 15061 (b) and 15308.**

**From: City Manager**

**Lead Department: Planning and Development Services**

### **Recommendation**

Staff recommends the City Council take the following actions:

1. Adopt an ordinance repealing and restating Palo Alto Municipal Code Chapter 16.17 and amending the 2019 California Energy Code, Title 24, Part 6, of the California Code of Regulations to include local amendments (Attachment A); and
2. Adopt a resolution declaring the City's intent to mandate all-electric service for new construction effective January 2022 (Attachment B).
3. Find that the proposed action is exempt from the provisions of the California Environmental Quality Act in accordance with Sections 15308 and 15061(b)(3).

### **Executive Summary**

Every three years the State of California requires the adoption of new building codes<sup>1</sup>, including energy codes. In addition to the mandatory updates, the State allows jurisdictions to adopt more stringent energy codes – or reach codes – to help meet greenhouse gas reduction targets<sup>2</sup>. The City of Palo Alto has adopted reach codes to meet its local greenhouse gas

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<sup>1</sup> A companion report is being presented to the City Council on November 4<sup>th</sup> that proposes ordinances adopting the State-mandated building code along with some locally initiated amendments.

<sup>2</sup> Following local adoption, the California Energy Commission must also approve any reach code based on demonstrated compliance with State-mandated energy requirements, a cost-effectiveness study, and compliance

emissions reduction goals set forth in the City's Sustainability and Climate Action Plan (S/CAP) for the past 3 code cycles (nine years).

The State-mandated energy codes being adopted in this code cycle are closer to the aggressive standards previously approved by the City Council and applied to new construction projects. Statewide feasibility studies<sup>3</sup> provide support for the adoption of more stringent codes beyond the State standard. However, as technological enhancements, energy efficiencies, and construction techniques continue to improve, the margin to achieve greater reductions in greenhouse gas emissions and energy efficiencies begins to narrow. Moreover, new construction only represents about 5% of the City's overall greenhouse gas emissions reduction strategy<sup>4</sup>.

Some communities have adopted reach codes that prohibit natural gas in new construction, but may include some exceptions for gas cooking ranges, fireplaces and outdoor grills in single family homes and still other exceptions for commercial kitchens and life science research facilities. The City of Berkeley adopted a gas ban for new construction through a regulatory approach outside of the reach code process.

For Palo Alto, staff recommends a multi-pronged approach to set a two-year target for all-electric new construction and, in the meantime, incentivize all-electric construction and require any mixed-fuel construction to meet the maximum standards found to be cost-effective. This strategy is intended to further the City's greenhouse gas emission reduction goals and improve overall building efficiency and, therefore, consume or demand less energy. This approach includes all of the following:

1. Exceed State-mandated energy codes by requiring new homes and low-rise multi-family buildings of three-stories or less be built using:
  - a. An all-electric design – no gas utility hookups; or,
  - b. Mixed-fuel (electric/gas) with a design to facilitate conversion to electrical utility service AND achieve a ten point energy reduction rating (EDR 10) beyond the state standard.
2. Exceed state-mandated energy codes by requiring new office and retail buildings be constructed using:
  - a. An all-electric design – no gas utility hookups; or,

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with environmental regulations. This State-review would occur prior to the effective of the more stringent standards.

<sup>3</sup> 2019 Cost-effectiveness Study: Low-Rise Residential New Construction and 2019 Nonresidential New Construction Reach Code Cost Effectiveness Study. Retrieved from: <https://localenergycodes.com/content/2019-local-energy-ordinances/>

<sup>4</sup> The S/CAP has a goal for reducing community-wide greenhouse gas emission to 150,430 MT by 2030.

- b. Mixed-fuel with a design to facilitate conversion to electrical utility service AND increase building efficiency by a 12% margin beyond the state standard.<sup>5</sup>
3. Exceed State-mandated energy codes by requiring hotels, motels, and four-story multi-family buildings be constructed using:
  - a. An all-electric design – no gas utility hookups; or,
  - b. Mixed-fuel with a design to facilitate conversion to electrical utility service AND increase building efficiency by a 5% margin beyond the State standard.<sup>5</sup>
4. Promote voluntary electrification in existing homes and business (which represents 38% of the City’s GHG emissions reduction strategy) through:
  - a. Utility financial incentives; AND
  - b. Public outreach/education campaigns
5. Strengthen compliance with state and local reach codes by:
  - a. Requiring third-party compliance certification to ensure energy efficiency targets are achieved in new mixed-fuel buildings; AND
  - b. Define terms related to substantial remodels in the next 18 months to clearly distinguish when residential and non-residential remodels constitute new construction.
6. Declare a goal to enact an all-electric mandate for new construction effective January 2022 – one year ahead of the schedule for the next code cycle implementation.

This approach recognizes the strong community interest to reduce natural gas consumption and therefore reduce greenhouse gas emissions. It further balances this interest with homeowner desires for gas ranges and fireplaces, which are common features in new home construction and, compared to other appliances, produce less greenhouse gas emissions. The staff recommendation also leverages the City’s own utility service as a way to target existing homeowners and businessowners to encourage a voluntary transition toward all electric service which would have a meaningful impact on local greenhouse gas emission reductions and help the City achieve its 2030 S/CAP goal. To ensure better oversight of the reach code compliance, the modeling of the building energy design will require a Certified Energy Analyst (CEA) to perform the energy analysis report that is submitted to the City as part of the permitting process. The elements of this design will be enforced in the field through construction inspections. This newly added level of compliance exceeds state standards and previous Palo Alto code cycle requirements in which no CEA was required.

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<sup>5</sup> Increasing the building’s energy efficiencies by a 5-12% margin beyond the minimum state requirements requires that the building design uses less energy by improving the proposed design of the building’s energy systems, such as heating and cooling systems, better ventilation duct sealing and leakage testing, building envelope elements, such as cool-roof materials, low-e windows, increased wall and floor insulation, and quality insulation installation that require a third party inspector.

Lastly, the staff recommendation serves to provide advanced notice to prospective homebuilders and developers of the City's intent to move quickly toward an all-electric design requirement.

The balance of this report provides more background and detailed information, including alternative recommendations should the Council be interested in less or more aggressive measures in its reach code.

## Background

Palo Alto has a history of leadership in the area of sustainability and energy efficiency. Over the past three code cycles, Palo Alto has adopted local green building and energy reach code requirements that are more aggressive than the State's requirements. In April 2016, the City Council adopted a Sustainability and Climate Action Plan Framework (S/CAP), which includes an ambitious greenhouse gas reduction goal of 80% from the 1990 level by 2030. This goal is 20 years ahead of the state's goal of an 80% reduction by 2050. Subsequently, the City Council approved a three-year Sustainability Implementation Plan (SIP) spanning from 2018 to 2020, which directs staff to explore green building, energy efficiency, and electrification policy options that go beyond code minimum for the 2019 code cycle.<sup>6</sup> As shown in Figure 1, among the S/CAP emission reduction strategies, building electrification accounts for 43% of the 2030 greenhouse gas emissions reduction strategies.

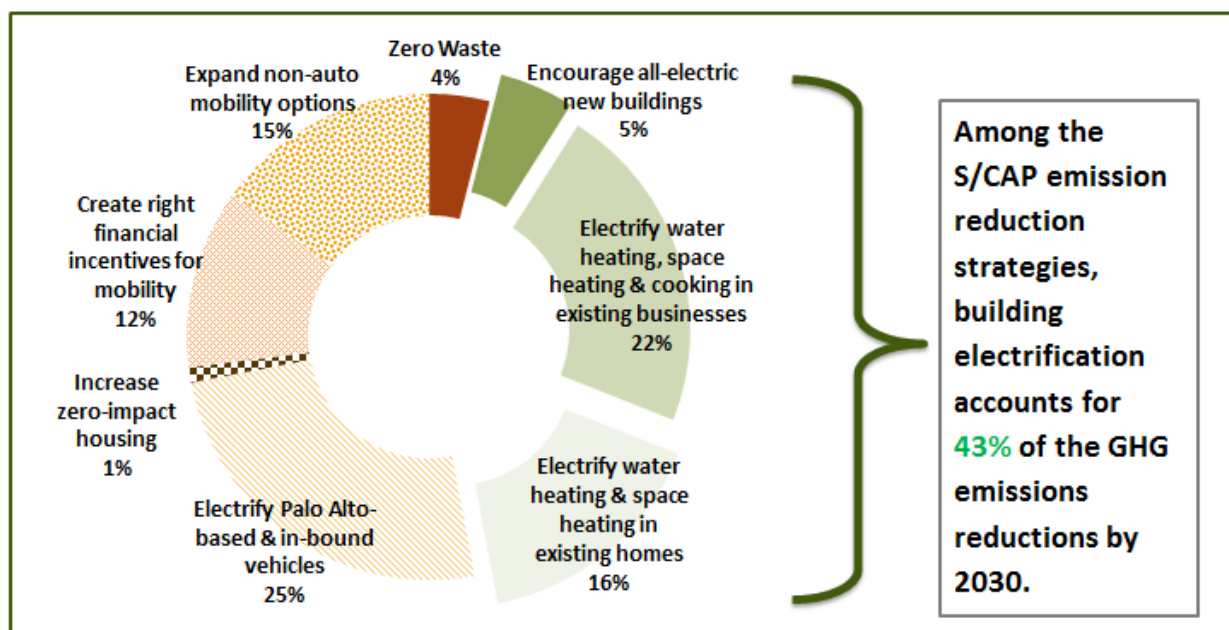


Figure 1: City of Palo Alto's S/CAP Emission Reduction Strategies.

<sup>6</sup> City of Palo Alto. (2017, December 11). City of Palo Alto Sustainability Implementation Plan (SIP) Key Actions 2018-2020. Retrieved from

[https://www.cityofpaloalto.org/services/sustainability/sustainability\\_and\\_climate\\_action\\_plan/default.asp](https://www.cityofpaloalto.org/services/sustainability/sustainability_and_climate_action_plan/default.asp)

In order to meet the S/CAP goal, an interdepartmental staff team collaborated to develop a multi-faceted strategy to expedite electrification in Palo Alto. Integral to this process was a thorough public engagement strategy through which staff sought input from the Green Building Advisory Group (GBAG)<sup>7</sup>. The GBAG is a group of green building professionals and stakeholders who has met regularly since 2013 to develop recommendations for Palo Alto's green building policies.

The 2019 California Building Energy Efficiency Standards contains new mandated energy efficiency standards and has a target effective date of January 1, 2020. The state's 2019 Building Energy Standards are more stringent than the 2016 standards. The 2019 standards require rooftop photovoltaic systems (PV) in new low-rise residential buildings (up to three stories high). Single-family homes built under the 2019 standards will use about 7 percent less energy than those under the 2016 standards due to improved energy efficiency standards. After factoring in the rooftop solar electric generation, homes built under the 2019 standards will use about 53 percent less energy than those under the 2016 standards. Nonresidential buildings will use about 30 percent less energy, due mainly to lighting upgrades.<sup>8</sup>

To achieve the state's energy efficiency and greenhouse gas reduction goals, the California Energy Commission (CEC) has encouraged cities to adopt "energy reach codes" that are more stringent than the baseline statewide requirements. Public Resources Code Section 25402.1(h)(2) and Section 10-106 of the Building Energy Efficiency Standards establish a process that allows local adoption of energy standards that are more stringent than the statewide standards. Under this process, the CEC requires any local amendments to the California Energy Code that affect energy use in regulated buildings to be cost effective (i.e. do not create additional financial burden to building owners) and use less energy than the standard requirements. Cost effectiveness and energy use findings of the proposed Energy Reach Code are provided later in this report and in the Reach Code Ordinance.

In late 2018, Palo Alto joined the statewide reach code cost effectiveness study (Statewide Study), led by the California Codes and Standards Local Ordinance Team, with participation from investor-owned utilities including Pacific Gas & Electric and Southern California Edison. The Statewide Study covers residential and non-residential new construction projects to inform local governments to develop local energy reach codes. This Statewide Study is also being used by other cities including Menlo Park, San Francisco, and San Jose to implement reach codes.<sup>9</sup>

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<sup>7</sup> Climate/Sustainability and Climate Action Plan, Green Building Update Staff Report. Retrieved from <https://www.cityofpaloalto.org/civicax/filebank/blobdload.aspx?t=59283.07&BlobID=70007>

<sup>8</sup> California Energy Commission 2019 Building Energy Standards Frequently Asked Questions. Retrieved from [https://www.energy.ca.gov/title24/2019standards/documents/2018\\_Title\\_24\\_2019\\_Building\\_Standards\\_FAQ.pdf](https://www.energy.ca.gov/title24/2019standards/documents/2018_Title_24_2019_Building_Standards_FAQ.pdf)

<sup>9</sup> When adopting energy reach codes, local governments must ensure that the code requirements are cost effective, meet the state's minimum Building Energy Standards, and do not exceed federal appliance efficiency standards. The CEC requires that local government undertake a cost-effectiveness study to demonstrate that the proposed energy reach code do not create additional financial burden to building owners while meeting the state's Building Energy Standards. See California Energy Codes and Standards. (2019, August 1). Title 24, Parts 6 and 11

The final reports of the Statewide Study were released in late July and early August 2019.<sup>10</sup> The non-residential study report includes cost effectiveness results using Palo Alto utility rates, while cost effectiveness results for residential new construction projects using Palo Alto rates are separately provided in an addendum report.<sup>11</sup>

For Palo Alto, the study found that all-electric single family and low-rise multifamily new construction projects are cost effective. For non-residential new construction projects, the study also found that all-electric medium office buildings (prototype is a 3-story, 54,000 sq.ft. office building) and medium retail buildings (prototype is a 1-story, 25,000 sq.ft. retail building) are cost effective; and mixed-fuel office and retail buildings with up to a 14% compliance margin<sup>12</sup> are cost effective. All-electric small hotels (prototype is a 4-story, 43,000 sq.ft. hotel) are not cost effective, although mixed-fuel hotels with up to a 6% compliance margin are cost effective. To meet the CEC's cost effectiveness requirements for local energy reach code, there must be one cost effective compliance pathway for each building type. For example, Palo Alto could require a compliance margin of 20% for new medium office buildings even when that is not cost effective, as long as an all-electric new medium office building is cost effective.

Once Council adopts the proposed Energy Reach Code ordinance, staff will file an application to the CEC to approve the local energy standards, along with documentation to demonstrate that the proposed local energy standards are cost effective and consume no more than energy than permitted by the Building Energy Standard. The CEC will post the locally adopted energy standards for a 60-day public comment period prior to approving the standards at a CEC business meeting. After obtaining CEC approval, staff will file the local energy standards with the Building Standards Commission. Based on this process, staff anticipates an effective date of the proposed Energy Reach Code of March 1, 2020.

## Discussion

The proposed reach code ordinance will encourage all-electric design and increase the minimum requirements for building energy performance for mixed-fuel design compared to the 2019 California Energy Code. The proposed energy ordinance adopts cost-effective compliance options and would be triggered on permit application for the following project types: 1) new one- and two-family residential, 2) new low-rise multi-family residential, 3) new commercial "non-residential" office and retail, 4) new high-rise hotel/ motel construction. A summary of the proposed standards is provided in the following table:

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<sup>10</sup> 2019 Residential New Construction Cost-Effectiveness Study (2019, August 1) and 2019 Nonresidential New Construction Cost-Effectiveness Study (2019, July 25). Retrieved from: <https://localenergycodes.com/content/2019-local-energy-ordinances/>

<sup>11</sup> Attachment C: 2019 Draft Cost Effectiveness Study: Low-Rise Residential Addendum – CPAU Analysis (2019, April 5)

<sup>12</sup> The compliance margin represents the percentage of energy savings compared to the state's Building Energy Standard, e.g. a 5% compliance margin means that the proposed building will use 5% less energy than the standard design

**Table 1. Proposed Reach Code Components**

	All- Electric Design	Mixed-Fuel Design
New One- and Two-Family Residential Buildings	No additional efficiency requirements above the Standard Building Design (16.17.110 (b)1.A)	<ul style="list-style-type: none"><li>● Increase building efficiency to achieve an EDR 10 points less than the Standard Building Design</li><li>● Electrification ready for water and space heating, cooking and clothes drying (16.17.110 (b)1.B)</li></ul>
New Low- Rise Multi-Family Buildings (3-Stories of less)	No additional efficiency requirements above the Standard Building Design (16.17.110 (b)1.A)	<ul style="list-style-type: none"><li>● Increase building efficiency to achieve an EDR 10 points less than the Standard Building Design</li><li>● Electrification ready for water and space heating, cooking and clothes drying (16.17.110 (b)1.B)</li></ul>
New Office/ Retail Buildings	No additional efficiency requirements above the Standard Building Design (16.17.080)	<ul style="list-style-type: none"><li>● Increase building efficiency to achieve 12% margin above the Standard Building Design</li><li>● Electrification ready for water and space heating, cooking and clothes drying (16.17.080 Table 140.1-A)</li></ul>
New Hotel/Motel/ Multi-Family Buildings 4-stories or more	No additional efficiency requirements above the Standard Building Design (16.17.080)	<ul style="list-style-type: none"><li>● Increase building efficiency to achieve 5% margin above the Standard Building Design</li><li>● Electrification ready for water and space heating, cooking and clothes drying (16.17.080 Table 140.1-A)</li></ul>

There are two methods for demonstrating compliance with the 2019 California Energy Code. The first type of compliance is called the “performance approach” and the second type is the “prescriptive approach”.

The performance approach is required to develop an energy budget that assigns a maximum amount of energy that a building can use within the design. Each budget is unique to the project and is based on many factors. Examples of components that contribute to an energy budget include location, size and orientation, building geometry, exterior wall design, and heating and cooling system design. The allowable energy budget for a building is referred to as the “standard” design. The actual energy budget for the design of a building is referred to as the “proposed” design.

The prescriptive approach can also be used for new construction, additions and alterations and it prescribes a set of standard requirements for all the energy components of the building design and accounts for the climate zone of the building’s location. The prescriptive approach is typically more conservative and less flexible than the performance approach.

The proposed energy reach code ordinance (see Attachment A) encourages all-electric new construction projects and will require higher energy efficiency standards than the 2019 Building Energy Standards and all-electric readiness for newly-constructed residential and non-residential buildings with connected natural gas service. The efficiency requirements will vary by building type.

In the 2019 California Energy Code, there will be a new rating for the energy performance for new residential buildings. New low-rise residential construction will be measured by an Energy Design Rating (EDR) and will be used in the energy modelling software. The EDR score is a metric for energy performance measured on a scale of zero (0) to one hundred (100). A score of zero is a zero-net-energy building and a score of 100 represents an inefficient building with the energy consumption of a building built to the requirements of the 2006 International Energy Conservation Code. The lower the EDR index score, the better.

For new one and two-family dwellings and low-rise multi-family residential buildings of three stories or less, the design performance approach of these buildings will increase the building’s energy efficiency by reducing the building’s required Energy Design Rating (EDR) score. The proposed building’s EDR score will be required to be lower than the Standard Building EDR based on the building type and use (see Table 1). This design approach will include certain exceptions to account for limited solar access. Staff recommends that the energy analysis report or the Certificate of Compliance is required to be performed by a Certified Energy Analyst, who is registered with the California Association of Building Energy Consultants, as an added assurance for compliance.

In lieu of the performance method, a prescriptive compliance approach can be utilized for low-rise residential construction, that specifies additional measures and higher standards for the



building's energy systems and components, such as higher efficiency space and water heating systems, increased floor slab insulation to reduce heat loss, cool-roof products with increased solar reflectance for less heat absorption and lower cooling loads, duct system sealing and leakage testing to increase efficiency, ducts located in conditioned space to reduce heat loss, and ducted central force air heating systems for better efficiency. (See Attachment A, 2019 Energy Code Ordinance for Low-Rise Residential Prescriptive Standards 16.17.110).

New nonresidential buildings, such as office, retail, hotels, motels and high-rise residential buildings of four stories or more, will have performance design requirements that increase the building's energy performance standards by reducing the building's energy budget compared to the Standard Building Design by 5-12%, depending upon the occupancy type (see Table 1). The increased efficiency margins have found to be cost-effective for Palo Alto's climate zone 4 as referenced in the Statewide Cost-Effectiveness Study<sup>13</sup>. Staff also recommends that this performance approach should require a Certified Energy Analyst to perform the energy analysis report or Certificate of Compliance.

Similarly, as an alternate to the performance design approach, prescriptive compliance measures that provide additional and higher performance requirements for some of the building components can be used, such as cool roof products, economizers for air-handling systems, reduced lighting densities, daylight dimming controls, drain water heat recovery devices, etc. (See Attachment A, 2019 Energy Code Ordinance, 16.17.090, Section 140.2).

The all-electric readiness requirements apply only to new buildings that will be connected to natural gas service. This means that in order to meet the Reach Code's requirements, these buildings with gas connections must include electric circuits and/or conduit for water and space heating equipment, cooking equipment and clothes dryers, as well as space requirements for water heaters in preparation for an eventual conversion from gas to electric appliances.

The residential energy reach code ordinance for one- and two-family dwellings do not apply to additions and Accessory Dwelling Units, ADUs. This is an effort to encourage and not restrict the construction of ADU's to alleviate the housing shortage within Palo Alto. Residential additions and alterations are also not subject to the energy reach code. Retrofitting existing buildings for electrification was not part of the statewide cost-effectiveness study. It is difficult to mandate electric-readiness, which would require upgrading the service panel to 200 amps and installing electrical conduits to all existing gas appliances, for remodel projects on existing buildings that did not incur any electrical work. Staff has discussed with the Energy Commission staff and with the City's energy consultant on how to apply electrification readiness to existing buildings, with no reasonable approaches identified to date. The Energy Commission staff is aware of these challenges and plans future studies to address electrifying existing buildings.

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<sup>13</sup> 2019 Nonresidential New Construction Cost-Effectiveness Study (2019, July 25). Retrieved from: <https://localenergycodes.com/content/2019-local-energy-ordinances/>

In addition, new non-residential industrial and manufacturing buildings do not fall under the reach code and are not required to be designed with a higher efficiency margin than the standard design. These buildings were not part of the cost-effectiveness study<sup>14</sup> and thus cannot be shown to be cost-effective with the proposed ordinance, as required by the California Energy Commission.

The all-electric design will be the preferred design for all building types, residential and non-residential. As such, an all-electric building is only required to meet the performance standard of the Standard Building Design with no additional energy efficiencies or increased prescriptive requirements or measures required.

### Comparison to Other Jurisdictions

More than fifty communities in California are considering adopting reach codes. Some cities have been exploring the feasibility of an all-electric reach code where new buildings are not permitted to have natural gas beginning in January 2020. The local ordinances of these cities have many provisional conditions that allows gas infrastructure in new construction projects.

In July, the City of Berkeley adopted an ordinance banning natural gas infrastructure in new buildings. Exemptions to the ordinance include building systems that have not been modeled for all electric design by the CEC, internal ADUs, and an exemption for cases natural gas use is shown to serve the public interest.<sup>15</sup> As part of the gas ban adoption, the City of Berkeley has also approved an allocation of \$238,341 per year to fund a two-year position in the building division to assist with implementing the gas prohibition ordinance and reach codes, including training staff and assisting permit applicants.

In September, the City of Menlo Park adopted a reach code ordinance that requires residential buildings (three stories or less) to be electrically heated or all-electric. These residential buildings are still allowed to use gas for stoves, fireplaces, or other appliances if desired provided there is pre-wiring for electric appliances. The ordinance also requires non-residential buildings and high-rise residential buildings to be all-electric with a few exceptions. Life science buildings may use natural gas for space heating and public agency owned and operated emergency operations centers may use natural gas if they demonstrate that an all-electric design is not cost effective and feasible. In addition, Menlo Park's ordinance allows non-residential kitchens to appeal to use natural gas stoves.<sup>16</sup>

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<sup>14</sup> 2019 Nonresidential New Construction Cost-Effectiveness Study (2019, July 25). Retrieved from: <https://localenergycodes.com/content/2019-local-energy-ordinances/>

<sup>15</sup> City of Berkeley. (2019, July 9). City Council Agenda Action Calendar Item C “Adopt an Ordinance adding a new Chapter 12.80 to the Berkeley Municipal Code Prohibiting Natural Gas Infrastructure in New Buildings.” Retrieved from [https://www.cityofberkeley.info/Clerk/City\\_Council/2019/07\\_Jul/Documents/2019-07-16\\_Revised\\_Packet\\_2019-07-16\\_Item\\_C\\_Adopt\\_an\\_Ordinance\\_adding\\_a\\_new\\_Chapter\\_pdf.aspx](https://www.cityofberkeley.info/Clerk/City_Council/2019/07_Jul/Documents/2019-07-16_Revised_Packet_2019-07-16_Item_C_Adopt_an_Ordinance_adding_a_new_Chapter_pdf.aspx)

<sup>16</sup> City of Menlo Park. (2019, September 24). City Council Meeting Agenda Item J-3 “Adopt Ordinance No. 1057 to establish local amendments to the 2019 California Energy Code that require higher levels of building electrification

Also in September, the City of San Jose adopted a reach code ordinance that requires new mixed-fuel buildings using natural gas to meet higher efficiency requirements and be pre-wired for electrification; all-electric buildings are exempt from these requirements.<sup>17</sup> San Jose City Council also directed staff to introduce a companion ordinance in October that will require all new municipal buildings to be all-electric, as well as requiring all new single-family and low-rise multi-family housing to be all-electric.

### Goal of 2022 All-Electric Mandate for New Construction Projects

Attached is a proposed resolution expressing the City Council's goal to adopt an all-electric mandate for new residential and non-residential buildings with an effective date of January 2022.

With ongoing active promotion of the many benefits of all-electric buildings, including lower construction costs, improved indoor air quality and safety, and avoided greenhouse gas emissions, staff expects that a majority of the new construction projects in Palo Alto in 2020 and 2021 will be all-electric design. During this time, city staff will also research and develop practical solutions to encourage electrification and energy efficiency upgrades in existing buildings. Calendar years 2020-2021 would serve as a transitional period for the building industry to gain experience with all-electric design, and for equipment suppliers to plan their inventory to meet industry needs and prepare to solve some the current challenges to an all-electric mandate.

There are several challenges to all-electric mandates for commercial buildings. As an example, heat pump equipment to meet the air conditioning load for life science and laboratory buildings is currently not commercially available or could be very costly for other large commercial buildings<sup>18</sup>. Many restaurant owners continue to prefer gas equipment for cooking and other food preparations. Additionally, the compliance software<sup>19</sup> for Title 24 Building Energy Standard currently does not accommodate central heat pump space heating and water heating, which would make compliance with an all-electric mandate very difficult for large commercial buildings and high-rise multifamily buildings. The California Energy Commission is aware of this

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and solar production for newly constructed buildings to reduce greenhouse gas emissions effective January 1, 2020." Retrieved from <https://www.menlopark.org/DocumentCenter/View/22922/J3---Second-reading-and-adoption-of-reach-code-ord-CC?bidId=>

<sup>17</sup> City of San Jose. (2019, September 17). City Council Meeting Agenda Item 7.3 "Building Reach Code for New Construction." Retrieved from <https://sanjose.legistar.com/LegislationDetail.aspx?ID=4123955&GUID=2028B4BB-E839-4E3C-A340-066CE3452D29&Options=&Search=>

<sup>18</sup> Letter from Stanford Real Estate on Potential All-Electric Mandate for Non-Residential Buildings in Palo Alto, September 27, 2019.

<sup>19</sup> The CEC creates computer software for new construction projects to demonstrate compliance with the state's Building Energy Standards. To apply for a building permit for a proposed new construction project, the designer needs to use the compliance software to show that the simulated energy usage for the building based on the envelope design, energy systems, etc. does not exceed the energy usage of a similar building that meets the state's efficiency requirements (baseline requirements).

limitation and is working to include these systems in a future release of the compliance software.

Some challenges also remain to an all-electric mandate for the residential sector. Residential consumers are likely to have limited awareness of efficient electric alternatives to space and water heating and continue to express a passion for gas cooktops and gas fireplaces. There are limited equipment options for heat pump radiant floor heating and many contractors are unfamiliar with these systems.

For large nonresidential buildings, central heat pump space and water heating systems are not modeled in the energy compliance software; until the software can model these systems, all-electric mandate will need exceptions. It is currently difficult to find commercially available heat pump equipment for these spaces.

#### Customer Programs and Education Campaign

Palo Alto is a fully built-out city, with less than 1% of the building stock being torn down and rebuilt each year. To meet the City's aggressive greenhouse gas reduction goals, it is necessary to address emissions from existing building stock in addition to major reconstruction. The Utilities Department (CPAU) offers customer programs and education campaigns to promote and facilitate building electrification targeting the existing building stock, but an expansion of these programs will incentivize electrification of existing buildings and complement the Reach Code.

CPAU's existing programs include rebate programs and technical assistance. CPAU launched a Heat Pump Water Heater (HPWH) Rebate pilot in 2016 to promote the replacement of gas water heaters with heat pump water heaters. CPAU will be launching a Home Electrification Readiness assessment at the end of 2019 to help homeowners evaluate their energy use and assess the master electric panel for home electrification.<sup>20</sup> This service will be offered as part of CPAU's Home Efficiency Genie program.

Over the next 12 months, CPAU plans to launch a broader suite of electrification incentives to drive electrification of existing buildings. These incentives will cover air source heat pumps for space conditioning, induction cooking, and high efficiency electric clothes dryers. In addition, CPAU plans to offer a rebate to homeowners who install an EV charger and upgrade their master electric panel at the same time, which makes additional electrification measures easier to implement. Having a menu of home electrification incentives gives homeowners the option to either replace home appliances one at a time as appliances reach the end of useful life or do it more comprehensively as part of a remodeling project to fully electrify the house and disconnect the gas meter.

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<sup>20</sup> Most older homes in the city have electric panels with a limited capacity of 100 amps. While this is sufficient for homes with gas water heating, gas space heating and gas cooking, a 100amp panel is insufficient to handle the additional power draw when gas appliances are replaced with electric alternatives and also for EV charging. A minimum master electric panel capacity of 200amp is recommended for panel upgrade in single family homes.

To complement the home electrification incentives, CPAU will actively promote an education campaign to raise the awareness of the benefits of an all-electric home. Recently, CPAU launched a Home Electrification webpage<sup>21</sup> as an online resource for homeowners. Staff plans to build on this webpage as new electrification incentive becomes available for each type of appliance, along with home efficiency improvement tips to improve comfort and minimize utility bills. Aside from the website, CPAU will undertake extensive community outreach including customer workshops, neighborhood meetings, and targeted social media campaigns to educate the public on the benefits of electric appliances. An example of this type of outreach is the Electrification Expo held on October 10 where representatives from various appliance manufacturers, contractors, environmental advocacy groups and energy consultants were available to answer questions. Leading experts on building electrification gave presentations to explain why and how to electrify homes (see Attachment F for the keynote presentation). The Expo was free to the public and attracted over 400 attendees. CPAU plans to organize similar events in the future to promote building electrification. CPAU also plans to work with other local governments and environmental advocacy groups to get the maximum exposure of the building electrification campaign across the Bay Area.

Currently, program delivery models are primarily based on rebates and technical assistance, but as opportunities present themselves, CPAU will partner with other agencies and/or supply chain actors to facilitate building electrification. For example, the City is collaborating with the Bay Area Regional Energy Network (“Bay REN”) to launch a regional HPWH market transformation program in 2020 that offers incentives to distributors and contractors to install HPWHs. Midstream incentives lower the inventory cost of stocking HPWH units to distributors and contractors, and therefore helps to encourage contractors to promote HPWH as a water heater replacement option. CPAU will also explore on-bill financing in the future when the new utility billing software enables this function.

## **Resource Impact**

In preparation of this request, the former Development Services Department engaged the services of an energy consultant who performed a Cost Effectiveness Study at a cost of \$80,000 and Green Building Consultant who provided support for program development and implementation at a cost of \$73,000. These costs spanned two fiscal years and were covered by the department budget which is fully fee funded. Staff estimates that it will cost an additional \$25,000 annually for Green Building Consultants to continue program implementation for the attached ordinance. The budget to cover these annual costs is included in the Planning and Development Services base budget. In Fiscal Year 2022, in preparation for the 2023 code adoption cycle, staff will need to complete another Cost Effectiveness Study which is anticipated to also cost approximately \$80,000. If additional budget is needed at that time, staff will include the request in the Fiscal Year 2022 Proposed Operating Budget and adjust fees accordingly so that appropriate costs are recovered through fees. If the City Council expands the scope of ordinance, either upon approval of this ordinance or directs staff to increase the

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<sup>21</sup> <https://www.cityofpaloalto.org/electrification>

scope (home electrification) prior to 2023, staff will need to access the new scope, obtain cost estimates and return to City Council for additional resources and realignment of fees to cover the costs.

Staff time and other resources will be required to implement the utility programs intended to complement the Reach Code effort. The cost of the home electrification incentives in year 1, 2 and 3 is estimated at around \$500K, \$600K, and \$800K respectively. It will require 0.75 FTE to 1.0 FTE to administer the incentive programs, implement a marketing/education campaign, and manage technical assistance, as well as the cost of the marketing and outreach. Customer incentives account for the biggest fraction of this cost, increasing from 55% in year 1 to 85% in year 3. The total 3-year costs were estimated at \$1.9 million. Various funding sources are available for these programs depending on program benefits and terms, including Low Carbon Fuel Standard funds and certain revenues related to Cap and Trade Program activities. Staff is evaluating possible funding sources and prioritizing funding sources (like Low Carbon Fuel Standard funds) that do not result in rate increases. The budget for these utility programs will be reviewed internally, examined in the context of departmental priorities and capacity, and evaluated through the development of the FY 2021 Budget and brought forward through the budget process as appropriate.

## **Policy Implications**

Based on the proposed reach code, staff estimates annual avoided greenhouse gas emissions of 280 MT (Million Tons), 307 MT and 325 MT in year 1, 2 and 3 respectively of the 3-year code cycle. Assuming a 50-year building life, the total avoided greenhouse gas emissions are estimated at 48,750 MT.

For the proposed building electrification incentive programs, staff estimates annual avoided greenhouse gas emissions of 62 MT, 110 MT, 188 MT for rebates processed in year 1, 2 and 3. We expect that electric appliances will remain in place after the initial fuel switch and therefore the total avoided greenhouse gas emissions over a 50 year period is estimated at 18,025 MT.

The proposed reach code supports the City's S/CAP Framework and the greenhouse gas reduction goal of 80% from the 1990 level by 2030. It is also consistent with the key action EGY 5 in the 2018-2020 Sustainability Implementation Plan ("Develop programs that will result in even greater efficiency savings and decarbonization from 2020 to 2030. Potential evaluations include higher efficiency standards for new and existing buildings.")

Given that new home construction represents less than a 1% per year turnover of the existing residential building stock (and less than that for commercial customers), staff expects only a small impact to the gas utility from an all-electric mandate for new construction. Staff is working to assess the long-term impacts of building electrification on the gas utility in the coming years, including participating in a working group on this issue with various stakeholders from across the State. Such an assessment is included in the Utilities Department's strategic plan.

## **Stakeholder Engagement**

On February 22, 2018, the City of Palo Alto hosted the “Green Building Summit” at Mitchell Park Library. Approximately 100 community stakeholders gathered to explore ways to address priorities in the 2019 update of local green building and energy reach code. Areas covered during the summit included: Energy, Water Efficiency, Electrification, Emissions, Indoor Air Quality, Construction Debris, Demolition, and Salvage. Following the Green Building Summit, the Technical Advisory Committee (TAC), a sub-committee of the GBAG, continued to meet between May and September 2018 to develop the requirements of Palo Alto’s green building ordinance and energy reach code.

During the summer of 2019, the City held meetings with the public in addition to meetings with technical stakeholders to describe the proposed reach code requirements and collect feedback on any questions and concerns. The city used various communication channels to alert the public about the event, including online calendars, community list servers, newsletters, city website posts Printed fliers, and social media platforms (Nextdoor, Twitter, and Facebook). Two public engagement meetings were held in August and attended by 25-40 community members. The TAC was reconvened in August and October to support refinement of the staff recommendation for the 2019 Energy Reach Code.

At the October 2 Utilities Advisory Commission (UAC) meeting, staff gave an overview of the background of energy reach code, the 2019 reach code development process, reach code options adopted by other cities, and proposed utility initiatives to support building electrification. (see UAC presentation in Attachment E)

## **Environmental Review**

This action is exempt from the California Environmental Quality Act under CEQA Guidelines section 15308 as an action by the City for protection of the environment, and under section 15061(b)(3) on the grounds that the proposed standards are more stringent than the State energy standards, there are no reasonably foreseeable adverse environmental impacts and there is no possibility that the activity in question may have a significant effect on the environment.

### **Attachments:**

- Attachment A: Ordinance Repealing and Restating Ch 16.17 Energy Code
- Attachment B: CPA All Electric Resolution
- Attachment C: 2019 Low Rise Reach Code Analysis CPAU Rates
- Attachment D: 2019 Reach Code-Handout
- Attachment E: 2019 Reach Code Presentation- Oct 2 UAC meeting
- Attachment F: 2019 CPA Electification Expo Keynote Presentation 10.10.19

Ordinance No.  
Ordinance of the Council of the City of Palo Alto Repealing and  
Restating Chapter 16.17 of the Palo Alto Municipal Code, California  
Energy Code, 2019 Edition, and Local Amendments and Related Findings

The Council of the City of Palo Alto does ORDAIN as follows:

**SECTION 1.** Chapter 16.17 of the Palo Alto Municipal is hereby amended by repealing in its entirety Chapter 16.17 and adopting a new Chapter 16.17 to read as follows:

**16.17 CALIFORNIA ENERGY CODE**

**16.17.010 2019 California Energy Code adopted.**

The California Energy Code, 2019 Edition, Title 24, Part 6 of the California Code of Regulations together with those omissions, amendments, exceptions and additions thereto, is adopted and hereby incorporated in this Chapter by reference and made a part hereof the same as if fully set forth herein. Except as amended herein, all requirements of the California Energy Code, 2019 Edition, Title 24, Part 6 of the California Code of Regulations shall apply.

Unless superseded and expressly repealed, references in City of Palo Alto forms, documents and regulations to the chapters and sections of the former California Code of Regulations, Title 24, shall be construed to apply to the corresponding provisions contained within the California Code of Regulations, Title 24, 2016. Ordinance No. 5383 of the City of Palo Alto and all other ordinances or parts of ordinances in conflict herewith are hereby suspended and expressly repealed.

One copy of the California Energy Code, 2019 Edition, has been filed for use and examination of the public in the Office of the Building Official of the City of Palo Alto.

**16.17.020 Violations -- Penalties.**

It is unlawful for any person to violate any provision or to fail to comply with any of the requirements of this Chapter or any permits, conditions, or variances granted under this Chapter. Violators shall be subject to any penalty or penalties authorized by law, including but not limited to: administrative enforcement pursuant to Chapters 1.12 and 1.16 of the Palo Alto Municipal Code; and criminal enforcement pursuant to Chapter 1.08 of the Palo Alto Municipal Code. Each separate day or any portion thereof during which any violation of this Chapter occurs or continues shall be deemed to constitute a separate offense.



When the chief building official determines that a violation of this Chapter has occurred, the chief building official may record a notice of pendency of code violation with the Office of the County Recorder stating the address and owner of the property involved. When the violation has been corrected, the chief building official shall issue and record a release of the notice of pendency of code violation.

**16.17.030      Enforcement -- Criminal Enforcement authority.**

The employee positions designated in this section are authorized to exercise the authority provided in California Penal Code section 836.5 for violations of this Chapter. The designated employee positions are: (1) chief building official, (2) assistant chief building official, (3) building inspection manager, and (4) code enforcement officer.

**16.17.040      Local Amendments.**

The provisions of this Chapter shall constitute local amendments to the cross-referenced provisions of the California Energy Code, 2019 Edition, and shall be deemed to replace the cross-referenced sections of said Code with the respective provisions set forth in this Chapter.

**16.17.050      Section 100.1 Definitions and Rules of Construction**

Section 100.1(b) is amended by adding the following definitions:

**ALL-ELECTRIC BUILDING or ALL-ELECTRIC DESIGN** is a building or building design that uses a permanent supply of electricity as the source of energy for all space heating, water heating (including pools and spas), cooking appliances, and clothes drying appliances, and has no natural gas or propane plumbing installed in the building.

**CERTIFIED ENERGY ANALYST** is a person registered as a Certified Energy Analyst with the California Association of Building Energy Consultants as of the date of submission of a Certificate of Compliance as required under Section 10-103 of the Building Energy Efficiency Standards for Residential and Non-Residential Buildings.

**FREE STANDING ACCESSORY DWELLING UNIT** is a detached building that is not intended for sale separate from the primary residence, on a lot that is zoned for single-family or multifamily use, located on the same lot as an existing dwelling, and does not exceed 900 square feet of total floor area.

**MIXED-FUEL BUILDING or MIXED-FUEL DESIGN** is a building or building design that uses natural gas or propane as fuel for space heating, water heating (including pools and spas), cooking appliances or clothes drying appliances or is plumbed for such equipment.

**16.17.060      Section 110.10 Mandatory Requirements For Solar Ready Buildings.**

Section 110.10 Mandatory Requirements for Solar Ready Buildings is amended as follows:

(f) Subsection 110.10(f) is added to read:

(f) **Existing tree canopies.** In the event of a conflict between the provisions of this Code, the Solar Shade Act of 2009, and the Palo Alto Tree Ordinance (Chapter 8.10), the most protective of existing tree canopies shall prevail.

**16.17.070 SUBCHAPTER 5 -NONRESIDENTIAL, HIGH-RISE RESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES – PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR ACHIEVING ENERGY EFFICIENCY**

**Section 140.0 - Performance and Prescriptive Compliance Approaches**

Section 140.0 of the 2019 California Energy Code is amended to as follows:

- (b) The requirements of Sections 120.0 through 130.5 (mandatory measures for nonresidential, high-rise residential and hotel/motel buildings)-and:

**for all newly constructed buildings and additions, including new equipment installed to serve additions:**

1. The entire solar zone, as specified in Section 110.10, shall have a solar PV system installed that meets the minimum qualification requirements as specified in Joint Appendix JA11, subject to the exceptions in Section 110.10.
  - A. Exception to 140.0(b)1. Additions.
2. **Electric-Ready Mixed-Fuel Buildings.** Mixed-fuel buildings shall meet the following requirements:
  - A. **Water Heating**
    - i. A dedicated 240 volt 30-amp electrical receptacle is required, that is connected to the electric panel with conductors of adequate capacity, within 3 feet from the water heater and accessible to the water heater with no obstructions.
    - ii. Both ends of the unused conductor shall be labeled with the words “For Future Heat Pump Water Heater” and shall be electrically isolated.
    - iii. A condensate drain is required, that is no more than 2 inches higher than the base of the installed water heater and allows natural draining without pump assistance.
    - iv. Water heaters shall be located in an area with a minimum of 700 cubic feet of volume, or a ducting plan is required for eight-inch supply and exhaust ducts to the exterior or to a space with 700 cubic feet of volume.

Exception to 140.0(b)2.A.iv. The space and ventilation requirements may be reduced to conform with the manufacturer’s recommendations for a specific heat pump hot water heater that meets the requirements of Sections 110.0, 110.1 and 110.3.

1. **Clothes Drying**

- i. A dedicated 240-volt, 40 amp electrical receptacle is required that is connected to the electric panel with conductors of adequate capacity, within 3 feet of the appliance and accessible with no obstructions.
- ii. Both ends of the unused conductor shall be labeled with the words "For Future Heat Pump Clothes Drying" and be electrically isolated.

2. **Cooktop or Range.**

- i. A dedicated 240-volt, 50 amp electrical receptacle that is connected to the electric panel with conductors of adequate capacity, within 3 feet of the appliance and accessible with no obstructions.
- ii. Both ends of the unused conductor shall be labeled with the words "For Future Inductive Range" and shall be electrically isolated.

EXCEPTION to 140.0(b)2.A, B, and C: If gas or propane plumbing is not installed for the specified end uses.

3. **Other Gas Equipment.**

- i. For equipment that is specified or connected to natural gas or propane plumbing, the building shall include designated raceways and reserved capacity on the main electrical panel and subpanels, if applicable, sufficient to power electric equipment that provides the equivalent function to the intended function of the gas equipment; or,
- ii. If gas plumbing exists but no gas equipment is specified or connected, the building shall include designated raceways and reserved capacity on the main electrical panel and subpanels, if applicable, sufficient to provide equivalent power at a maximum gas flow rate under normal gas service pressure. Plans shall include calculations for delivered gas power and equivalent electrical power, conductors, raceway sizes and panel capacities.

Exception to 140.0(b)2.D. If the applicant demonstrates that there is no viable electrical equipment that can perform the intended function of the gas equipment.

- 4. All newly installed raceways between the main electric panel and any subpanels, and the point at which the conductors serving the building connect to the common conductors of the utility distribution system shall be sized for conductors adequate to serve all of the building's electrical requirements, including PV as specified Section 140.0(b)1 and future electric loads as specified in Section 140.0(b)2.
- 5. If the building includes an electrical transformer(s) feeding the main panel or any subpanels, the transformer(s) shall be located in a space large enough to accommodate a transformer(s) with a rated capacity

sufficient to serve all of the building's electrical requirements, including PV as specified in Section 140.0(b)1 and future electric loads as specified in Section 140.0(b)2.

**16.17.080 Section 140.1 – Performance Approach: Energy Budgets**

Section 140.1 of the 2019 California Energy Code is amended to read as follows:

A newly constructed All-Electric Building complies with the performance approach if the energy budget calculated for the proposed design building under Subsection (b) is no greater than the energy budget calculated for the Standard Design Building under Subsection (a).

A newly constructed Mixed-Fuel Building complies with the performance approach if the energy budget calculated for the proposed design building under Subsection (b) has a compliance margin, relative to the energy budget calculated for the Standard Design Building under Subsection (a), of at least the value specified for the corresponding occupancy type in Table 140.1-A below.

Table 140.1-A Mixed Fuel Building Compliance Margins

<u>Occupancy Type</u>	<u>Compliance Margins</u>
<u>Office Building</u>	<u>12%</u>
<u>Retail Store</u>	<u>12%</u>
<u>Hotel/motel and High-rise residential</u>	<u>5%</u>
<u>Industrial/Manufacturing</u>	<u>0%</u>
<u>All other Nonresidential occupancies</u>	<u>5%</u>

- (a) **Energy Budget for the Standard Design Building.** The energy budget for the Standard Design Building is determined by applying the mandatory and prescriptive requirements to the proposed design building. The energy budget is the sum of the TDV energy for space-conditioning, indoor lighting, mechanical ventilation, service water heating, and covered process loads.
- (b) **Energy Budget for the Proposed Design Building.** The energy budget for a proposed design building is determined by calculating the TDV energy for the proposed design building. The energy budget is the sum of the TDV energy for space-conditioning, indoor lighting, mechanical ventilation and service water heating and covered process loads.
- (c) **Calculation of Energy Budget.** The TDV energy for both the Standard Design Building and the proposed design building shall be computed by Compliance Software certified for this use by the Commission. The processes for Compliance Software approval by the Commission are documented in the ACM Approval Manual.
- (d) **Certificate of Compliance.** The Certificate of Compliance shall be prepared and signed by a Certified Energy Analyst and the energy budget for the Proposed Design shall be no greater than the Standard Design Building.

## **16.17.090 Section 140.2 - Prescriptive Approach**

Section 140.2 of the 2019 California Energy Code is amended to read as follows:

To comply using the prescriptive approach, a building shall be designed with and shall have constructed and installed systems and components meeting the applicable requirements of Sections 140.3 through 140.9, and the following requirements, as applicable:

### **(a) Mixed-Fuel Buildings of Hotel, Motels or High-Rise Multifamily Occupancies**

1. Install fenestration with a solar heat gain coefficient no greater than 0.22.
2. Design Variable Air Volume (VAV) box minimum airflows to be equal to the zone ventilation minimums.
3. Include economizers and staged fan control in air handlers with a mechanical cooling capacity  $\geq 33,000$  Btu/h.
4. Reduce the lighting power density (Watts/ft<sup>2</sup>) by ten percent (10%) from that required from Table 140.6-C.
5. In common areas, improve lighting without claiming any Power Adjustment Factor credits:
  - A. Control to daylight dimming plus off per Section 140.6(a)2H, and
  - B. Perform Institutional Tuning per Section 140.6(a)2J
6. Install one drain water heat recovery device per every three guest rooms that is field verified as specified in the Reference Appendix RA3.6.9.

### **(b) All Other Nonresidential Mixed-Fuel Buildings**

1. Install fenestration with a solar heat gain coefficient no greater than 0.22.
2. Limit the fenestration area on east-facing and west-facing walls to one-half of the average amount of north-facing and south-facing fenestration.
3. Design Variable Air Volume (VAV) box minimum airflows to be equal to the zone ventilation minimums where VAV systems are installed.
4. Include economizers and staged fan control in air handlers with a mechanical cooling capacity  $\geq 33,000$  Btu/h.
5. Reduce the lighting power density (Watts/ft<sup>2</sup>) by ten percent (10%) from that required from Table 140.6-C.
6. Improve lighting without claiming any Power Adjustment Factor credits:
  - A. Perform Institutional Tuning per Section 140.6(a)2J, and
  - B. In office spaces, control to daylight dimming plus off per Section 140.6(a)2H, and

- C. Install Occupant Sensing Controls in Large Open Plan Offices per Section 140.6(a)2l.

#### **16.17.100 SUBCHAPTER 7 - LOW-RISE RESIDENTIAL BUILDINGS- MANDATORY FEATURES AND DEVICES**

**Section 150.0 - Mandatory Features and Devices.** Section 150.0 of the 2019 California Energy Code is amended to read as follows:

Low-rise residential buildings shall comply with the applicable requirements of Sections 150(a) through 150(~~sr~~).

NOTE: The requirements of Sections 150.0 (a) through (~~sr~~) apply to newly constructed buildings. Sections 150.2(a) and 150.2(b) specify which requirements of Sections 150.0(a) through 150.0(r) also apply to additions or alterations. The amendments to sections 150.0 (h), 150.0 (n), and 150.0 (s) do not apply to additions, alterations, or ADUs.

**Section 150.0(h) Space-conditioning equipment,** Section 150.0 (h) is modified to add a new subsection (5) as follows:

5. Systems using gas or propane space heating equipment shall include the following components:
  - A. A designated exterior location for a future heat pump compressor unit with either a drain or natural drainage for condensate from possible future operation as cooling equipment.
  - B. A dedicated 240 volt, 30 amp electrical circuit that is connected to the electric panel with conductors of adequate capacity, terminating within 3 feet from the designated future location of the compressor unit with no obstructions. In addition, all of the following are required:
    - i. Both ends of the unused conductor shall be labeled with the word “For Future Heat Pump Space Heater” and be electrically isolated; and
    - ii. A double pole circuit breaker in the electrical panel labeled with the words “For Future Heat Pump Space Heater”.

EXCEPTION to Section 150.0(h)5.B. If a 240 volt 30 amp electrical circuit exists for space cooling equipment.

**Section 150.0(n) Water heating system,** Section 150.0 (n) is modified as follows:

**(n) Water Heating System.**

1. Systems using gas or propane water heaters to serve individual dwelling units excluding Free Standing Accessory Dwelling Units, shall include the following components:

- A. A dedicated 240 volt, 30 amp electrical receptacle that is connected to the electric panel with conductors of adequate capacity , within 3 feet from the water heater and accessible to the water heater with no obstructions. In addition, all of the following are required:
  - i. Both ends of the unused conductor shall be labeled with the words “For Future Heat Pump Water Heater” and be electrically isolated; and
  - ii. A double pole circuit breaker in the electrical panel labeled with the words “For Future Heat Pump Water Heater”.
- B. A Category III or IV vent, or a Type B vent with straight pipe between the outside termination and the space where the water heater is installed; and
- C. A condensate drain that is no more than 2 inches higher than the base of the installed water heater, and allows natural draining without pump assistance, and
- D. A location in an area that is both:
  - i. At least 3 feet by 3 feet by 7 feet high; and
  - ii. Has a minimum volume of 760 cubic feet or a ventilation plan that includes the equivalent of one 16 inch by 24 inch grill for warm supply air and one 8 inch duct of no more than 10 feet in length for cool exhaust air.

Exception 1 to 150.0(n)1.D. The space and ventilation requirements may be reduced to conform with the manufacturer’s recommendations for a specific heat pump hot water heater that meets the requirements of Sections 110.0, 110.1 and 110.3.

- 2. Water heating recirculation loops serving multiple dwelling units shall meet the requirements of Section 110.3(c)5.
- 3. Solar water-heating systems and collectors shall be certified and rated by the Solar Rating and Certification Corporation (SRCC), the International Association of Plumbing and Mechanical Officials, Research and Testing (IAPMO R&T), or by a listing agency that is approved by the chief building official.
- 4. Instantaneous water heaters with an input rating greater than 6.8 kBTU/hr (2kW) shall meet the requirements of Section 110.3(c)7.
- 5. Systems using gas or propane water heaters to serve multiple dwelling units and/or common areas shall:
  - A. Be located in a space that can accommodate a heat pump water heating system of equivalent capacity and performance; and
  - B. Have a condensate drain that is no more than 2 inches higher than the base of the installed water heater, and allows natural draining without pump assistance; and

- C. Include designated raceways and reserved capacity on the main electrical panel and subpanels, if applicable, sufficient to power a heat pump hot water heater of equivalent capacity and performance. Plans shall include calculations for equivalent capacity and performance, electrical power, conductors, raceway sizes and panel capacities.

**Section 150.0 Mandatory Features and Devices,** Section 150.0 is modified to add a new subsection (s) as follows:

- (s) **Clothes Drying and Cooking.** Buildings plumbed for natural gas or propane clothes drying or cooking equipment shall include the following components for each gas terminal or stub out:

- 1. **Clothes Drying.**

- A. A dedicated 240-volt, 30 amp electrical receptacle that is connected to the electric panel with conductors of adequate capacity, within 3 feet of the appliance and accessible with no obstructions. In addition, all of the following are required:
  - i. Both ends of the unused conductor shall be labeled with the word “For Future Heat Pump Clothes Dryer” and be electrically isolated; and
  - ii. A double pole circuit breaker in the electrical panel labeled with the words “For Future Heat Pump Clothes Dryer”.

- 2. **Cooking Range.**

- A. A dedicated 240-volt, 50-amp electrical receptacle that is connected to the electric panel with conductors of adequate capacity, within 3 feet of the appliance and accessible with no obstructions. In addition, all of the following are required:
  - i. Both ends of the unused conductor shall be labeled with the word “For Future Electric Range” and be electrically isolated; and
  - ii. A double pole circuit breaker in the electrical panel labeled with the words “For Future Electric Range”.

## **16.17.110 SUBCHAPTER 8 – LOW-RISE RESIDENTIAL BUILDINGS- PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES**

**Section 150.1 - Performance and Prescriptive Compliance Approaches for Low-Rise Residential Buildings.** Section 150.1 of the 2019 California Energy Code is amended to read as follows:

- (a) Section (a) is adopted without modification
- (b) **Performance Standards.** A building complies with the performance standards if the energy consumption for the proposed design building is no greater than the



energy budget calculated for the Standard Design Building using Commission-certified compliance software as specified by the Alternative Calculation Methods Approval Manual.

1. **Newly Constructed Buildings.** The Energy Budget for newly constructed buildings is expressed in terms of the Energy Design Rating, which is based on TDV energy. The Energy Design Rating (EDR) has two components, the Energy Efficiency Design Rating, and the Solar Electric Generation and Demand Flexibility Design Rating. The Solar Electric Generation and Demand Flexibility Design Rating shall be subtracted from the Energy Efficiency Design Rating to determine the Total Energy Design Rating. The Proposed Building shall separately comply with the Energy Efficiency Design Rating and the Total Energy Design Rating.
  - A. An All-Electric Building complies with the performance standard if both the Total Energy Design Rating and the Energy Efficiency Design Rating for the Proposed Building are no greater than the corresponding Energy Design Ratings for the Standard Design Building.
  - B. A Mixed-Fuel Building complies with the performance standards if:
    - i. The Energy Efficiency Design Rating of the Proposed Building is no greater than the Energy Efficiency Design Rating for the Standard Design Building; and
    - ii. The Total Energy Design Rating for the Proposed Building is at least 10 points less than the Total Energy Design Rating for the Standard Design Building.

EXCEPTION 1 to Section 150.1(b)1.B.ii. Buildings with limited solar access are excepted if all of the following are true:

- a. The Total Energy Design Rating for the Proposed Building is no greater than the Standard Design Building; and
- b. A photovoltaic (PV) system(s) meeting the minimum qualification requirements as specified in Joint Appendix JA11 is installed on all available areas of 80 contiguous square feet or more with effective annual solar access. Effective annual solar access shall be 70 percent or greater of the output of an unshaded PV array on an annual basis, wherein shade is due to existing permanent natural or manmade barriers external to the dwelling, including but not limited to trees, hills, and adjacent structures.
- c. The Energy Efficiency Energy Design Rating for the Proposed Building is no greater than the respective value for the Standard Design Building by the EDR margin in Table 150.1(b)1 below.

Table 150.1(b)1: Energy Efficiency EDR Margins

<u>Building Type</u>	<u>Energy Efficiency EDR Margin</u>
<u>Single Family</u>	2
<u>Multifamily</u>	1

2. **Additions and Alterations to Existing Buildings.** The Energy Budget for additions and alterations is expressed in terms of TDV energy. A building complies with the performance standards if the energy consumption calculated for the Proposed Building is no greater than the energy budget calculated for the Standard Design Building.

3. **Compliance demonstration requirements for performance standards.**

Section 150.1(b)3A is modified to add subsection i as follows:

- i. **Certificate of Compliance.** The Certificate of Compliance is prepared and signed by a Certified Energy Analyst and the Total Energy Design Rating of the Proposed Design shall be no greater than the Standard Design Building.

(c) **Prescriptive Standards/Component Package.** Buildings that comply with the prescriptive standards shall be designed, constructed, and equipped to meet all of the requirements for the appropriate Climate Zone shown in TABLE 150.1-A or B.

In TABLE 150.1-A and TABLE 150.1-B, a NA (not allowed) means that feature is not permitted in a particular Climate Zone and a NR (no requirement) means that there is no prescriptive requirement for that feature in a particular Climate Zone as well as all of the requirements of Section 150.1(c)15 and 16, whichever are more stringent. Installed components shall meet the following requirements:

1. – 14. Subsections 150.1(c)(1) – (14) are adopted without modification.

**15. Additional Prescriptive Requirements for Single Family buildings.** Section 150.1(c) is modified to add subsection 15 as follows:

- A. **Duct System Sealing and Leakage Testing.** The duct systems shall exceed the minimum mandatory requirements of Section 150.0(m)11 A and B such that the total duct system leakage shall not exceed 2 percent of the nominal system air handler air flow.

- B. Slab insulation. Slab floor perimeter insulation shall be installed with an R-value equal to or greater than R10. The minimum depth of concrete-slab floor perimeter insulation shall be 16 inches or the depth of the footing of the building, whichever is less.
- C. Compact Hot Water. The hot water distribution system shall be designed and installed to meet minimum requirements for the basic compact hot water distribution credit according to the procedures outlined in the 2019 Reference Appendices RA4.4.6.
- D. Ducted Central Forced Air Heating Systems. Central Fan Integrated Ventilation Systems. The duct distribution system shall be designed reduce external static pressure to meet a maximum fan efficacy equal to:  
Gas Furnaces: 0.35 Watts per cfm  
Heat Pumps: 0.45 Watts per cfm,  
according to the procedures outlined in the 2019 Reference Appendices RA 3.3.

**16. Additional Prescriptive Requirements for Multifamily buildings. Section 150.1(c) is modified to add subsection 16 as follows:**

- A. Ducts in Conditioned Space. All ductwork shall be located entirely in conditioned space with ducts tested to have less than or equal to 25 cfm leakage to outside. Ductwork shall meet the requirements of Verified Low Leakage Ducts in Conditioned Space (VLLDCS) in the 2019 Reference Appendices RA3.1.4.3.8.s
- B. Roofing Products. Low-rise residential buildings with steep-sloped roofs shall have a minimum aged solar reflectance of 0.25.
- C. Slab insulation. Slab floor perimeter insulation shall be installed with an R-value of equal to or greater than R10. The minimum depth of concrete-slab floor perimeter insulation shall be 16 inches or the depth of the footing of the building, whichever is less.
- D. Compact Hot Water. The hot water distribution system shall be designed and installed to meet minimum requirements for the basic compact hot water distribution credit according to the procedures outlined in the 2019 Reference Appendices RA4.4.6.
- E. Central Fan Integrated Ventilation Systems. Central forced air system fans used to provide outside air, shall have an air-handling unit fan efficacy less than or equal to 0.35 W/CFM. The airflow rate and fan

efficacy requirements in this section shall be confirmed through field verification and diagnostic testing in accordance with all applicable procedures specified in Reference Residential Appendix RA3.3. Central Fan Integrated Ventilation Systems shall be certified to the Energy Commission as RA3.7.4.2.

#### **16.17.120 Infeasibility Exemption.**

- (a) **Exemption.** If an applicant for a Covered Project believes that circumstances exist that makes it infeasible to meet the requirements of this Chapter, the applicant may request an exemption as set forth below. In applying for an exemption, the burden is on the Applicant to show infeasibility.
- (b) **Application.** If an applicant for a Covered Project believes such circumstances exist, the applicant may apply for an exemption at the time of application submittal in accordance with the Planning and Development Services administrative guidelines. The applicant shall indicate the maximum threshold of compliance he or she believes is feasible for the covered project and the circumstances that make it infeasible to fully comply with this Chapter. Circumstances that constitute infeasibility include, but are not limited to the following:
  - (1) There is conflict with the compatibility of the currently adopted green building ordinance and/or California Building Standards Code;
  - (2) There is conflict with other City goals, such as those requiring historic preservation or the Architectural Review criteria;
  - (3) There is a lack of commercially available materials and technologies to comply with the requirements of this Chapter;
  - (4) Applying the requirements of this Chapter would effectuate an unconstitutional taking of property or otherwise have an unconstitutional application to the property.
- (c) **Review by Architectural Review Board (ARB).** For any covered project for which an exemption is requested and Architectural Review is required by the ARB, the ARB shall provide a recommendation to the Director of Planning and Development Services or designee regarding whether the exemption shall be granted or denied, along with its recommendation on the project.
- (d) **Granting of Exemption.** If the Director of Planning and Development Services, or designee, determines that it is infeasible for the applicant to fully meet the requirements of this Chapter based on the information provided, the Director, or designee, shall determine the maximum feasible threshold of compliance reasonably achievable for the project. The decision of the Director, or designee, shall be provided to the applicant in writing. If an exemption is granted, the applicant shall be required to comply with this Chapter in all other respects and shall be required to achieve, in

accordance with this Chapter, the threshold of compliance determined to be achievable by the Director or designee.

- (e) **Denial of Exemption.** If the Director of Planning and Development Services or designee determines that it is reasonably possible for the applicant to fully meet the requirements of this Chapter, the request shall be denied and the Director or designee shall so notify the applicant in writing. The project and compliance documentation shall be modified to comply with this Chapter prior to further review of any pending planning or building application.
- (f) **Council Review of Exemption.** For any covered project that requires review and action by the City Council, the Council shall act to grant or deny the exemption, based on the criteria outlined above, after recommendation by the Director of Planning and Development Services.

#### **16.17.130 Appeal.**

- (a) Any aggrieved Applicant may appeal the determination of the Director of Planning and Development Services or designee regarding the granting or denial of an exemption pursuant to 16.17.070.
- (b) Any appeal must be filed in writing with the Planning and Development Services Department not later than fourteen (14) days after the date of the determination by the Director. The appeal shall state the alleged error or reason for the appeal.
- (c) The appeal shall be processed and considered by the City Council in accordance with the provisions of Section 18.77.070(f) of the City of Palo Alto Municipal Code.

SECTION 2. The Council adopts the findings for local amendments to the California Energy Code, 2019 Edition, attached hereto as Exhibit “A” and incorporated herein by reference.

SECTION 3. Under the authority granted by Public Resources Code Section 25402.1(h)(2), which permits local California Energy Code amendments, and based on staff’s analysis of the “2019 Nonresidential New Construction Reach Code Cost Effectiveness Study” and “2019 Cost-effectiveness Study: Low-Rise Residential New Construction” developed for the California Energy Codes and Standards Program and attached to staff’s report to Council, the Council finds the proposed local amendments to the 2019 California Energy Code that affect building energy performance to be cost-effective and consume less energy than permitted by Title 24, Part 6.

SECTION 4. If any section, subsection, clause or phrase of this Ordinance is for any reason held to be invalid, such decision shall not affect the validity of the remaining portion or sections of the Ordinance. The Council hereby declares that it should have adopted the Ordinance and each section, subsection, sentence, clause or phrase thereof irrespective of the fact that any one or more sections, subsections, sentences, clauses or phrases be held invalid.

SECTION 5. The Council finds that this action is exempt from the provisions of the California Environmental Quality Act ("CEQA"), under Section 15308 of the CEQA Guidelines, because it is a regulatory action for the protection of the environment, and under Section 15061(b)(3) on the grounds that the proposed standards are more stringent than the State energy standards, there are no reasonably foreseeable adverse environmental impacts and there is no possibility that the activity in question may have a significant effect on the environment.

SECTION 6. This Ordinance shall be effective on the commencement of the thirty-first day after the date of its adoption.

INTRODUCED:

PASSED:

AYES:

NOES:

ABSENT:

ABSTENTIONS:

ATTEST:

\_\_\_\_\_  
City Clerk

\_\_\_\_\_  
Mayor

APPROVED AS TO FORM:

APPROVED:

\_\_\_\_\_  
Assistant City Attorney

\_\_\_\_\_  
City Manager

\_\_\_\_\_  
Director of Planning and Development Services

\_\_\_\_\_  
Director of Administrative Services

## Exhibit A

### FINDINGS FOR LOCAL AMENDMENTS TO CALIFORNIA ENERGY CODE, 2019 EDITION

Section 17958 of the California Health and Safety Code provides that the City may make changes to the provisions in the uniform codes that are published in the California Building Standards Code. Sections 17958.5 and 17958.7 of the Health and Safety Code require that for each proposed local change to those provisions in the uniform codes and published in the California Building Standards Code which regulate buildings used for human habitation, the City Council must make findings supporting its determination that each such local change is reasonably necessary because of local climatic, geological, or topographical conditions.

Regarding the Energy Code, local jurisdictions have the authority to adopt local energy efficiency ordinances—or reach codes—that exceed the minimum standards defined by Title 24 (as established by Public Resources Code Section 25402.1(h)2 and Section 10-106 of the Building Energy Efficiency Standards, provided the City Council finds that the requirements of the proposed ordinance are cost-effective and do not result in buildings consuming more energy than is permitted by Title 24.

Local building regulations having the effect of amending the uniform codes, which were adopted by the City prior to November 23, 1970, were unaffected by the regulations of Sections 17958, 17958.5 and 17958.7 of the Health and Safety Code. Therefore, amendments to the uniform codes which were adopted by the City Council prior to November 23, 1970, and have been carried through from year to year without significant change, need no required findings. Also, amendments to provisions not regulating buildings used for human habitation, including amendments made only for administrative consistency, do not require findings.

Code: Cal Green					
Section(s)	Title	Add	Deleted	Amended	Justification (See below for keys)
100.1	Definitions	✓			C & E
100.3 and 100.4	Local Energy Efficiency Reach Code and Exceptions		✓		C & E
110.10	Mandatory Requirements For Solar Ready Buildings	✓		✓	C
140.0	Nonresidential Performance and Prescriptive Compliance Approaches	✓		✓	C & E
140.1	Performance Approach: Energy Budgets	✓		✓	C & E
140.2	Prescriptive Approach	✓		✓	C & E
150.0	Low-Rise Residential – Mandatory Features and Devices	✓		✓	C & E
150.1	Compliance Approaches for Low-Rise Residential Buildings	✓		✓	C & E

## Key to Justification for Amendments to Title 24 of the California Code of Regulations

- C** This amendment is justified on the basis of a local climatic condition. The seasonal climatic conditions during the late summer and fall create severe fire hazards to the public health and welfare in the City. The hot, dry weather frequently results in wild land fires on the brush covered slopes west of Interstate 280. The aforementioned conditions combined with the geological characteristics of the hills within the City create hazardous conditions for which departure from California Energy Code is required. Failure to address and significantly reduce greenhouse gas (GHG) emissions could result in rises in sea level, including in San Francisco Bay, that could put at risk Palo Alto homes and businesses, public facilities, and Highway 101 (Bayshore Freeway), particularly the mapped Flood Hazard areas of the City. Energy efficiency is a key component in reducing GHG emissions, and construction of more energy efficient buildings can help Palo Alto reduce its share of the GHG emissions that contribute to climate change. The burning of fossil fuels used in the generation of electric power and heating of buildings contributes to climate change, which could result in rises in sea level, including in San Francisco Bay, that could put at risk Palo Alto homes and businesses, public facilities, and Highway 101. Due to decrease in annual rain fall, Palo Alto experiences the effect of drought and water saving more than some other communities in California.
- E** Energy efficiency enhances the public health and welfare by promoting the environmental and economic health of the City through the design, construction, maintenance, operation and deconstruction of buildings and sites by incorporating green practices into all development. The provisions in this Chapter are designed to achieve the following goals:
- (a) Increase energy efficiency in buildings;
  - (b) Increase resource conservation;
  - (c) Provide durable buildings that are efficient and economical to own and operate;
  - (d) Promote the health and productivity of residents, workers, and visitors to the city;
  - (e) Recognize and conserve the energy embodied in existing buildings; and
  - (f) Reduce disturbance of natural ecosystems.
- G** This amendment is justified on the basis of a local geological condition. The City of Palo Alto is subject to earthquake hazard caused by its proximity to San Andreas fault. This fault runs from Hollister, through the Santa Cruz Mountains, epicenter of the 1989 Loma Prieta earthquake, then on up the San Francisco Peninsula, then offshore at Daly City near Mussel Rock. This is the approximate location of the epicenter of the 1906 San Francisco earthquake. The other fault is Hayward Fault. This fault is about 74 mi long, situated mainly along the western base of the hills on the east side of San Francisco Bay. Both of these faults are



T

considered major Northern California earthquake faults which may experience rupture at any time. Thus, because the City is within a seismic area which includes these earthquake faults, the modifications and changes cited herein are designed to better limit property damage as a result of seismic activity and to establish criteria for repair of damaged properties following a local emergency.

The City of Palo Alto topography includes hillsides with narrow and winding access, which makes timely response by fire suppression vehicles difficult. Palo Alto is contiguous with the San Francisco Bay, resulting in a natural receptor for storm and waste water run-off. Also the City of Palo Alto is located in an area that is potentially susceptible to liquefaction during a major earthquake. The surface condition consists mostly of stiff to dense sandy clay, which is highly plastic and expansive in nature. The aforementioned conditions within the City create hazardous conditions for which departure from California Building Standards Codes is warranted.

\* NOT YET APPROVED \*

Resolution No. \_\_\_\_\_

Resolution of the Council of the City of Palo Alto declaring the goal of  
adopting an All-Electric Energy Reach Code Ordinance for New  
Construction to become effective in January 2022

R E C I T A L S

- A. In April 2016, the Palo Alto City Council adopted a Sustainability and Climate Action Plan (S/CAP), which includes an ambitious Green House Gas (GHG) reduction goal of 80% from the 1990 level by 2030 – a goal which is 20 years ahead of the state’s goal of 80% reduction by 2050; and
- B. Building electrification accounts for 43% of the GHG emissions reduction laid out in the S/CAP strategies to achieve Palo Alto’s 80% by 2030 goal; and
- C. A statewide study led by the California Codes and Standards Local Ordinance Team found that all-electric single family and low-rise multifamily new construction projects are cost effective; all-electric medium office buildings and medium retail buildings are cost effective; and mixed-fuel office and retail buildings with up to a 14% compliance margin are cost effective; and
- D. The City of Palo Alto will work over the next two years to educate consumers and the building industry to promote the accessibility and desirability of equipment necessary for all-electric construction with the understanding that the City’s goal is for these options to become mandatory in 2022;

The Council of the City of Palo Alto does hereby RESOLVE, as follows:

SECTION 1. The Council of the City of Palo Alto declares the goal of adopting an all-electric energy reach code for new residential and non-residential buildings to become effective in January 2022.

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SECTION 2. The Council finds that the adoption of this resolution declaring the goal described above is not a project subject to California Environmental Quality Act (CEQA) review because adoption of this resolution is an administrative government activity that will not result in any direct or indirect physical change to the environment as a result (CEQA Guidelines section 15378(b)(5)).

INTRODUCED AND PASSED:

AYES:

NOES:

ABSENT:

ABSTENTIONS:

ATTEST:

APPROVED:

\_\_\_\_\_  
City Clerk

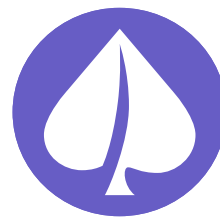
\_\_\_\_\_  
Mayor

\_\_\_\_\_  
Assistant City Attorney

\_\_\_\_\_  
City Manager

\_\_\_\_\_  
Director of Planning and Development Services

\_\_\_\_\_  
Director of Administrative Services



**CALIFORNIA  
ENERGY**  
CODES & STANDARDS

A STATEWIDE UTILITY PROGRAM

Title 24, Parts 6 and 11  
Local Energy Efficiency Ordinances

**2019 Cost-effectiveness Study:  
Low-Rise Residential New Construction  
Addendum – CPAU Analysis**

**Prepared for:**

Kelly Cunningham  
Codes and Standards Program  
Pacific Gas and Electric Company

**Prepared by:**

Frontier Energy, Inc.  
Misti Bruceri & Associates, LLC

Last Modified: April 5, 2019

## **LEGAL NOTICE**

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# 1 Introduction

This addendum presents results from analysis conducted in response to a request from City of Palo Alto Utilities (CPAU) to more accurately reflect anticipated local energy costs. This report documents cost-effective combinations of measures within CPAU territory that exceed the minimum state requirements, the 2019 Building Energy Efficiency Standards, which become effective January 1, 2020, for new single family and low-rise (one- to three-story) multifamily residential construction. The analysis includes evaluation of both mixed fuel and all-electric homes, documenting that the performance requirements can be met by either type of building design. Compliance package options and cost-effectiveness analysis are presented for California Climate Zone 4 (Palo Alto). All proposed package options include a combination of efficiency measures and on-site renewable energy.

This analysis builds upon the results of the Draft 2019 Cost-effectiveness Study: Low-Rise Residential (Statewide Reach Codes Team, 2019) conducted for the California Statewide Codes and Standards Program and last modified March 15, 2019, which evaluated compliance packages across all sixteen California climate zones.

# 2 Methodology and Assumptions

The same methodology used in the statewide analysis was applied to this analysis with two exceptions, as described below.

1. CPAU E-1 (for electricity delivered to the customer from CPAU) and E-EEC-1 (for electricity received by CPAU from the customer) electricity rate schedules were applied in place of PG&E electricity rate schedules.
2. CPAU G-1 rate schedule was applied in place of PG&E gas rates. The monthly total gas rate in \$/therm was applied on a monthly basis for the 12-month period ending March 2019. Appendix A summarizes the utility rate schedules used for this study.
3. Revised assumptions for escalation of utility fuel rates over the 30-year analysis period to reflect recent General Rate Case filings in the near term and historical escalation rates for the long term. The escalation rates are provided in Table 1 and were provided by Energy & Environmental Economics (E3) in March 2019.



**Table 1: Utility Escalation Rates**

<u>Year</u>	<u>Natural Gas Real Escalation (%/yr)</u>	<u>Electricity Real Escalation (%/yr)</u>	<u>Year</u>	<u>Natural Gas Real Escalation (%/yr)</u>	<u>Electricity Real Escalation (%/yr)</u>
2021	2.0%	2.0%	2036	1.0%	1.0%
2022	2.0%	2.0%	2037	1.0%	1.0%
2023	4.0%	2.0%	2038	1.0%	1.0%
2024	4.0%	2.0%	2039	1.0%	1.0%
2025	4.0%	2.0%	2040	1.0%	1.0%
2026	1.0%	1.0%	2041	1.0%	1.0%
2027	1.0%	1.0%	2042	1.0%	1.0%
2028	1.0%	1.0%	2043	1.0%	1.0%
2029	1.0%	1.0%	2044	1.0%	1.0%
2030	1.0%	1.0%	2045	1.0%	1.0%
2031	1.0%	1.0%	2046	1.0%	1.0%
2032	1.0%	1.0%	2047	1.0%	1.0%
2033	1.0%	1.0%	2048	1.0%	1.0%
2034	1.0%	1.0%	2049	1.0%	1.0%
2035	1.0%	1.0%	2050	1.0%	1.0%

Refer to the Draft 2019 Cost-effectiveness Study: Low-Rise Residential (Statewide Reach Codes Team, 2019) for further details. Key components of the methodology are repeated below.

### **Cost-effectiveness**

This analysis uses two different metrics to assess cost-effectiveness. Both methodologies require estimating and quantifying the incremental costs and energy savings associated with energy efficiency measures as compared to the prescriptive Title 24 requirements. The main difference between the methodologies is the manner in which they value energy and thus the cost savings of reduced or avoided energy use.

- **Utility Bill Impacts (On-Bill):** Customer-based Lifecycle Cost (LCC) approach that values energy based upon estimated site energy usage and customer on-bill savings using electricity and natural gas utility rate schedules over a 30-year duration accounting for discount rate and energy inflation.
- **Time Dependent Valuation (TDV):** Energy Commission LCC methodology, which is intended to capture the “societal value or cost” of energy use including long-term projected costs such as the cost of providing energy during peak periods of demand and other societal costs such as projected costs for carbon emissions, as well as grid transmission and distribution impacts. This metric values energy use differently depending on the fuel source (gas, electricity, and propane), time of day, and season. Electricity used (or saved) during peak periods has a much higher value than electricity used (or saved) during off-peak periods (Horie et al, 2014). This is the methodology used by the Energy Commission in evaluating cost-effectiveness for efficiency measures in Title 24, Part 6.

Results for both methodologies are presented as a benefit-to-cost (B/C) ratio, which is a net present value (NPV) metric which represents the cost-effectiveness of a measure over a 30-year lifetime. A value of one indicates the NPV of the savings over the life of the measure is equivalent to the NPV of the lifetime incremental cost of that measure. A value greater than one represents a positive return on investment.





## Package Development

Three to four packages were evaluated for each prototype, as described below.

- 1) **Efficiency – Non-Preempted**: This package uses only efficiency measures that don't trigger federal preemption issues including envelope, and water heating and duct distribution efficiency measures.
- 2) **Efficiency – Equipment, Preempted**: This package shows an alternative design that applies HVAC and water heating equipment that are more efficient than federal standards.
- 3) **Efficiency & PV**: Using the Efficiency – Non-Preempted Package as a starting point, additional PV capacity is added to offset most of the estimated electricity use. This only applies to the all-electric case, since for the mixed fuel cases, 100% of the projected electricity use is already being offset in the efficiency only packages as required by 2019 Title 24, Part 6.
- 4) **Efficiency & PV/Battery**: Using the Efficiency & PV Package as a starting point, additional PV capacity is added as well as a battery system.

## Electrification Scenarios

In comparing mixed fuel and all-electric cases, two scenarios were evaluated for each prototype:

1. **2019 Code Compliant**: Compares a 2019 code compliant all-electric home with a 2019 code compliant mixed fuel home.
2. **Efficiency & PV Package**: Compares an all-electric home with efficiency and PV sized to 90% of the annual electricity use to a 2019 code compliant mixed fuel home. The first cost savings in the code compliant all-electric house is invested in above code efficiency and PV reflective of the Efficiency & PV packages described above.

## 3 Results & Discussion

The analysis found cost-effective, non-preempted packages for both single family and low-rise multifamily buildings, under both mixed fuel and all-electric cases. The results of this analysis can be used by local jurisdictions to support the adoption of reach codes.

For the efficiency-only packages, measures were refined to ensure that the non-preempted package was cost-effective based on one of the two metrics applied in this study, TDV or On-Bill. The preempted equipment package is what the Reach Code Team considers to be a package of upgrades most reflective of what builders commonly apply to exceed code requirements. The packages presented are representative examples of designs and measures that can be used to meet the requirements. In practice, a builder can use any combination of non-preempted or preempted compliant measures to meet the requirements.

Table 2 summarizes the target EDR reductions by case. Table 3 and Table 4 present details of the analysis results for single family and low-rise multifamily homes, respectively. Results are presented as EDR reduction instead of compliance margin, as EDR is the metric used to determine code compliance for residential buildings in the 2019 cycle. Target EDR reduction is based on taking the calculated EDR reduction for the case and rounding down to the next half of a whole number. Target EDR reduction for the Efficiency Package are defined based on the lower of the EDR reduction of the non-preempted package and the equipment, preempted package. For example, for single family homes the all-electric non-preempted package has an EDR reduction of 3.0 and the preempted package an EDR reduction of 3.5, the Target EDR reduction is set at 3.0 in this case.



**Table 2: Summary of Target EDR Reductions**

Climate Zone	Mixed Fuel		All-Electric		
	Efficiency	Efficiency & PV/Battery	Efficiency	Efficiency & PV	Efficiency & PV/Battery
Single Family	2.5	10	3.0	17.0	28.5
Multifamily	1.0	11.0	1.5	15.0	29.5

All packages are cost effective based on the TDV approach. However, most packages are not cost effective using the On-Bill approach, with the exception of the all-electric single family efficiency packages and the mixed fuel single family Efficiency – Equipment Package. All electrification scenarios are cost effective under both methodologies. An all-electric design reduces GHG emissions 46% for single family and 40% for multifamily relative to a comparable mixed fuel design.

The CPAU E-1 rate is a tiered with no time-of-use impact and usage rates lower than PG&E rates<sup>1</sup>. Electricity generation delivered to CPAU from the customer is compensated under the E-EEC-1 rate at \$0.07485/kWh, which differs from PG&E's net energy metering tariff which values delivered electricity at the retail rate. The CPAU G-1 rate has usage rates lower than PG&E rates, but there is a ~\$11 monthly service charge. These differences result in similar annual gas costs using both CPAU's and PG&E's tariffs.

Before taking into account the utility fuel escalation rates applied in this analysis, on-bill cost effectiveness using CPAU's rates is lower than with PG&E rates in Climate Zone 4 for both the mixed fuel and all-electric packages. On-bill cost-effectiveness is more favorable using CPAU rates for the electrification scenarios. Changes in escalation rates, which are on average higher for electricity and lower for natural gas than what was applied in the draft statewide study, improves cost effectiveness for the all-electric packages and decreases it for the mixed fuel packages and the electrification scenarios.

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<sup>1</sup> PG&E's E-TOU Option B which was applied in the statewide study for Climate Zone 12 (Statewide Reach Codes Team, 2019).



**Table 3: Single Family CPAU Climate Zone 4 Results Summary**

Climate Zone 4 CPAU Single Family		EDR Red.	PV Size Change (kW) <sup>4</sup>	CO <sub>2</sub> -Equivalent Emissions (lb/sqft)		Inc. Cost (\$)	First Year Utility Savings		Benefit to Cost Ratio (B/C)	
				Total	Red.		Elec	Gas	On- Bill	TDV
Mixed Fuel <sup>1</sup>	Efficiency-Non-Preempted	2.5	(0.0)	1.7	0.2	\$1,451	\$2	\$46	0.8	1.2
	Efficiency-Equipment	2.5	(0.0)	1.6	0.3	\$716	\$1	\$56	1.9	2.7
	Efficiency & PV/Battery	10.0	0.1	1.5	0.3	\$4,608	\$57	\$46	0.5	1.6
All- Electric <sup>2</sup>	Efficiency-Non-Preempted	3.0	0.0	0.9	0.1	\$1,417	\$110	\$0	1.7	1.9
	Efficiency-Equipment	3.5	0.0	0.9	0.1	\$1,996	\$111	\$0	1.2	1.4
	Efficiency & PV	17.0	1.8	0.5	0.5	\$8,251	\$371	\$0	1.0	1.6
	Efficiency & PV/Battery	28.5	2.4	0.3	0.8	\$13,289	\$544	\$0	0.9	1.7
Mixed Fuel to All- Electric <sup>3</sup>	Code Compliant	0.0	0.0	1.0	0.9	(\$5,349)	(\$697)	\$487	1.2	1.5
	Efficiency & PV	17.0	1.8	0.5	1.3	\$3,431	(\$326)	\$487	2.8	>1

**Table 4: Multifamily CPAU Climate Zone 4 Results Summary – Results Per Unit**

Climate Zone 4 CPAU Multifamily		EDR Red.	PV Size Change Per Unit (kW) <sup>4</sup>	CO <sub>2</sub> -Equivalent Emissions (lb/sqft)		Inc. Cost Per Unit (\$)	First Year Utility Savings Per Unit		Benefit to Cost Ratio (B/C)	
				Total	Red.		Elec	Gas	On- Bill	TDV
Mixed Fuel <sup>1</sup>	Efficiency-Non-Preempted	1.0	(0.1)	2.1	0.1	\$306	\$1	\$7	0.6	1.2
	Efficiency-Equipment	2.0	(0.1)	2.0	0.2	\$471	\$1	\$14	0.7	1.4
	Efficiency & PV/Battery	11.0	0.4	1.9	0.3	\$2,012	\$27	\$7	0.4	1.8
All- Electric <sup>2</sup>	Efficiency-Non-Preempted	1.5	0.0	1.2	0.0	\$336	\$14	\$0	0.9	1.6
	Efficiency-Equipment	2.5	0.0	1.2	0.1	\$753	\$25	\$0	0.7	1.2
	Efficiency & PV	15.0	6.6	0.7	0.6	\$2,940	\$124	\$0	0.9	1.8
	Efficiency & PV/Battery	29.5	9.2	0.4	0.9	\$5,530	\$198	\$0	0.8	1.9
Mixed Fuel to All- Electric <sup>3</sup>	Code Compliant	0.0	0.0	1.3	0.9	(\$2,337)	(\$218)	\$262	>1	1.6
	Efficiency & PV	15.0	6.6	0.7	1.4	\$786	(\$94)	\$262	7.8	>1

<sup>1</sup>All reductions and incremental costs relative to the mixed fuel code compliant home.<sup>2</sup>All reductions and incremental costs relative to the all-electric code compliant home.<sup>3</sup>All reductions and incremental costs relative to the mixed fuel code compliant home except the EDR reductions are relative to the Standard Design for each case which is the all-electric code compliant home.<sup>4</sup>Positive values indicate an increase in PV capacity relative to the Standard Design.

## 4 References

Statewide Reach Codes Team. 2019. Draft 2019 Cost-effectiveness Study: Low-Rise Residential. Prepared for Pacific Gas and Electric Company. Prepared by Frontier Energy. March 2019.

[http://localenergycodes.com/download/602/file\\_path/fieldList/2019%20ResNewCon%20Cost-Eff-PublicDraft](http://localenergycodes.com/download/602/file_path/fieldList/2019%20ResNewCon%20Cost-Eff-PublicDraft)



## Appendix A – Utility Tariff Details

Following are the CPAU electricity tariffs applied in this study.

### RESIDENTIAL ELECTRIC SERVICE

#### UTILITY RATE SCHEDULE E-1

#### A. APPLICABILITY:

This schedule applies to separately metered single-family residential dwellings receiving Electric Service from the City of Palo Alto Utilities.

#### B. TERRITORY:

This rate schedule applies everywhere the City of Palo Alto provides Electric Service.

#### C. UNBUNDLED RATES:

<u>Per kilowatt-hour (kWh)</u>	<u>Commodity</u>	<u>Distribution</u>	<u>Public Benefits</u>	<u>Total</u>
Tier 1 usage	\$0.07214	\$0.05240	\$0.00417	\$0.12871
Tier 2 usage Any usage over Tier 1	0.11347	0.07515	0.00417	0.19279
<u>Minimum Bill (\$/day)</u>				0.3040

#### D. SPECIAL NOTES:

##### 1. Calculation of Cost Components

The actual bill amount is calculated based on the applicable rates in Section C above and adjusted for any applicable discounts, surcharges and/or taxes. On a Customer's bill statement, the bill amount may be broken down into appropriate components as calculated under Section C.

##### 2. Calculation of Usage Tiers

Tier 1 Electricity usage shall be calculated and billed based upon a level of 11 kWh per day, prorated by Meter reading days of Service. As an example, for a 30-day bill, the Tier 1 level would be 330 kWh. For further discussion of bill calculation and proration, refer to Rule and Regulation 11.

{End}

---

#### CITY OF PALO ALTO UTILITIES

Issued by the City Council

*Supersedes Sheet No E-1-1 dated 7-1-2017*



Effective 7-1-2018  
Sheet No E-1-1



Attachment B

EXPORT ELECTRICITY COMPENSATION

UTILITY RATE SCHEDULE E-EEC-1

**A. APPLICABILITY:**

This schedule applies in conjunction with the otherwise applicable rate schedules for each customer class. This schedule may not apply in conjunction with any time-of-use rate schedule. This schedule applies to Customer-Generators as defined in Rule and Regulation 2 who are either not eligible for Net Energy Metering or who are eligible for Net Energy metering but elect to take service under this rate schedule.

**B. TERRITORY:**

Applies to locations within the service area of the City of Palo Alto.

**C. RATE:**

The following buyback rate shall apply to all energy exported to the grid.

	<u>Per kWh</u>
Export electricity compensation rate	\$0.07485

**D. SPECIAL CONDITIONS**

1. Metering equipment: Electricity delivered by CPAU to the Customer-Generator or received by CPAU from the Customer-Generator shall be measured using a meter capable of registering the flow of electricity in two directions (aka "bidirectional meter"). The electrical power measurements will be used for billing the Customer-Generator. CPAU shall furnish, install and own the appropriate meter.
2. Billing:
  - a. CPAU shall measure during the billing period, in kilowatt-hours, the energy delivered and received after the Customer-Generator serves its own instantaneous load.
  - b. CPAU shall bill the Customer-Generator consumption charges for the energy delivered by CPAU to the Customer-Generator based on the Customer-Generator's applicable rate schedule.
  - c. In the event the energy generated exceeds the energy consumed and therefore is received by CPAU, the Customer will receive a credit for all energy received by CPAU at the buyback rate designated in section C above.
3. Generation facilities shall adhere to Rule and Regulation 27: Generating Facility Interconnections.

*{End}*

---

**CITY OF PALO ALTO UTILITIES**

Issued by the City Council



Effective 7-1-2016  
Sheet No. E-EEC-1



Following are the CPAU natural gas tariffs applied in this study. The CPAU monthly gas rate in \$/therm was applied on a monthly basis for the 12-month period ending January 2018.

**RESIDENTIAL GAS SERVICE**

**UTILITY RATE SCHEDULE G-1**

**A. APPLICABILITY:**

This schedule applies to the following Customers receiving Gas Service from City of Palo Alto Utilities:

1. Separately-metered single-family residential Customers.
2. Separately-metered multi-family residential Customers in multi-family residential facilities.

**B. TERRITORY:**

This schedule applies anywhere the City of Palo Alto provides Gas Service.

**C. UNBUNDLED RATES:**

Per Service

Monthly Service Charge: ..... \$10.94

**Tier 1 Rates:**

Per Therm

**Supply Charges:**

1. Commodity (Monthly Market Based) ..... \$0.10-\$2.00
2. Cap and Trade Compliance Charge ..... \$0.00-\$0.25
3. Transportation Charge ..... \$0.00-\$0.15
4. Carbon Offset Charge ..... \$0.00-\$0.10

Distribution Charge: ..... \$0.4239

**Tier 2 Rates: (All usage over 100% of Tier 1)**

**Supply Charges:**

1. Commodity (Monthly Market Based) ..... \$0.10-2.00
2. Cap and Trade Compliance Charge ..... \$0.00-\$0.25
3. Transportation Charge ..... \$0.00-\$0.15
4. Carbon Offset Charge ..... \$0.00-\$0.10

Distribution Charge: ..... \$0.9948

**D. SPECIAL NOTES:**

1. Calculation of Cost Components

---

**CITY OF PALO ALTO UTILITIES**

Issued by the City Council

Supersedes Sheet No G-1-1  
dated 9-1-2017



**CITY OF PALO ALTO  
UTILITIES**

Effective 7-1-2018  
Sheet No G-1-1







### Monthly Gas Commodity & Volumetric Rates

Your gas bill includes two charge types: 1) a service charge, and 2) a volumetric charge. The service charge for your gas service can be found on the appropriate rate schedule, which you can find in the following locations: [Residential Rate Schedules](#), and [Business Rate Schedules](#).

The volumetric charge depends on your consumption, and the rate varies monthly based on the current price of gas. The following tables show the volumetric rates (\$/therm) for each gas rate schedule. The volumetric rates include a) a Commodity charge, which represents the cost of the gas, b) a Distribution rate, c) a Cap and Trade Compliance charge, a d) Carbon Offset Charge and e) a Transportation Charge. The Cap and Trade charge covers the cost of acquiring compliance instruments in California's Cap and Trade program, and will change in response to market conditions, sales volumes, and the quantity of allowances required. The Transportation Charge is based on the current PG&E G-WSL rate for Palo Alto, accounting for delivery losses to the Customer's Meter. Prior to November 1, 2016, it was included within the Distribution rate.

On September 15, 2014, Council adopted Resolution #9451 authorizing the City's participation in a natural gas purchase from Municipal Gas Acquisition and Supply Corporation (MuniGas) for the City's entire retail gas load for a period of at least 10 years. The MuniGas transaction includes a mechanism for municipal utilities to utilize their tax exempt status to achieve a discount on the market price of gas. As of November 1, 2018, gas will begin flowing under this program, reducing the City's gas commodity cost by about \$1 Million per year and saving gas customers approximately \$0.03 per therm on the commodity portion of their bills.

These charges are shown on the left-hand side of the table below for information purposes, while the total volumetric rate (Commodity+ Distribution+ Cap and Trade Compliance+ Carbon Offset+ Transportation) is shown on the right-hand side of the table. To calculate your variable gas costs, apply the total rate to your consumption for each month. If you are a resident, note that your gas rate varies based on how much you consume (Tier 1 and Tier 2). For information on consumption tiers please refer to the [G-1 Residential Gas Service Rate Schedule](#).

If you have questions on your bill, please call the City of Palo Alto Utilities Customer Service Center at 650-329-2161.

Effective Date	Commodity Rate	Cap and Trade Compliance Charge	Transportation Charge	Carbon Offset Charge	Total Volumetric Rate			
					<a href="#">G-1 (Residential)</a>		<a href="#">G-2 (Master Metered Multi-Family and Small Commercial)</a>	<a href="#">G-3 (Large Commercial)</a>
					Tier 1	Tier 2		
	per therm	per therm	per therm	per therm	per therm	per therm	per therm	per therm
3/1/19	0.4071	0.033	0.11607	0.040	1.0207	1.59097	1.21447	1.20597
2/1/19	0.3406	0.033	0.11607	0.040	0.95357	1.52447	1.14797	1.13947
1/1/19	0.4337	0.033	0.11607	0.040	1.04667	1.61757	1.24107	1.23257
12/1/18	0.6255	0.033	0.12554	0.040	1.24794	1.81884	1.44224	1.43384
11/1/18	0.3831	0.026	0.12554	0.040	0.99854	1.56944	1.19294	1.18444
10/1/18	0.3360	0.026	0.12554	0.040	0.95144	1.52234	1.14584	1.13734
9/1/18	0.3258	0.026	0.12554	0.040	0.94124	1.51214	1.13564	1.12714
8/1/18	0.3145	0.026	0.12554	0.040	0.92994	1.50084	1.12434	1.11584
7/1/18	0.3043	0.026	0.15000	0.040	0.94420	1.51510	1.13860	1.13010
6/1/18	0.3166	0.026	0.12431	0.040	0.90021	1.43881	1.08361	1.07561
5/1/18	0.2706	0.026	0.12431	0.040	0.85421	1.39281	1.03761	1.02961
4/1/18	0.2644	0.026	0.12431	0.040	0.84801	1.38661	1.03141	1.02341





## Appendix B –Detailed Results

**Table 5: Efficiency Package Cost-Effectiveness Results**

Climate Zone	BASECASE					Non-Preempted								Equipment - Preempted							
	Final EDR	Efficiency EDR	CALGreen Tier 1 EDR Target	lbs CO2 per sqft	PV kW	Final EDR	Efficiency EDR	EDR Red.	% Comp Margin	lbs CO2 per sqft	PV kW	On-Bill B/C Ratio	TDV B/C Ratio	Final EDR	Efficiency EDR	EDR Red.	% Comp Margin	lbs CO2 per sqft	PV kW	On-Bill B/C Ratio	TDV B/C Ratio
Mixed Fuel SF	22.9	44.4	8	1.9	2.7	20.6	41.9	2.5	14.2%	1.7	2.7	0.8	1.2	20.3	41.8	2.6	15.1%	1.6	2.7	1.9	2.7
All-Electric SF	31.6	53.2	12	1.0	2.7	28.2	49.8	3.4	15.7%	0.9	2.7	1.7	1.9	28.0	49.6	3.6	16.4%	0.9	2.7	1.2	1.4
Mixed Fuel MF	25.4	56.4	8	2.2	13.6	24.3	55.1	1.3	7.6%	2.1	13.5	0.6	1.2	23.4	54.2	2.2	12.5%	2.0	13.5	0.7	1.4
All-Electric MF	34.1	64.4	12	1.3	13.6	32.6	62.9	1.5	7.9%	1.2	13.6	0.9	1.6	31.6	61.9	2.5	12.9%	1.2	13.6	0.7	1.2

">1" = indicates cases where there is both first cost savings and annual utility bill savings.

EDR Red. = EDR Reduction.

**Table 6: Efficiency & PV-PV/Battery Package Cost-Effectiveness Results**

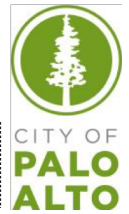
Climate Zone	BASECASE				Efficiency & PV							Efficiency & PV/Battery						
	Final EDR	CALGreen Tier 1 EDR Target	PV kW	lbs CO2 per sqft	Final EDR	EDR Red.	% Comp Margin	lbs CO2 per sqft	PV kW	On-Bill B/C Ratio	TDV B/C Ratio	Final EDR	EDR Red.	% Comp Margin	lbs CO2 per sqft	PV kW	On-Bill B/C Ratio	TDV B/C Ratio
Mixed Fuel SF	22.9	8	1.9	2.7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12.8	10.1	25.2%	1.5	2.8	0.5	1.6
All-Electric SF	31.6	12	1.0	2.7	14.4	17.2	15.7%	0.5	4.5	1.0	1.6	2.9	28.7	26.7%	0.3	5.15	0.9	1.7
Mixed Fuel MF	25.4	8	2.2	13.6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	14.3	11.1	14.6%	1.9	13.9	0.4	1.8
All-Electric MF	34.1	12	1.3	13.6	18.8	15.3	7.9%	0.7	20.2	0.9	1.8	4.5	29.6	14.9%	0.4	22.8	0.8	1.9

">1" = indicates cases where there is both first cost savings and annual utility bill savings.

EDR Red. = EDR Reduction.



# CITY OF PALO ALTO ENERGY REACH CODE



Palo Alto is interested in an Energy Reach Code that allows the Palo Alto community to **design, build, and operate a new generation of efficient, environmentally responsible, and healthy buildings.**

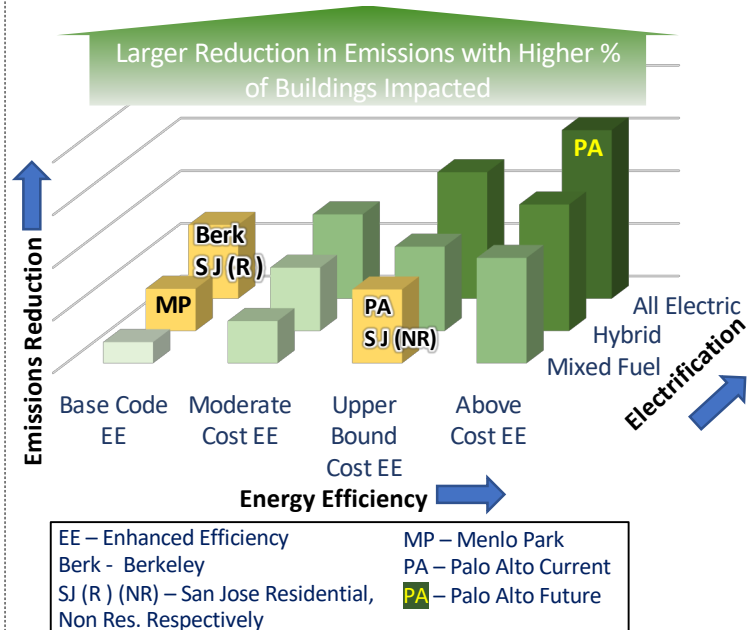
## Destination: Low Carbon Future

- |                |   |
|----------------|---|
| <b>NOW</b>     | <ul style="list-style-type: none"> <li>Pre-wiring for Electrification</li> <li>All Electric or High Energy Efficiency New Construction</li> <li>Reach Requirements for Existing Buildings</li> <li>Clean Home Rebate &amp; Customer Education</li> </ul>  |
| <b>BY 2022</b> | <ul style="list-style-type: none"> <li>Mandate All-electric                             <ul style="list-style-type: none"> <li>Low-rise residential new construction</li> <li>Small to medium office/retail</li> </ul> </li> <li>Increase &amp; Incentivize Existing Building Efficiency</li> </ul> |

### Challenges with adopting an all-electric mandate effective in 2020:

- Lack of awareness of efficient electric alternatives to space and water heating, passion for gas cooktops and gas fireplaces
- Limited equipment options for heat pump radiant floor heating; many contractors are unfamiliar with these systems
- Central heat pump space and water heating systems in large nonresidential buildings are not currently modeled in the energy compliance software; until the software can model these systems, all-electric mandate will need exceptions

## Emissions Reduction from Reach Code



Many factors affect the scale of the emissions reduction a Reach Code creates. All-electric codes that do not improve the efficiency of the building stock, or highly energy efficient codes that still allow a large amount of natural gas, will yield a smaller emissions reductions. The total reduction also depends on how the Reach Code impacts the existing building stock.

## 2019 ENERGY REACH CODE ORDINANCE REQUIREMENTS

	New One & Two Family, and Low-Rise Multi-Family Residential (≤ 3 stories)	New Office/Retail Buildings	New Hotel/Motel/ High-Rise Multi-Family (≥ 4 Stories )
<b>Mixed-Fuel</b>	Total EDR <sup>1</sup> reduction of ≥10 points less than standard design Pre-wired for future electrification of water, heating, space heating, cooking and clothes drying	Requires proposed design to be <b>12% more efficient</b> than standard design <sup>2</sup> Pre-wired for future electrification of water heating, space heating, cooking and clothes drying	Requires proposed design to be <b>5% more efficient</b> than standard design <sup>3</sup> Pre-wired for future electrification of water heating, space heating, cooking and clothes drying
<b>All-Electric</b>	No additional efficiency required Clean Home Rebate Option	No additional efficiency required	No additional efficiency required

- EDR - Energy Design Rating, a metric for energy performance measured from 0 to 100, where 0 is a zero-net energy building
  - Proposed project must achieve minimum TDV compliance margin of at least **12%** for Office/Retail buildings
  - Proposed project must achieve minimum TDV compliance margin of at least **5%** for Hotels/Motels/High-Rise Multi-Family buildings
- The Compliance Metric for non-residential energy code is Time Dependent Valuation (TDV). TDV Compliance Margin represents the percentage of energy savings compared to the base code

### Utility Incentive Programs

- Clean Home Rebate Program incentivizes all-electric residential **new construction** projects to exceed base code efficiency
- Expand rebates for electrification of gas appliances in **existing homes** Currently for Heat Pump Water Heaters (HPWH):
  - \$1,200-\$1,500: Replacing an existing gas water heater
  - \$500: Replacing an existing electric water heater
  - \$600-\$800: HPWH installation with remodel or new construction
- Resources available through CPAU Electrification webpage
- Customer Outreach Campaign to promote all-electric home

### Proposal Based on Reach Cost-Effectiveness Analysis

- Statewide & Palo Alto Studies
- Analyzed energy efficiency measures, including building electrification, that are more stringent than the upcoming California Energy Code.



# **Proposed 2019 Palo Alto Energy Reach Code**

## **October 2, 2019**

# Agenda

- ☐ Significance of Building Electrification
- ☐ What is an Energy Reach Code?
- ☐ History of Palo Alto Reach Code
- ☐ 2019 Reach Code Development Process
- ☐ Options for Reach Code
- ☐ Proposed Utility Incentive Programs and Marketing Initiatives

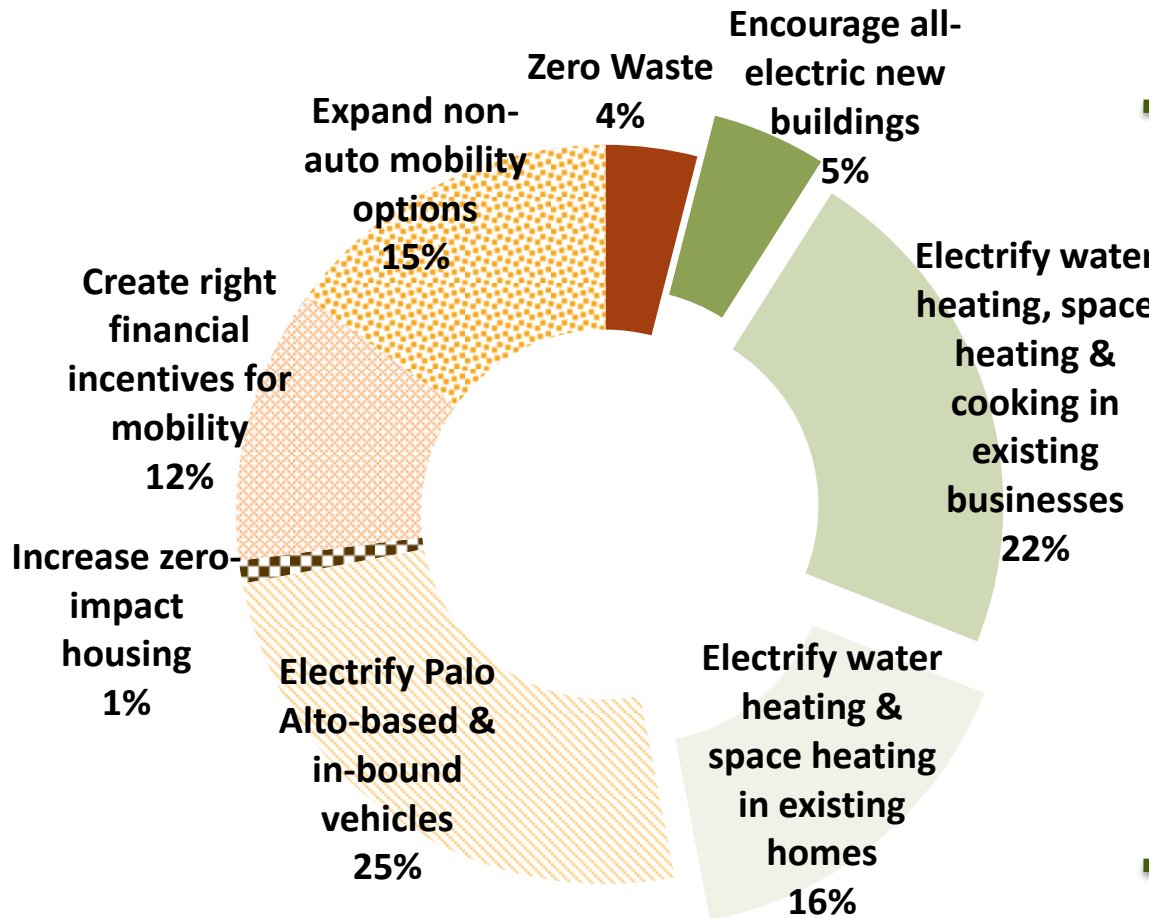
Seek UAC Input on:

Policy Options for Energy Reach Code

Proposed Utility Incentives Programs and Marketing Initiatives

# Palo Alto Sustainability and Climate Action Plan

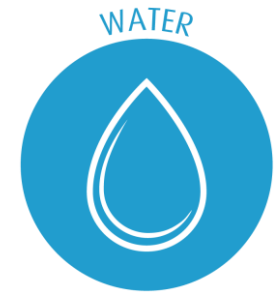
Achieve 80% reduction in Greenhouse Gas below 1990 levels by 2030



Among the S/CAP emission reduction strategies, building electrification accounts for **43%** of the GHG emissions by 2030.

# Building Electrification as a key S/CAP strategy

## Sustainability Implementation Plan Focus Areas

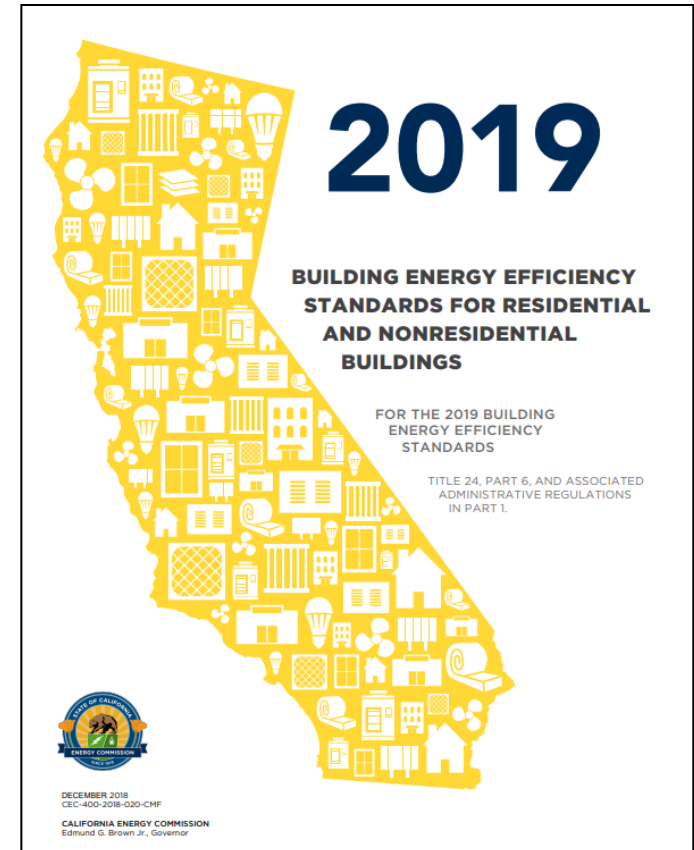


- Achieve cost effective energy efficiency savings through voluntary programs
- Encourage voluntary electrification of natural gas appliances
- Increase efficiency of new and existing building stock beyond state's standards and support building electrification through Palo Alto's energy reach code



# What is the Energy Reach Code?

- **The California Building Energy Standards** are updated every three years. Next code will be effective 1/1/2020.
- **Local codes may voluntarily “reach”** beyond baseline requirements
- **Reach Code Criteria**
  - More stringent than state requirements (use less energy)
  - Cost effective (economically justified)
  - Must not preempt federal appliance efficiency standards



# History of Palo Alto Energy Ordinances

- Palo Alto adopted its first **Energy Reach Code** in 2008
- Increased stringency over state requirements for the last 3 code cycles (2010, 2013, 2016)
- Green Building Advisory Group provides directions on the development green building and energy reach code





# Green Building Vision

## A Green, Sustainable Built Environment in Palo Alto

- meet today's needs without compromising the needs of future generations

- Design excellence
- Innovation in construction
- Creative approaches to development

★ Energy Conservation

★ Interior Air Quality

★ Water Conservation

★ Materials Conservation

★ Minimize Waste

★ Minimize Emissions

- **GOALS**
- Self-reliant buildings that contribute...
- ✓ More energy than used
- ✓ Clean water
- ✓ Healthy places to live, work & play

Raising the bar for green buildings... higher than the rest!

## 2016 CODE CYCLE

### ZERO NET ENERGY TARGETS

- Keep state TDV
- Each home has budget = 1000 sq ft home
- Everything above must be offset with renewable energy sources.



### SOLAR MANDATE

- All non-residential buildings will have to produce x% of energy from onsite solar or additional savings

### LANDSCAPING

- Lower trigger for landscape projects below BAWSKA requirement
- Yes to permit to allow enforcement, final building w/o landscape install
- Study rainwater capture options

### MATERIALS & WASTE

- Lower construction/demo recycling requirement to 80%
- Increase diversion
- Limit to approved facilities

### INDOOR AIR QUALITY

- IAQ management plan mandatory during Tier 2 construction

### WATER EFFICIENCY

- Explore grey water systems for residential
- Require grey water reuse for non-residential buildings
- Water budget required for new commercial buildings and single/multi-family homes

### CHALLENGES & LIMITATIONS

- How to enforce?
- Cost
- Flexibility
- Functionality
- Buildability
- Cooperation with utilities companies

## Palo Alto Green Building Ordinance

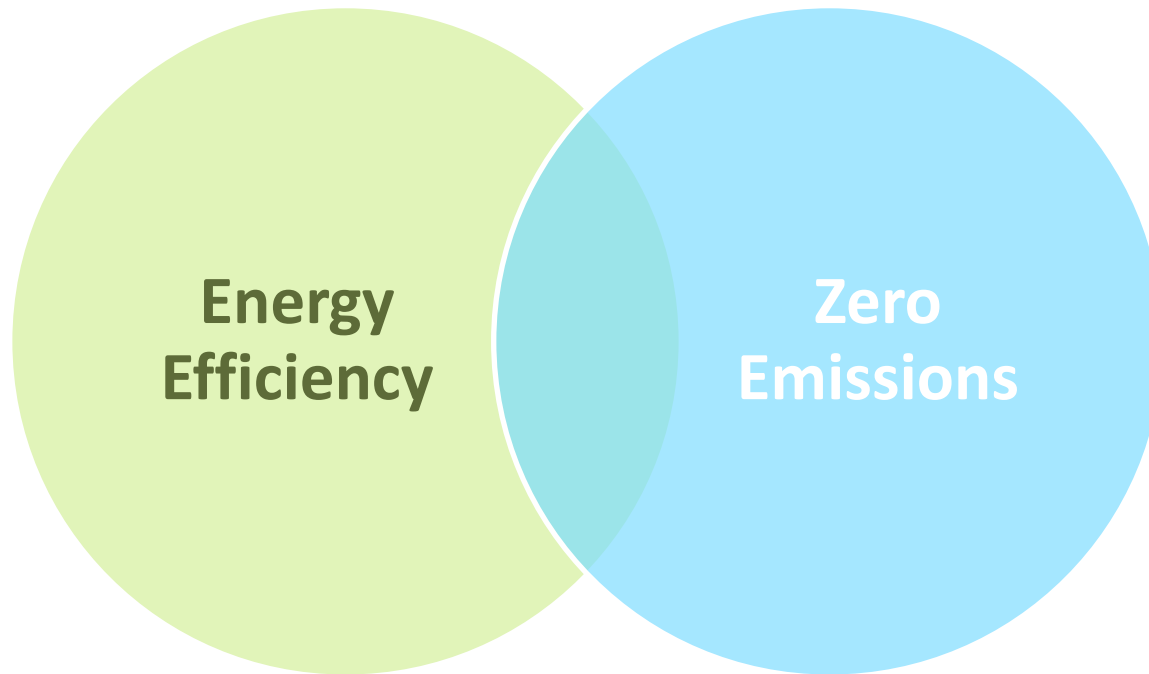
# 2016 Energy Reach Code

	New Single-Family Residential	New Multi-family Residential	New Commercial
Mixed-Fuel Project Without PV Solar Panels	10% More efficient than Base Code	10% More efficient than Base Code	10% More efficient than Base Code
Mixed-Fuel Project With PV Solar Panels	20% More efficient than Base Code <sup>1</sup>	12% More efficient than Base Code <sup>1</sup>	Comply with minimum Base Code + Install a 5 kW or larger PV system <sup>2</sup>
All-Electric	Exempted from Reach Code	Exempted from Reach Code	Exempted from Reach Code

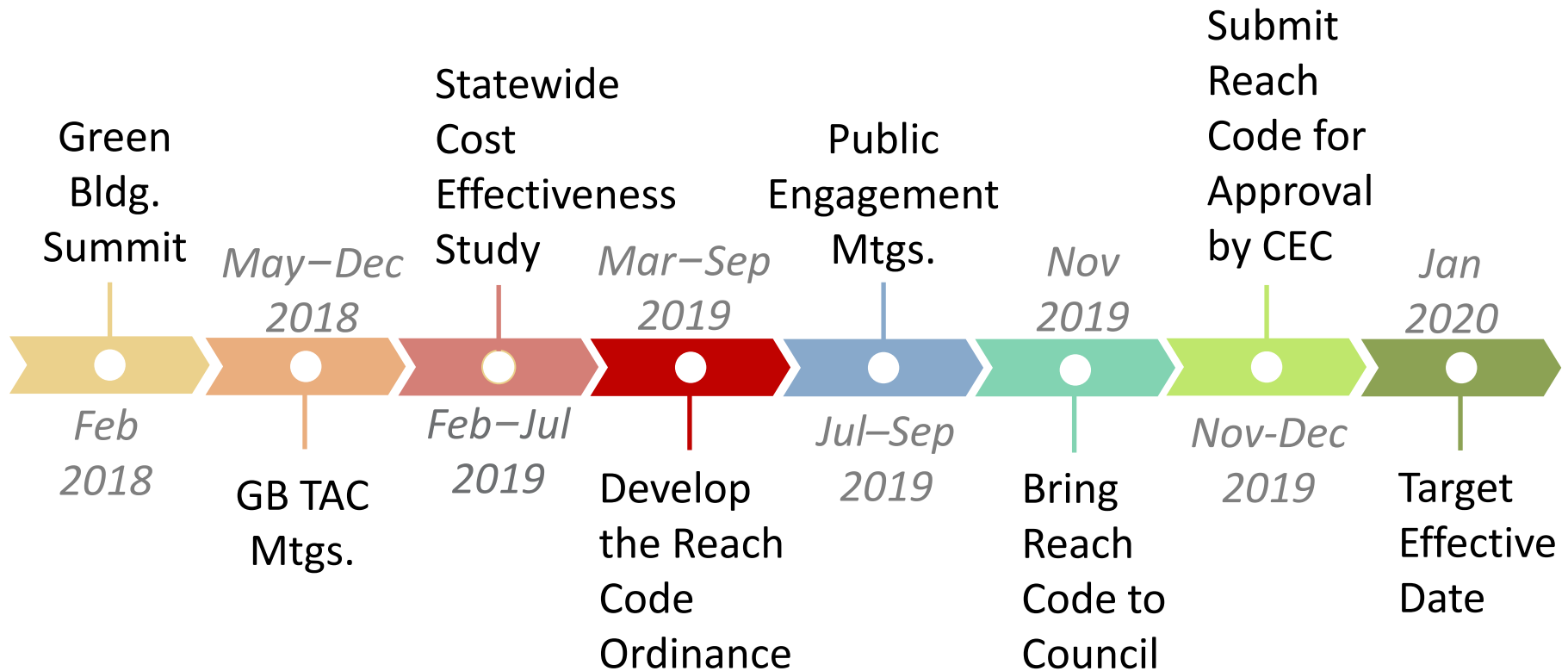
<sup>1</sup> “PV credit” may be applied to meeting the minimum T24 Energy Code. Therefore, a higher percentage reduction is required for single-family and multi-family with PV panels.

<sup>2</sup> Less than 5 kW PV system is not considered

# Policy Goals of 2019 Energy Reach Code



# 2019 Reach Code Development Process



# Policy Options for Reach Code



Prohibits natural gas infrastructure in new buildings (alternative legal basis)

- Building systems not currently modeled for all-electric design by CEC are exempted
- Internal ADUs are exempted
- Exemption allowed for cases where the use of natural gas to serve public interest is demonstrated



Requires new residential buildings (3 stories or less) to be electrically heated or all-electric. Natural gas allowed for stoves, fireplaces, or other appliances.

Requires new nonresidential buildings to be all-electric

- Exception #1: Life science building may use natural gas for space heating if electric heating is not cost effective and feasible
- Exception #2: Public agency owned and operated emergency operations centers may use natural gas if electric heating is not cost effective and feasible
- Exception #2: Nonresidential kitchens may appeal to use natural gas stoves



No reach code requirements for all-electric new buildings. Mixed-fuel new buildings that use gas need to meet higher efficiency requirements, larger PV system, battery storage and be all-electric ready.



# Utility Incentive Programs Being Considered

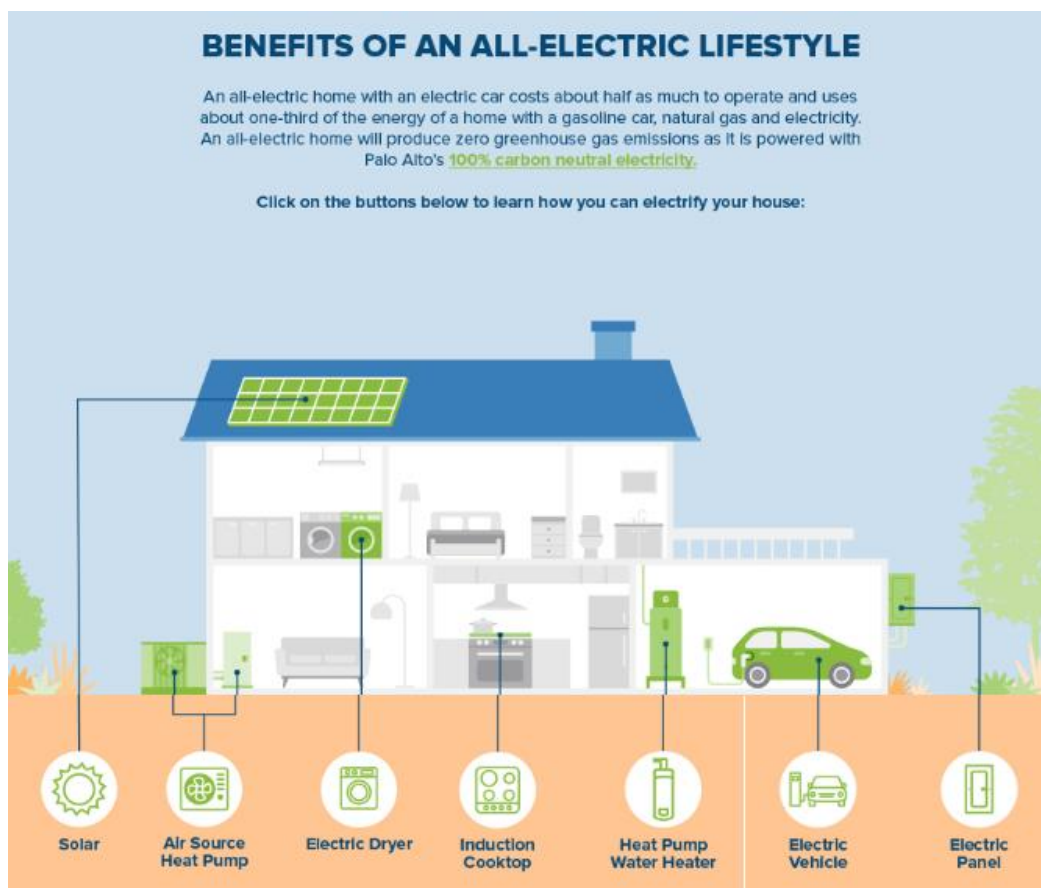
1. Clean Home Rebate Program to incentivize all-electric residential **new construction** projects to exceed base code efficiency standard
2. Expand rebate offering for electrification in **existing homes**
  - ☒ Heat Pump Water Heater
  - ☐ Air Source Heat Pump
  - ☐ Induction Cooktop
  - ☐ Energy Star Electric Clothes Dryer
  - ☐ EV charger installation with electric panel upgrade



# Utility Initiatives to support Building Electrification

- CPAU to offer Home Electrification Readiness Assessment service in Q4, 2019
- Community outreach through workshops and social media campaign
- Online resources available through CPAU Electrification webpage

[www.cityofpaloalto.org/electrification](http://www.cityofpaloalto.org/electrification)



# Budget Impact of Potential New Utility Programs

Projections of rebate uptake	year 1	year 2	year 3	Rebate
All-Electric SF new construction	35	45	50	\$2,000
All-Electric MF new construction	8	8	8	\$1,000
SF: mixed-fuel to all-electric conversion	15	30	50	\$6,000
Total Rebate amount	\$168,000	\$278,000	\$408,000	\$854,000
Staffing (FTE)	0.75	0.75	0.75	
Estimated Marketing Budget	\$100,000	\$25,000	\$25,000	\$150,000



## Questions & Feedback

**Seek UAC Input on:**

**Policy Options for Energy Reach Code**

**Proposed Utility Incentives Programs & Marketing Initiatives**

# Stakeholder Feedback

Reach code places an unfair burden on new construction without addressing larger operational impacts of older homes

City should stop new gas connections to avoid stranded assets

Ideal is no new gas hook up and all electric

Could settle for Menlo Park approach that targets building components that have the largest environmental impact

Tiered rate structure disincentivizes electrification. An all-electric rate is a must

It's unclear whether electric heat pump system can work with radiant heating



# Electric and affordable buildings – critical pillar to meet our climate, health and equity goals

Bruce Nilles, RMI  
October 10, 2019

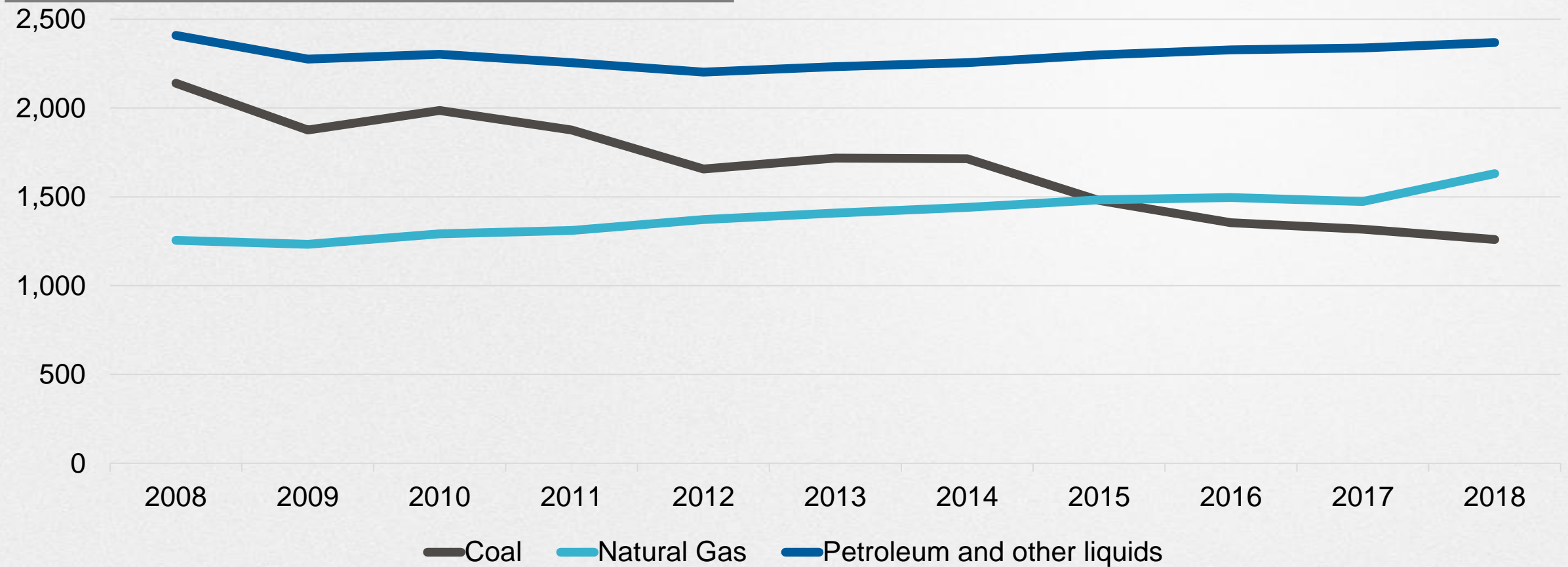


# Carbon pollution sources in the US are now Oil #1, Gas #2, Coal #3

## This year coal will be down 50% since 2008, oil and gas both increased.

### U.S. energy-related carbon dioxide emissions by fuel

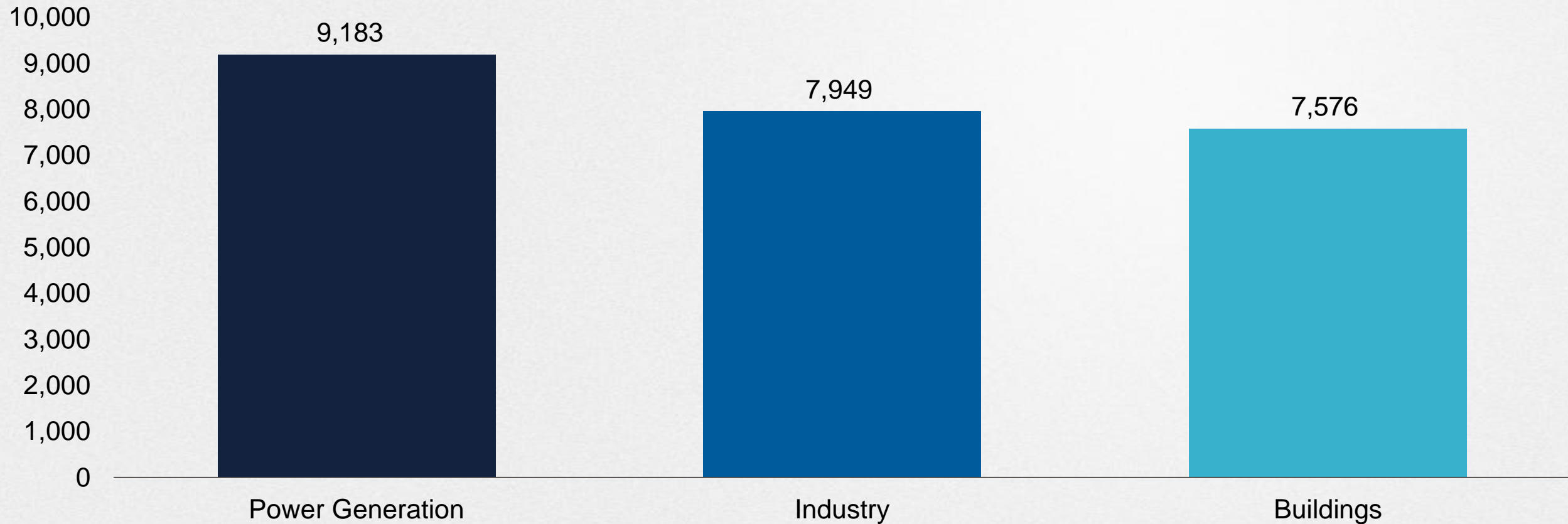
Million metrics tons CO<sub>2</sub>



# Gas is burned in largely equal amounts to make electricity, in industrial applications and in our buildings.

## Natural Gas Consumption by Sector

U.S., Bcf, 2017



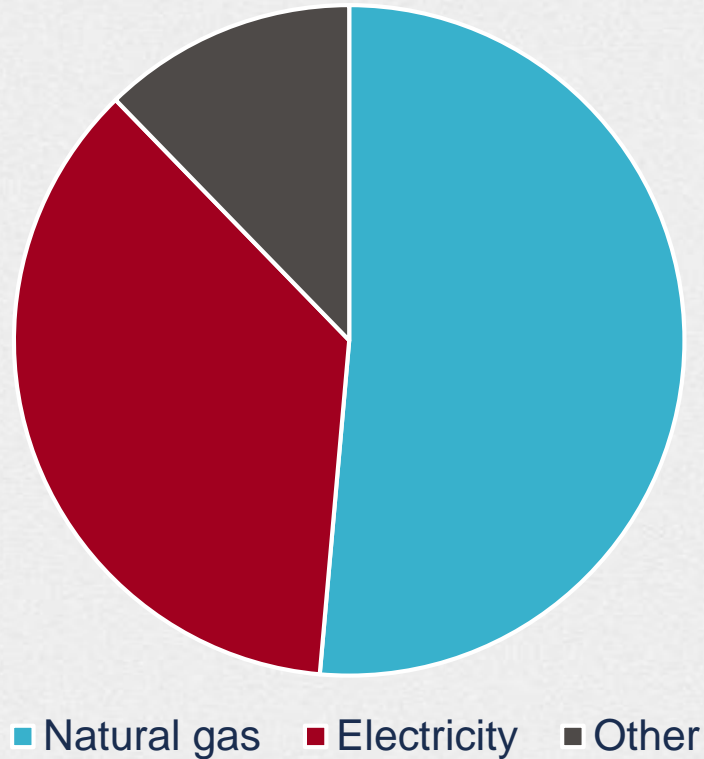
Source: EIA  
These 3 end uses represent 91% of natural gas consumption



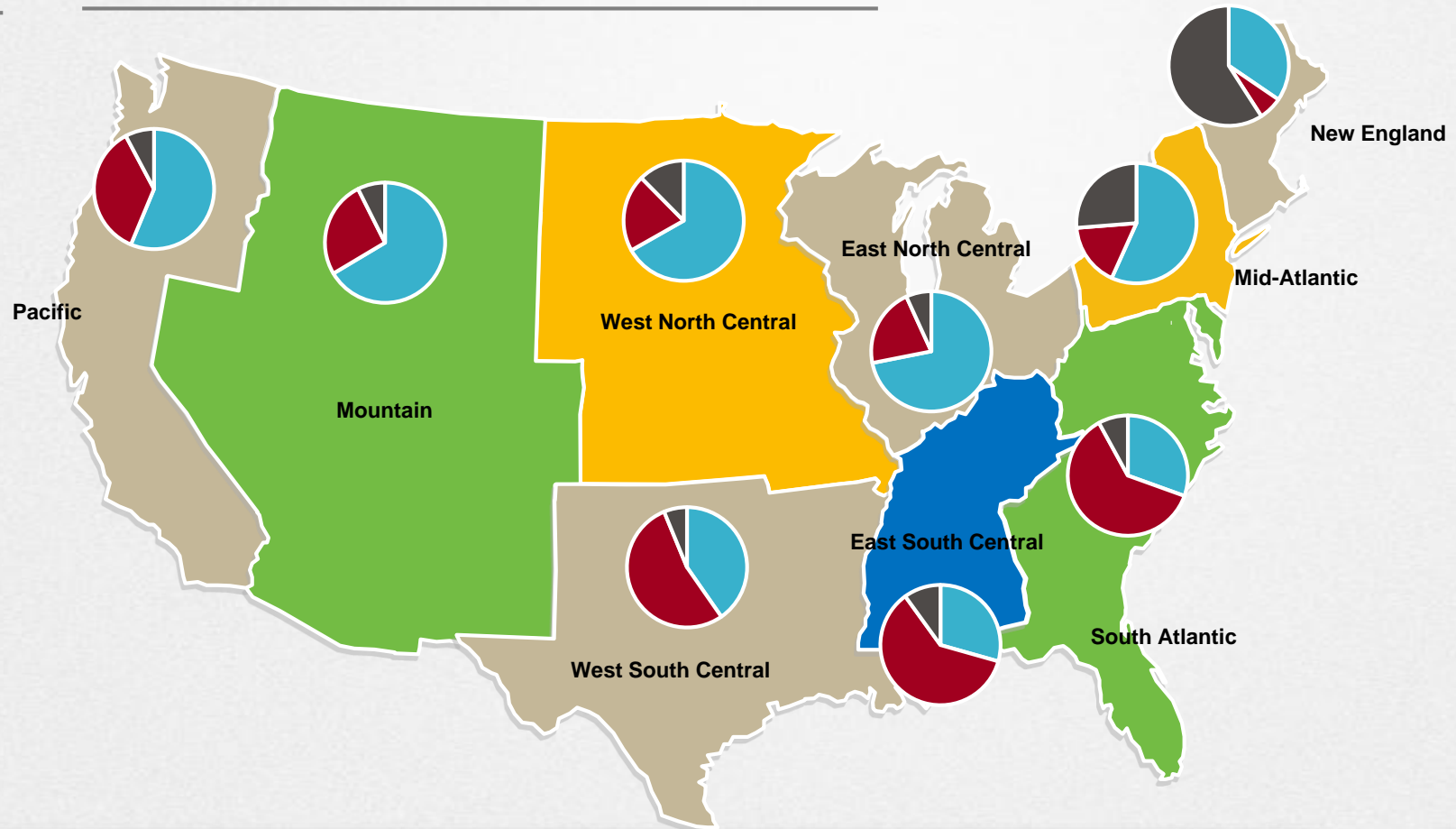


# 70 million buildings in U.S. burn gas, oil or propane, but significant variability

Primary Heating Fuel of U.S. Residences  
2015

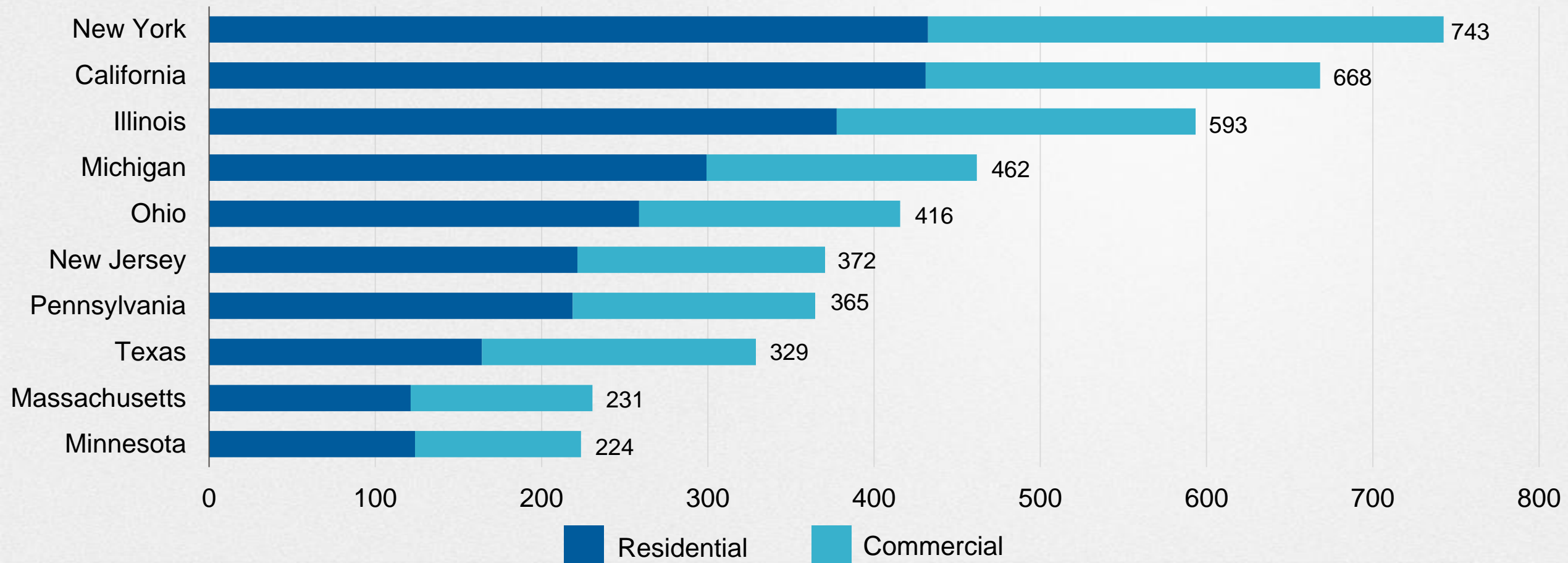


Primary Heating Fuel of Residences by Census Division  
2015

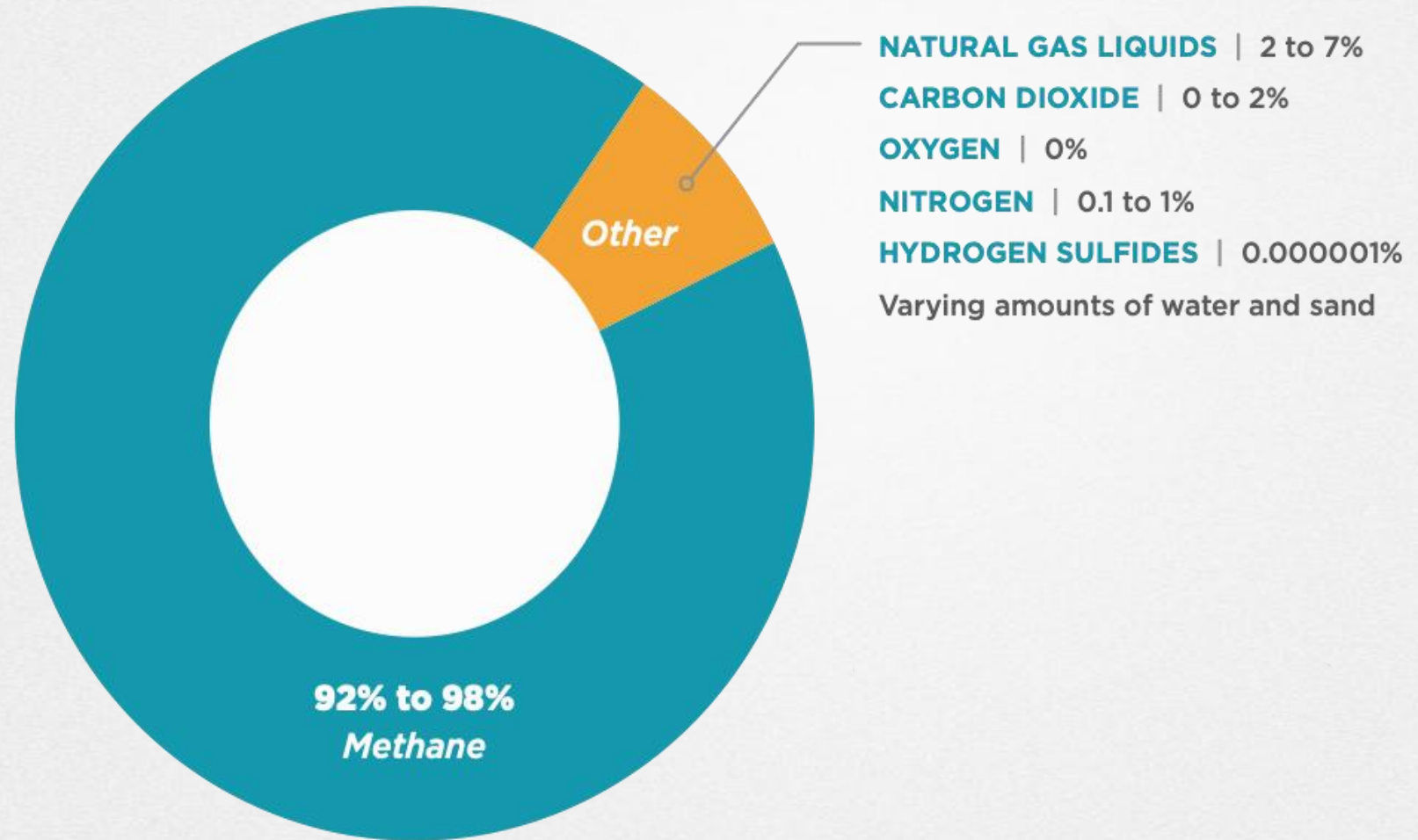
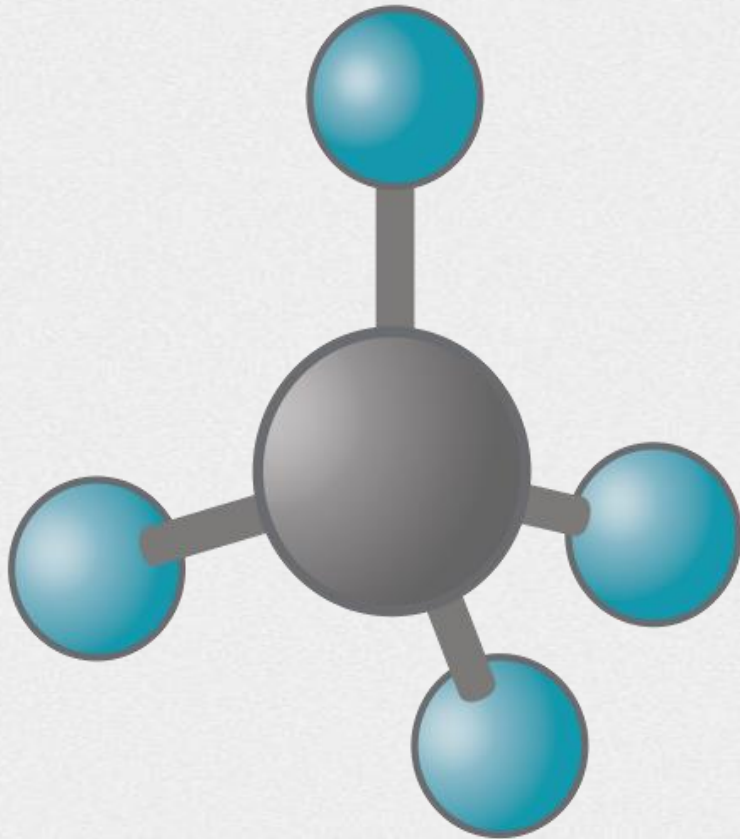


# Ten states account for 58% of building natural gas use in 2017

**Natural Gas Delivery by State**  
2017, Bcf



# “Natural Gas” is Methane







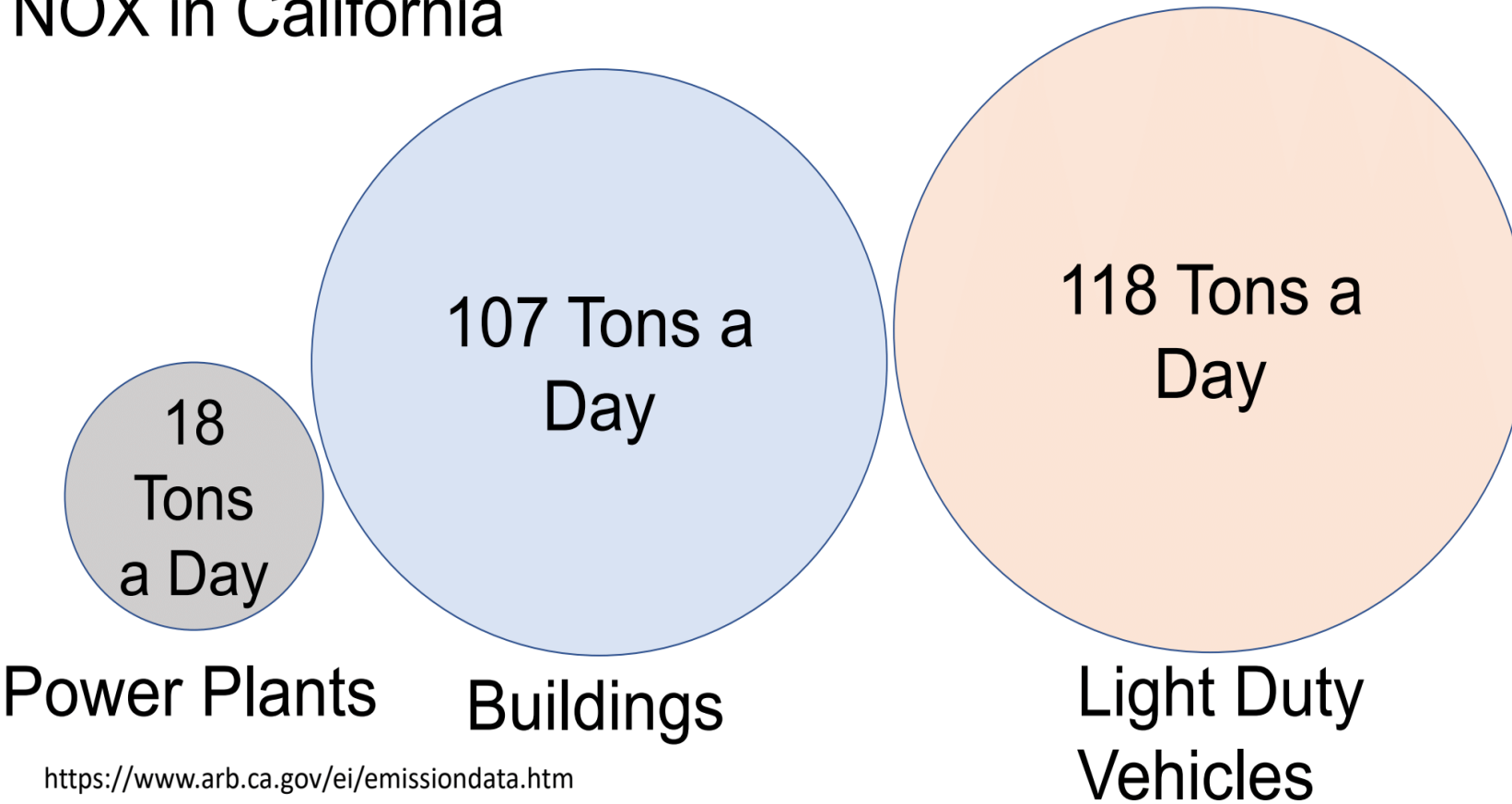
METHANE IS

**84x more potent**  
than CO<sub>2</sub> in the short run



# Burning of gas, oil and propane in our buildings is also a big part of our outdoor smog problem

## NOX in California



# Cooking with Gas Can Harm Children:

Cooking with gas stoves is associated with increased risk of childhood respiratory illnesses, including asthma

Andee Krasner, MPH\* and T Stephen Jones, MD, MPH

## Key Points

**Question** Does cooking with a gas stove harm children's health?

**Findings** In a systematic review of the literature, we found that cooking with natural gas increases nitrogen dioxide, degrades indoor air quality, and increases the risk of respiratory illnesses in children, including asthma. More than 30% of United States households cook with gas. In Massachusetts, many health workers and others do not know that cooking with gas is associated with increased risk of asthma.

*Children living in a home with a gas stove are 42% more likely to have asthma.*

# California Air Board: Residential Cooking Exposure Study Finds Unhealthful Levels

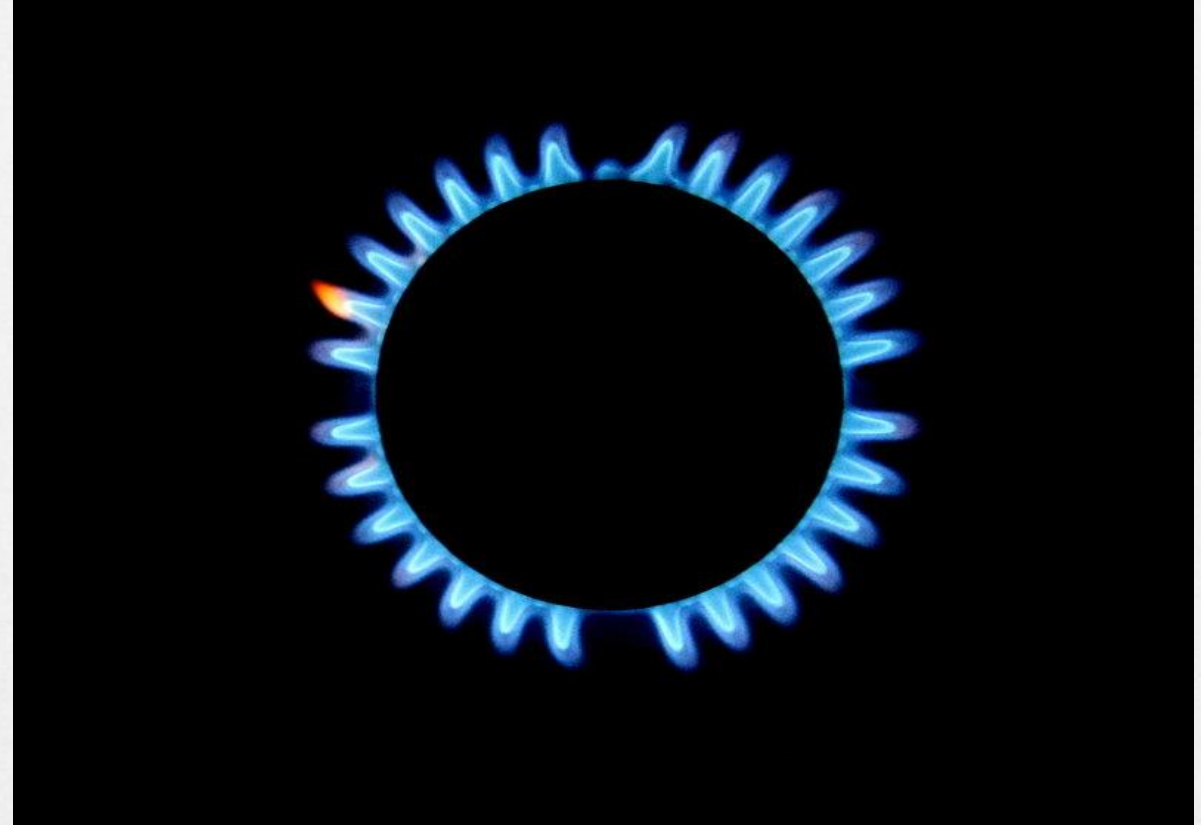
Making a fried chicken dinner produced average indoor nitrogen dioxide levels of up to **400 parts per billion**.

EPA's health-based air quality standard is **100 parts per billion**.

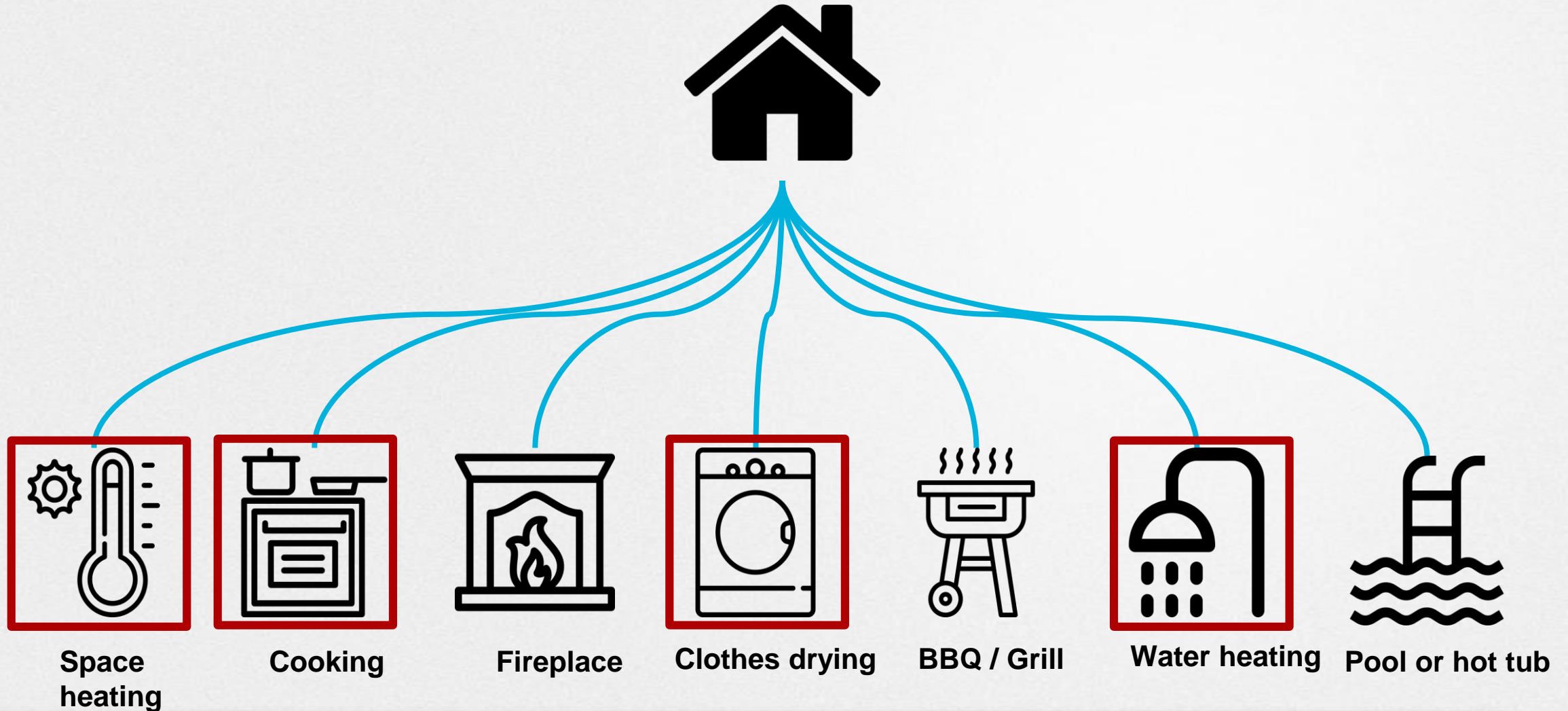


# SUMMARY: “Natural Gas” Has At Least Three Challenges

- Climate
- Health
- Community Safety



# The most common uses of natural gas in buildings are for space and water heating, clothes drying, and cooking











Gas Infrastructure  
Costs – pipe to  
building, venting,  
and indoor pipes:  
\$6,000-\$15,000/home



Every \$1,000 increase  
in house price prevents  
9,897 California families  
from affording  
-NAHB, 2019



# July 16, 2019 – Berkeley becomes first city in US to ban gas in new buildings

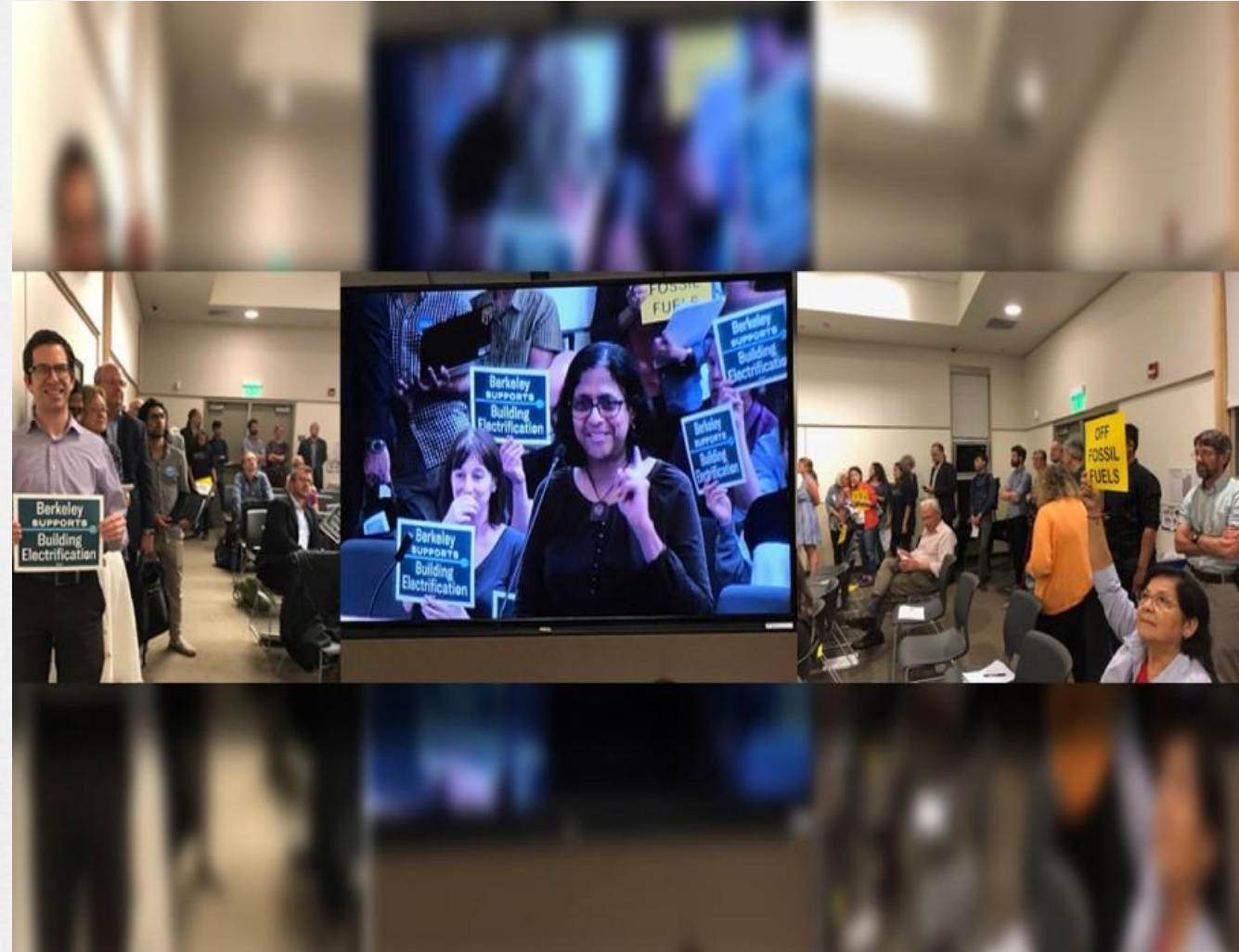
## Berkeley became first US city to ban natural gas. Here's what that may mean for the future

The California city on Tuesday voted to ban natural gas hook-ups in new buildings, in a historic move



▲ The view of the Bay from the Berkeley Hills. Photograph: Alamy Stock Photo

Berkeley this week became the first city in the United States to ban natural, fossil gas hook-ups in new buildings.



# Generated significant national interest



## Give Up Your Gas Stove To Save The Planet? Banning Gas Is The Next Climate Push

August 5, 2019 - 4:29 PM ET  
Heard on All Things Considered

## Los Angeles Times

The popular image of gas cooking and heating — clean, cheap and reliable, a “bridge fuel” from coal to renewables — requires drastic revision. Natural gas is in fact the new coal; its greenhouse gas emissions overall in the U.S. have **surpassed coal's** since 2015. The California Air Resources Board calculates that natural gas emissions from the state's 12 million buildings account for **12%** of the state's greenhouse gas emissions. Add to that a reasonable estimate of the leaks from the state's natural gas pipelines, and according to Bruce Nilles, an electrification advocate at the Rocky Mountain Institute, that percentage likely doubles, surpassing emissions from all the state's power plants.

Natural gas is combustible, a frequent culprit in fires and explosions and a particular menace in earthquake zones. But even without major temblors, gas pipes beneath cities **pose risks**. An underground gas pipe explosion in the Bay Area city of San Bruno in 2010 killed eight people and destroyed or damaged more than 100 homes, and the Aliso Canyon **gas storage leak** forced the evacuation of more than **8,300 households** in Granada Hills for more than 100 days in 2015 and 2016.

## San Francisco Proposes Natural Gas Ban, Following Other Bay Area Cities

By Lauren Sommer Sep 24



Gas in new homes. (Lindsay Moore/KQED)

## The next target in the climate-change debate: your gas stove

Valerie Volcovici, Nichola Groom

WASHINGTON/LOS ANGELES (Reuters) - Dozens of cities, such as California, Washington, and Massachusetts are now limit the use of natural gas in commercial and residential buildings. This move opens a new front in the fight against climate change that ranges from heating systems in skyscrapers to stoves in suburban homes.



REUTERS

## The Guardian

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▲ The view of the Bay from the Berkeley hills. Photograph: Getty Images

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## THE WALL STREET JOURNAL.

OPINION | LETTERS

## Berkeley's Gas Ban Should Only Be a Start

Where will the electricity come from if everyone is forced to use electricity for everything at home? The current electric capacity.





# Seven California cities followed suit with similar ban-style policies, including San Jose, 10<sup>th</sup> largest US city



"San Luis Obispo's forward looking ordinance is both an ambitious local policy and a piece of a broader statewide effort to move towards a clean, renewable energy future. We applaud San Luis Obispo's leadership and look forward to what it and other cities across the state will accomplish next." - Matt Gough, Sierra Club



## Conclusions

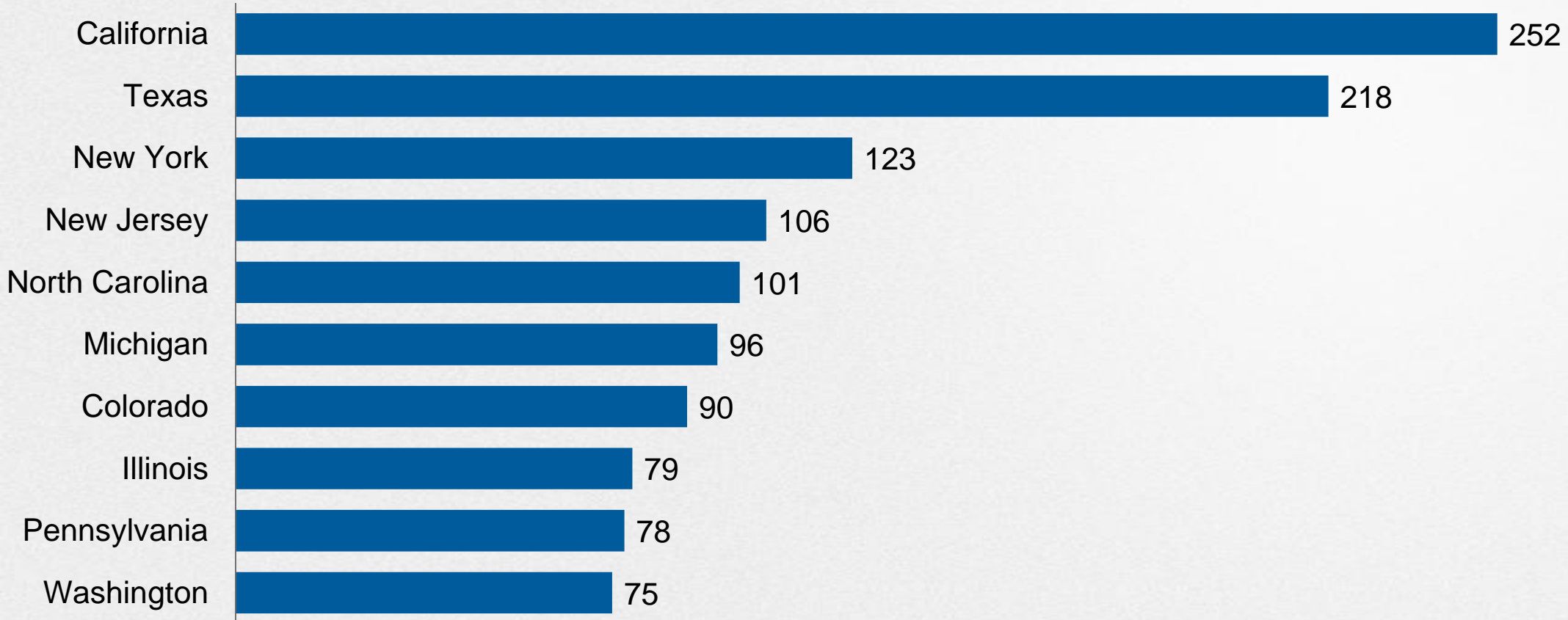
- The burning of fossil fuels – primarily natural gas – in our buildings is a significant public health and climate threat. All-electric buildings offer significant health benefits for residents.
- The solutions to electrify buildings exist today, and are cost-effective for new construction, and increasingly so for retrofits of existing buildings. Programs to help renters and low-income home owners are critical.
- First important step is to address new buildings, so we are not making the problem worse, as we design smart and inclusive programs to electrify existing buildings.
- Cities and states have a huge opportunity to lead on this issue, and to make sure it is done equitably and expeditiously.



# The ten states where we have been adding the most new gas customers from 2013 to 2017

## New Natural Gas Customers, 2013-2017

Residential and Commercial Sectors, thousands of customers







# The electric alternatives are available today and they are better.



Induction cooking



Air or ground source heat pumps

