STAFF REPORT

City Council
Meeting Date: 9/24/2019
Staff Report Number: 19-187-CC

Consent Calendar: Introduction of Ordinance No. 1057 adopting updated building codes and local amendments to the 2019 California Energy Code to require higher levels of building electrification and solar production for newly constructed buildings to reduce greenhouse gas emissions effective January 1, 2020

Executive Summary

Staff recommends that the City Council introduce Ordinance No. 1057 adopting updated building codes and local amendments to the 2019 California Energy Code as written in Attachment A that would require higher levels of building electrification and solar production for newly constructed buildings to reduce greenhouse gas emissions effective January 1, 2020, as originally presented August 27, with the following City Council directed amendments to Section 100:

1. Clothes dryers to use electricity for residential homes and low-rise multifamily buildings.
2. All new buildings to be electric-ready if allowed to use natural gas appliances through exceptions or appeal.
3. Nonresidential kitchens (such as office cafeterias and for-profit restaurants) to be all-electric with the right to appeal for gas cooking appliances.

The amendments above are determined to meet the cost effectiveness requirement. If the City Council desires to make substantive amendments beyond those outlined above, it is unlikely that the codes will be implemented by January 1, 2020.

For the purposes of application to the California Energy Commission (CEC,) the following report outlines the background and analysis supporting this ordinance development and does not include any new information for City Council consideration.

Policy Issues

Adoption of environmentally sustainable local amendments to the California Building Code (known as Reach Codes) is in the City Council 2019 workplan. Adopting local energy codes that reduce fossil fuels, such as natural gas used in buildings, aligns with the City’s climate action plan to reduce greenhouse gas emissions (GHG) and the climate and sustainability resolution (Resolution No. 6493) signed by the mayor on Earth Day that specifies working toward zero carbon (greenhouse gas free) buildings. The adoption of local building code standards or amendments requires City Council and state approval.
Background

California state building code and local Reach Code opportunity

Each local government is required by law to adopt new changes to the California Building Standards Code every three years (known as code cycles) proposed by the State. The next code cycle will take effect January 1, 2020.

This creates an opportunity to simultaneously adopt optional local building code amendments (known as Reach Codes) that exceed state code standards. Historically, cities/counties sometimes adopt amendments to the Energy (Title 24, Part 6) and California Green Building Standards – CALGreen (Title 24, Part 11) codes to meet local environmental goals or aspirations.

Menlo Park’s environmental goal is to meet its greenhouse gas reduction goal of 27 percent below 2005 levels by 2020 as outlined in the City’s climate action plan (Attachment B.) New buildings that have energy delivered from burning fossil fuels contribute to climate change by emitting greenhouse gases (GHG). In 2013, energy usage from buildings accounted for 55 percent (196,000 tons) of the total community GHG emissions in Menlo Park.

More than 80 percent of a building’s energy use relates to heating/cooling space and heating water. Natural gas is fossil fuel that is typically used for heating space and water for building occupants. As increased development occurs in the community, it is important to consider feasible and reasonable policies and regulations that will not increase the community’s natural gas usage to achieve or exceed the City’s GHG emissions reduction goal.

Menlo Park is in a unique position due to its large renewable energy portfolio. Residents and businesses in Menlo Park receive energy from Peninsula Clean Energy (PCE,) which provides 50 percent renewable energy and 90 percent greenhouse gas (carbon) free electricity at a cost slightly less than PG&E.

This creates a significant Reach Code opportunity to reduce future GHG in new buildings by discouraging or eliminating the use of natural gas. This can be accomplished by incentivizing and/or requiring new buildings to use more electric appliances to utilize the clean renewable electricity available rather than natural gas. All-electric buildings are defined as having electric appliances for space heating, water heating, clothes-drying, fireplaces and cooking appliances.

Based on past building permit trends and the number of new developments in the planning phase, Menlo Park may experience over the upcoming code cycle the replacement and rebuild of 100 new homes and the addition of 21 new buildings that include high-rise residential, retail, office and hotels (if approved.) If these buildings still use natural gas for heating, 212,876 tons of GHG would be emitted over the expected life of the buildings (30 years for residential and 50 years for commercial.) This adds about 5,000 to 6,000 tons each year to the community GHG emissions (equivalent to the weight of 130 humpback whales.) In addition, the majority of development would occur near the bay front, which is vulnerable to sea level rise resulting from climate change. This provides further motivation to avoid additional GHG emissions.

PCE has a goal to be 100 percent greenhouse gas free by 2021, which would mean all new all-electric buildings in Menlo Park would be GHG free by 2021. This maximizes the use of clean and renewable energy currently available and ensures that the climate action plan goals are met.

It is also important to note that as the State and region quickly move toward renewable energy, future regulation will likely require electrification of buildings, particularly through retrofit requirements. Addressing electrification now for new buildings avoids hardships and costs for building owners in the future. The state is already requiring that power providers achieve 100 percent greenhouse gas (carbon) free electricity by
City Council direction
Staff presented reach code options and recommendations at three EQC meetings and two City Council meetings before the September 10 meeting. Each meeting outcome provided additional direction for increased electrification requirements (Attachment C.) Based on the last City Council meeting August 27, staff has incorporated the direction to require:
1. Clothes dryers to use electricity for residential homes and low-rise multifamily buildings.
2. All new buildings to be electric-ready if allowed to use natural gas appliances through exceptions or appeal.
3. Nonresidential kitchens (such as office cafeterias and for-profit restaurants) to be all-electric with the right to appeal for gas cooking appliances.

Floor area ratio (FAR) exclusions are not recommended for changes as the zoning ordinance already allows a process and methods for excluding mechanical equipment.

Analysis
Proposed Reach Code
The proposed Reach Code in Attachment A only applies to newly constructed buildings, and not additions or remodels. Tenant improvements that result from an all-electric core and shell would also be required to comply. Based on the evaluation criteria and City Council direction August 27, the proposed Reach Code for Menlo Park would have the following standards/requirements:
## Table 1: Summary of proposed Reach Code requirements/standards

<table>
<thead>
<tr>
<th>Building type</th>
<th>Requirements/Standards</th>
</tr>
</thead>
</table>
| New residential buildings (single family and three stories or less multifamily) | Require to build all-electric building for:  
  Space heating, water heating and clothes dryers.  
  a. Natural gas can still be used for stoves, fireplaces or other appliances if desired.  
  b. Prewiring for electric appliances is required where natural gas appliances are used. |
| New nonresidential buildings and high-rise multifamily buildings (three stories and greater) | Require to:  
  1. Build an all-electric building that uses electricity as the source of energy for all appliances, including but not limited to heating/cooling appliances, cooking appliances, fireplaces and clothes dryers; and  
  2. Install a minimum amount of on-site solar based on square footage:  
     a. Less than 10,000 square feet requires a minimum of three kilowatt photovoltaic system  
     b. Greater than or equal to 10,000 square feet requires a minimum of five kilowatt photovoltaic system  
  Exceptions include:  
    - Life science buildings may use natural gas for space heating if desired. To grant exception, applicants are required to provide third-party verification to analyze why all-electric space-heating requirement is not cost effective and feasible.  
    - Public agency owned and operated emergency operations centers (such as fire stations and police stations) may use natural gas. To grant exception, applicants are required to provide third-party verification to analyze why all-electric space-heating requirement is not cost effective and feasible.  
    - Nonresidential kitchens (such as for-profit restaurants and cafeterias) may appeal under certain conditions to an appointed body designated by the City Council if they want to use natural gas stoves. The advisory body’s decision can be appealed to City Council.  
  For all exceptions, natural gas appliance locations must be electrically pre-wired for future electric appliance installation |

The Reach Code option was chosen based on these following criteria:  
- Feasibility and cost-effectiveness  
- Significant greenhouse gas reductions (greatest environmental benefit)  
- Ease of implementation and efficiency for the development community and city operations  
- Community acceptance

### State code and Reach Code process
The California Health and Safety Code enables local communities to modify the California Building Standards Code and adopt different or more restrictive requirements with the caveat that:  
- The local modifications must be substantially equivalent to or more stringent than the building standards published by the California Building Standards Code; and  
- The local jurisdiction is required to make specific or express findings that such changes are reasonably necessary because of local geological, climatic or topographic conditions.
These findings are included in Attachment A. If Reach Codes involve energy requirements, cities/counties need to file an application to the CEC to prove that any local amendments related to the energy code are cost effective and save more energy than those required by the state. This is done through submitting a cost effectiveness study to the CEC.

Cost effectiveness study results
The studies and memorandum in Attachment E, F, and G present the research and cost effectiveness analysis of various building prototypes with different Reach Code options.

The studies act as tools for communities to select different Reach Code options ranging from increased energy efficiency to all-electric requirements. For Menlo Park, the studies provide evidence that the proposed electric requirements for new buildings and solar production are cost effective. Table 2 highlights the estimated cost savings between new all-electric and natural gas buildings.

<table>
<thead>
<tr>
<th>Building prototype</th>
<th>Construction savings</th>
<th>Operational savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single family home</td>
<td>Up to $5,349</td>
<td>$4,416</td>
</tr>
<tr>
<td>Multifamily- three stories or less</td>
<td>Up to $2,337</td>
<td>$1,864</td>
</tr>
<tr>
<td>Office</td>
<td>$82,330</td>
<td>$52,738</td>
</tr>
<tr>
<td>Retail</td>
<td>$24,111</td>
<td>$22,661</td>
</tr>
<tr>
<td>Hotel</td>
<td>$1.3 million</td>
<td>$1.24 million</td>
</tr>
</tbody>
</table>

A majority of the cost savings is experienced upfront in the construction phase by avoiding the cost to install natural gas infrastructure. Additionally, building operational savings was calculated using time dependent valuation (TDV.) TDV was developed by the CEC to reflect time dependent value of energy including the long-term projected costs of energy, such as the cost of energy during peak periods. It also provides a value for GHG emissions produced/reduced as part of the calculation. TDV is expressed as the overall lifecycle savings of a building, which for the purposes of the study is 15 years for residential and 30 years for nonresidential.

If peak demand costs and greenhouse gas costs are removed from TDV, the cost to operate single-family, multifamily, offices and hotels would be increased. However, there are other important local factors to consider that would further reduce operational costs. For example, Menlo Park’s electricity provider, PCE, has slightly lower electricity rates than the PG&E rates used in the cost effectiveness studies.

Additionally, the studies used the lowest energy efficient appliances allowable under federal law for the building prototypes. There is higher energy efficient and cost effective appliances available on the market that would further reduce utility bill costs for customers.

In addition, producing on-site solar as required under the proposed Reach Code for new buildings would further reduce operation costs. Based on Menlo Park’s PCE rates, nonresidential/high-rise residential on-site solar requirements, and higher energy efficient appliances available, the expected average annual utility bill would be much lower than projected in the cost effectiveness studies.

Also, the addition of the prewiring requirement directed by City Council is considered to be cost effective. The supplemental memorandum from TRC (Attachment G) confirms that the cost to pre-wire for stoves is
minimal. Natural gas cooking appliances use electricity for ignition, fans and lights. Electrical outlets will already be present. The cost of pre-wiring is estimated to be $280 as opposed to $930 to retrofit an existing electrical line.

Overall, the proposed Reach Code requirements have been shown to be cost effective.

Community engagement and feedback
Five public meetings between February and August 2019 have been held regarding Reach Code options. Multiple news articles have been published about the proposed Reach Codes. Since the August 27 meeting, a San Jose Mercury article was published August 28 regarding the proposed Reach Codes (Attachment J.)

A project page (Attachment K) was published on the City’s website in July. In addition, the planning division has been providing information to current planning permit applicants about the proposed Reach Codes that could impact their project when applying for building permits after January 1, 2020. Staff spoke with various stakeholders concerned about the proposed Reach Codes multiple times.

Exemption for life sciences laboratories
Staff received feedback from the development community, residents, energy providers, the CEC, and nonprofit organizations. In July and August, staff addressed some community concerns about the reliability of an all-electric laboratory or life science building. These buildings contain vulnerable lab experiments, which depend on temperature-controlled rooms. Menlo Park has a life science district that houses incubator space for startup companies and medical/biotechnology research and development companies. Staff met with life science stakeholders to understand the concerns and explore options for all-electric life science buildings.

While all-electric laboratories and life science buildings are technically feasible as demonstrated by the University of California systems (Attachment D,) staff recommended those buildings to be exempted only for space heating. Life science buildings in Menlo Park have a higher tenant turnover rate than university campuses. The stakeholders need flexibility to change the building structures to attract new tenants.

As a result of lacking case studies, life science buildings may use natural gas for space heating, but water heating appliances are required to be electric. However, for every life science and laboratory building permit application, the applicant must submit a third-party verification to analyze why electric heating is not feasible and cost effective. This exception only applies to the 2019 building code cycle (effective January 1, 2020) and would be re-evaluated in 2022.

All-electric high-rise residential buildings
In August, staff received feedback from some high-rise residential building stakeholders. They had two main concerns. First, the state codes do not provide a pathway for large central electric water heating systems to be used for compliance and secondly, the unknown reliability of these electric water systems to provide domestic hot water. Staff consulted with TRC (cost effectiveness study technical consultants,) the CEC, and the City’s building division to consider these concerns.

After further analysis, it was found that there are two alternative state code pathways for compliance:
1. Provide individual electric water heating systems to each unit; or
2. Use a smaller scale electric central water heating system that serves up to eight units, which are also known as “mini-plants.”

In addition, staff found many case studies (Attachment H and I) of all-electric high-rise residential buildings.
It should be noted that these buildings are not typical and are considered cutting edge. This requires innovative thinking and leadership in designing all-electric hot water systems.

After working on alternative state code pathways and case studies with the high-rise residential stakeholders, they expressed willingness at the City Council meeting August 27 to take on the challenge of all-electric buildings, but still acknowledged that this comes with challenges and requested consideration of exclusions in FAR calculations to account for the increased mechanical equipment. FAR exclusions are specified by zoning code and therefore not a matter would require a separate ordinance amendment. As this time, however, staff does not recommend exploration of zoning code changes as the zoning ordinance already allows a process and methods for excluding mechanical equipment.

Next steps
If approved, a second reading of the ordinance is tentatively scheduled September 24.

After adoption by City Council September 24, staff will submit the proposed Reach Codes to the California Building Standards Commission and the CEC for approval. Approval can take up to 60 days from the CEC. Staff has been working closely with the CEC to ensure that the proposed Reach Codes and cost effectiveness studies meet the state standards for adopting local energy code amendments. After approval by the CEC, staff will submit the proposed Reach Codes to the Building Standards Commission for final approval.

Staff will also develop an implementation plan over the next few months to prepare the necessary protocols and procedures for development applicants to comply with the Reach Codes. In addition, staff will inform the development community of the changes before the January 1, 2020 effective date.

The building code amendments discussed in this report focus on the Energy Code. Energy code local amendments are more difficult to process as they require a separate cost effectiveness study, and public review and approval by the CEC. Staff anticipates recommending additional local amendments to the Green Building code, Fire Code and possible other uniform State building codes. As these other local amendments do not require CEC approval, staff anticipates bringing forward a second building code ordinance for City Council approval in November 2019. The second ordinance will address the remainder of the uniform codes required by the state to adopt.

Environmental Review
Pursuant to Title 14 of the California Administrative Code, Section 15061(b)(3) this ordinance is exempt from the requirements of the California Environmental Quality Act ("CEQA") on the grounds that these standards are more stringent than the State energy standards, there are no reasonably foreseeable adverse impacts and there is no possibility that the activity in question may have a significant effect on the environment.

Public Notice
Public notification was achieved by posting the agenda, with the agenda items being listed, at least 72 hours prior to the meeting.

Attachments
A. Ordinance No. 1057 amending Title 12 (Buildings and Construction) of the Menlo Park Municipal Code adopting the updated uniform building codes and adopting local amendments to the Energy Code

B. Hyperlink – climate action plan: menlopark.org/ArchiveCenter/ViewFile/Item/8360

C. Summary of staff’s recommendation and City Council direction


E. Hyperlink – Statewide Reach Code residential cost effectiveness study: menlopark.org/DocumentCenter/View/22644/H4--Att-C

F. Hyperlink – Statewide Reach Code nonresidential cost effectiveness study: menlopark.org/DocumentCenter/View/22642/H4---Att-D

G. Supplemental TRC memorandum

H. Scott Shell’s all-electric buildings presentation

I. Supplemental memo on all-electric high-rise residential buildings


K. Hyperlink – Reach Code project page: menlopark.org/reachcodes

Report prepared by:
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Rebecca Lucky, Sustainability Manager
Chuck Andrews, Assistant Community Development Director
Cara Silver, Assistant City Attorney
WHEREAS, the City of Menlo Park ("City") wishes to adopt a building code in accordance with law and to use the most updated regulations in the processing of development in the City;

WHEREAS, California Health and Safety Code section 17958 requires that cities adopt building regulations that are substantially the same as those adopted by the California Building Standards Commission and contained in the California Building Standards;

WHEREAS, the California Energy Code is a part of the California Building Standards which implements minimum energy efficiency standards in buildings through mandatory requirements, prescriptive standards, and performances standards;

WHEREAS, California Health and Safety Code Sections 17958.5, 17958.7 and 18941.5 provide that the City may make changes or modifications to the building standards contained in the California Building Standards based upon express findings that such changes or modifications are reasonably necessary because of local climatic, geological or topographical conditions;

WHEREAS, the City Council of the City of Menlo Park finds that each of the amendments, additions and deletions to the California Energy Code contained in this ordinance are reasonably necessary because of local climatic, geological or topographical conditions described in Section 1;

WHEREAS, Public Resources Code Section 25402.l(h)2 and Section 10-106. of the Building Energy Efficiency Standards (Standards) establish a process which allows local adoption of energy standards that are more stringent than the statewide Standards, provided that such local standards are cost effective and the California Energy Commission finds that the standards will require buildings to be designed to consume no more energy than permitted by the California Energy Code;

WHEREAS, the California Codes and Standards Reach Code Program, has determined specific modifications to the 2019 State Energy Code for each climate zone that are cost effective;

WHEREAS, that such modifications will result in designs that consume less energy than they would under the 2019 State Energy Code;

WHEREAS, the City of Menlo Park, through TRC Advanced Energy, has performed an additional cost effectiveness analyses as required by the California Energy Commission for the local amendments to the California Energy Code contained in this ordinance which memo is hereby incorporated by reference;

WHEREAS, based upon these analyses, the City Council of the City of Menlo Park finds that the local amendments to the California Energy Code contained in this ordinance are cost
effective and will require buildings to be designed to consume no more energy than permitted by
the California Energy Code;

WHEREAS, because of the City's unique local climatic, geologic and topographic
conditions, the City desires to make amendments and additions to the code.

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF MENLO PARK DOES ORDAIN
AS FOLLOWS:

SECTION 1: FINDINGS AND DETERMINATIONS. The following local climatic,
conditions justify modifications to the California Building Standards Code.

A. Climatic: The City is located in Climate Zone 3 as established in the 2019
California Energy Code. Climate Zone 3 incorporates mostly coastal
communities from Marin County to southern Monterey County including San
Francisco. The City experiences precipitation ranging from 13 to 20 inches per
year with an average of approximately 15 inches per year. Ninety-five percent of
precipitation falls during the months of November through April, leaving a dry
period of approximately six months each year. Relative humidity remains
moderate most of the time. Temperatures in the summer average around 80
degrees Fahrenheit and in the winter in the mid 50 degrees Fahrenheit.
Prevailing winds in the area come from the west with velocities generally in the 12
miles per hour range, gusting from 25 to 35 miles per hour. These climatic
conditions along with the greenhouse emissions generated from structures in
both the residential and nonresidential sectors requires exceeding the energy
standards for building construction established in the 2019 California Buildings
Standards Code. The City Council also adopted a Climate Action Plan that has a goal of
reducing greenhouse gas emissions 27% below 2005 levels by 2020. In order to achieve and
maintain this goal, the City needs to adopt policies and regulations that reduce the use of fossil
fuels that contribute to climate change, such as natural gas in buildings, in new development.
Human activities, such as burning natural gas to heat buildings, releases
greenhouse gases into the atmosphere and causes an overall increase in global
average temperature. This causes sea levels to rise, affecting the City’s shoreline
and infrastructure.

Many new buildings in Menlo Park will be built near the coastline in an area known
as the Bayfront Area that is situated on marshlands and former salt ponds. San
Francisquito Creek also runs through the City, which creates an increasing
potential flooding risk with climate change as a result of human generated
greenhouse gas emissions. Menlo Park is vulnerable to sea level rise where new
development is proposed in this code cycle. New buildings that are directly
vulnerable to sea level rise should avoid generating additional greenhouse gas
emissions. The proposed Reach Code would ensure that new buildings use
cleaner sources of energy that are greenhouse gas free.

B. Geologic: The City of Menlo Park 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 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.

C. Topographic: The City of Menlo Park is contiguous with the San Francisco Bay, resulting in a natural receptor for storm and waste water run-off. Also the City is located in an area that is relatively high liquefaction potential given its proximity to the Bay. 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 Code is warranted.

SECTION 2: AMENDMENT OF CODE. Section 12.04.010 of Chapter 12.04 [Adoption of Codes] of Title 12 [Buildings and Construction] is hereby repealed and a new Section 12.04.010 is hereby added to read as follows:

12.04.010 Municipal building code.
The following codes are hereby adopted and by reference are incorporated herein as if set forth in full:


(6) The 2019 California Plumbing code the Uniform Plumbing Code, 2018 Edition, including the Installation Standards thereto, published by the International Association of...
Plumbing and Mechanical Officials, together with those omissions, amendments, exceptions and additions thereto as amended in Part 5 of the California Building Standards Code, California Code of Regulations Title 24;


(10) The 2019 California Green Building Standards Code, published by the International Code Council, as amended in Part 11 of the California Building Standards Code, California Code of Regulations Title 24; and


A copy of each code is on file in the office of the city clerk. The provisions of this title, including said codes and amendments thereto, shall be known as the building code of the city.

SECTION 3: AMENDMENT OF CODE. Chapter 12.16 [Energy Code] of Title 12 [Buildings and Construction] is hereby repealed and a new Chapter 12.16 is hereby added to read as follows:

SECTION 100.0 – Scope
(e) Sections applicable to particular buildings. TABLE 100.0-A and this subsection list the provisions of Part 6 that are applicable to different types of buildings covered by Section 100.0(a).

1. All buildings. Sections 100.0 through 110.12 apply to all buildings.
   EXCEPTION to Section 100.0(e) 1: Spaces or requirements not listed in TABLE 100.0-A.

2. Newly constructed buildings.
   A. All newly constructed buildings. Sections 110.0 through 110.12 apply to all newly constructed buildings within the scope of Section 100.0(a). In addition, newly constructed buildings shall meet the requirements of Subsections B, C, D or E, as applicable; and shall be an All-Electric Building as defined in Section 100.1(b).

   Exception 1: Non-Residential Buildings containing a Scientific Laboratory Building, such area may contain a non-electric Space Conditioning System.
To take advantage of this exception applicant shall provide third party verification that All-Electric space heating requirement is not cost effective and feasible.

Exception 2: All Residential buildings may contain non-electric Cooking Appliances and Fireplaces.

Exception 3: Exemption for public agency owned and operated emergency centers. To take advantage of this exception applicant shall provide third party verification that All-Electric space heating requirement is not cost effective and feasible.

Conditional Exception 4: Non-residential buildings containing a for-profit restaurant open to the public or an employee kitchen may apply to a City Council appointed body, such as the Planning Commission or Environmental Quality Commission, for an exception to install gas-fueled cooking appliances. This request must be based on a business-related reason to cook with a flame that cannot be reasonably achieved with an electric fuel source. Examples include barbeque-themed restaurants and pizza ovens. The City Council appointed body shall grant this exception if they find the following:
1. There is a business-related reason to cook with a flame;
2. This need cannot be reasonably achieved with an electric fuel source;
3. The applicant has employed reasonable methods to mitigate the greenhouse gas impacts of the gas-fueled appliance;
4. The applicant shall comply with the pre-wiring provision of Note 1 below.

The City Council appointed body’s decision shall be final unless the applicant appeals to the City Council within 15 days of the appointed body’s decision. The City Council’s decision on the appeal shall be final.

Note 1: If natural gas appliances are used in any of the above exceptions 1-4, natural gas appliance locations must also be electrically pre-wired for future electric appliance installation. They shall include the following:

1. A dedicated circuit, phased appropriately, for each appliance, with a minimum amperage requirement for a comparable electric appliance (see manufacturer’s recommendations) with an electrical receptacle or junction box that is connected to the electric panel with conductors of adequate capacity, extending to within 3 feet of the appliance and accessible with no obstructions. Appropriately sized conduit may be installed in lieu of conductors;
2. Both ends of the unused conductor or conduit shall be labeled with the words “For Future Electric appliance” and be electrically isolated;
3. A reserved circuit breaker space shall be installed in the electrical panel adjacent to the circuit breaker for the branch circuit and labeled for each circuit, an example is as follows (i.e “For Future Electric Range;”) and
4. All electrical components, including conductors, receptacles, junction boxes, or blank covers, related to this section shall be installed in accordance with the California Electrical Code.

Note 2: If any of the exceptions 1-4 are granted, the Building Official shall have the authority to approve alternative materials, design and methods of construction or equipment per CBC 104.

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

ALL ELECTRIC BUILDING: is a building that has no natural gas or propane plumbing installed within the building, and that uses electricity as the source of energy for its space heating, water heating, cooking appliances, and clothes drying appliances. All Electric Buildings may include solar thermal pool heating.

Scientific Laboratory Building: is a building or area where research, experiments, and measurement in medical, and life sciences are performed and/or stored requiring examination of fine details. The building may include workbenches, countertops, scientific instruments, and supporting offices.

Section 100.1 is modified as follows:
SHADING – is the protection from heat gains because of direct solar radiation by permanently attached exterior devices of building elements, interior shading devices, glazing material, adherent materials, including items located outside the building footprint such as Heritage trees or high rise buildings that may affect shading.

Section 110.2 is modified as follows:
SECTION 110.2 – MANDATORY REQUIREMENTS FOR SPACE-CONDITIONING EQUIPMENT
Certification by Manufacturers. Any space-conditioning equipment listed in this section, meeting the requirements of section 100.0 (e)2A, may be installed only if the manufacturer has certified to the Commission that the equipment complies with all the applicable requirements of this section.

Section 110.3 is modified as follows:
SECTION 110.3 – MANDATORY REQUIREMENTS FOR SERVICE WATER-HEATING SYSTEMS AND EQUIPMENT
(a) Certification by manufacturers. Any service water-heating system or equipment, meeting the requirements of section 100.0 (e)2A, may be installed only if the manufacturer has certified that the system or equipment complies with all of the requirements of this subsection for that system or equipment.

Section 110.4 is modified as follows:
SECTION 110.4 – MANDATORY REQUIREMENTS FOR POOL AND SPA SYSTEMS AND EQUIPMENT
(a) Certification by Manufacturers. Any pool or spa heating system or equipment, meeting the requirements of section 100.0 (e)2A, may be installed only if the manufacturer has certified that the system or equipment has all of the following:
**Section 110.5 is modified as follows:**
SECTION 110.5 – NATURAL GAS CENTRAL FURNACES, COOKING EQUIPMENT, POOL AND SPA HEATERS, AND FIREPLACES: PILOT LIGHTS PROHIBITED
Any natural gas system or equipment, meeting the requirements of Section 100.0 (e)2A, listed below may be installed only if it does not have a continuously burning pilot light:

**Section 110.10 is modified as follows:**
SECTION 110.10 – MANDATORY REQUIREMENTS FOR SOLAR READY BUILDINGS AND SOLAR PANEL SYSTEM REQUIREMENTS FOR NON-RESIDENTIAL NEW BUILDINGS
(a) Covered Occupancies.
1. Single Family Residences. Single family residences located in subdivisions with ten or more single family residences and where the application for a tentative subdivision map for the residences has been deemed complete approved by the enforcement agency, which do not have a photovoltaic system installed, shall comply with the requirements of Section 110.10(b) through 110.10(e).
2. Low-rise Multifamily Buildings. Low-rise multi-family buildings that do not have a photovoltaic system installed shall comply with the requirements of Section 110.10(b) through 110.10(d).
3. Hotel/Motel Occupancies and High-rise Multifamily Buildings. Hotel/motel occupancies and high-rise multifamily buildings with ten habitable stories or fewer shall comply with the requirements of Section 110.10(b) through 110.10(d), and Table 2.
4. Nonresidential Buildings. Nonresidential buildings with three habitable stories or fewer, other than healthcare facilities, shall comply with the requirements of Section 110.10(b) through 110.10(d), and Table 2.

<table>
<thead>
<tr>
<th>Square footage of building</th>
<th>Size of panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10,000 sq. ft.</td>
<td>Minimum of 3-kilowatt PV systems</td>
</tr>
<tr>
<td>Greater than or equal to 10,000 sq. ft.</td>
<td>Minimum of 5-kilowatt PV systems</td>
</tr>
</tbody>
</table>

**EXCEPTION:** As an alternative to a solar PV system, the building type may provide a solar hot water system (solar thermal) with a minimum collector area of 40 square feet, additional to any other solar thermal equipment otherwise required for compliance with Part 6.

(b) Solar Zone.
1. Minimum Solar Zone Area. The solar zone shall have a minimum total area as described below. The solar zone shall comply with access, pathway, smoke ventilation, and spacing requirements as specified in Title 24, Part 9 or other Parts of Title 24 or in any requirements adopted by a local jurisdiction. The solar zone total area shall be comprised of areas that have no dimension less than five feet and are no less than 80 square feet each for buildings with roof areas less than or equal to 10,000 square feet or no less than 160 square feet each for buildings with roof areas greater than 10,000 square feet.

A. Single Family Residences. The solar zone shall be located on the roof or overhang of the building and have a total area no less than 250 square feet.
EXCEPTION 1 to Section 110.10(b)1A: Single family residences with a permanently installed domestic solar water-heating system meeting the installation criteria specified in the Reference Residential Appendix RA4 and with a minimum solar savings fraction of 0.50.

EXCEPTION 2 to Section 110.10(b)1A: Single family residences with three habitable stories or more and with a total floor area less than or equal to 2000 square feet and having a solar zone total area no less than 150 square feet.

EXCEPTION 3 to Section 110.10(b)1A: Single family residences located in the Wildland-Urban Interface Fire Area as defined in Title 24, Part 2 and having a whole house fan and having a solar zone total area no less than 150 square feet.

EXCEPTION 4 to Section 110.10(b)1A: Buildings with a designated solar zone area that is no less than 50 percent of the potential solar zone area. The potential solar zone area is the total area of any low-sloped roofs where the annual solar access is 70 percent or greater and any steep-sloped roofs oriented between 90 degrees and 300 degrees of true north where the annual solar access is 70 percent or greater. Solar access is the ratio of solar insolation including shade to the solar insolation without shade. Shading from obstructions located on the roof or any other part of the building shall not be included in the determination of annual solar access.

EXCEPTION 5 to Section 110.10(b)1A: Single family residences having a solar zone total area no less than 150 square feet and where all thermostats are demand responsive controls and comply with Section 110.12(a), and are capable of receiving and responding to Demand Response Signals prior to granting of an occupancy permit by the enforcing agency.

EXCEPTION 6 to Section 110.10(b)1A: Single family residences meeting the following conditions:

A. All thermostats are demand responsive controls that comply with Section 110.12(a), and are capable of receiving and responding to Demand Response Signals prior to granting of an occupancy permit by the enforcing agency.

B. Comply with one of the following measures:
   i. Install a dishwasher that meets or exceeds the ENERGY STAR Program requirements with a refrigerator that meets or exceeds the ENERGY STAR Program requirements, a whole house fan driven by an electronically commutated motor, or an SAE J1772 Level 2 Electric Vehicle Supply Equipment (EVSE or EV Charger) with a minimum of 40 amperes; or
   ii. Install a home automation system capable of, at a minimum, controlling the appliances and lighting of the dwelling and responding to demand response signals; or
   iii. Install alternative plumbing piping to permit the discharge from the clothes washer and all showers and bathtubs to be used for an irrigation system in compliance with the California Plumbing Code and any applicable local ordinances; or
iv. Install a rainwater catchment system designed to comply with the California Plumbing Code and any applicable local ordinances, and that uses rainwater flowing from at least 65 percent of the available roof area.

B. Low-rise and High-rise Multifamily Buildings, Hotel/Motel Occupancies, and Nonresidential Buildings. The solar zone shall be located on the roof or overhang of the building or on the roof or overhang of another structure located within 250 feet of the building or on covered parking installed with the building project, and shall have a total area no less than 15 percent of the total roof area of the building excluding any skylight area. The solar zone requirement is applicable to the entire building, including mixed occupancy.

EXCEPTION 1 to Section 110.10(b)1B: High-rise Multifamily Buildings, Hotel/Motel Occupancies, and Nonresidential Buildings with a permanently installed solar electric system having a nameplate DC power rating, measured under Standard Test Conditions, of no less than one watt per square foot of roof area.

EXCEPTION 2 to Section 110.10(b)1B: High-rise multifamily buildings, hotel/motel occupancies with a permanently installed domestic solar water-heating system complying with Section 150.1(c)8Biil- and an additional collector area of 40 square feet.

EXCEPTION 3 to Section 110.10(b)1B: Buildings with a designated solar zone area that is no less than 50 percent of the potential solar zone area. The potential solar zone area is the total area of any low-sloped roofs where the annual solar access is 70 percent or greater and any steep-sloped roofs oriented between 90 degrees and 300 degrees of true north where the annual solar access is 70 percent or greater. Solar access is the ratio of solar insolation including shade to the solar insolation without shade. Shading from obstructions located on the roof or any other part of the building shall not be included in the determination of annual solar access.

EXCEPTION 4 to Section 110.10(b)1B: Low-rise and high-rise multifamily buildings with all thermostats in each dwelling unit are demand response controls that comply with Section 110.12(a), and are capable of receiving and responding to Demand Response Signals prior to granting of an occupancy permit by the enforcing agency. In addition, either A or B below:

A. In each dwelling unit, comply with one of the following measures:
   i. Install a dishwasher that meets or exceeds the ENERGY STAR Program requirements with either a refrigerator that meets or exceeds the ENERGY STAR Program requirements or a whole house fan driven by an electronically commutated motor; or
   ii. Install a home automation system that complies with Section 110.12(a) and is capable of, at a minimum, controlling the appliances and lighting of the dwelling and responding to demand response signals; or
   iii. Install alternative plumbing piping to permit the discharge from the clothes washer and all showers and bathtubs to be used for an irrigation
system in compliance with the California Plumbing Code and any applicable local ordinances; or
iv. Install a rainwater catchment system designed to comply with the California Plumbing Code and any applicable local ordinances, and that uses rainwater flowing from at least 65 percent of the available roof area.

B. Meet the Title 24, Part 11, Section A4.106.8.2 requirements for electric vehicle charging spaces.

EXCEPTION 5 to Section 110.10(b)1B: Buildings where the roof is designed and approved to be used for vehicular traffic or parking or for a heliport.

Exception 6 to section 110.10(b)1B: Performance equivalency approved by the building official.

2. Azimuth. All sections of the solar zone located on steep-sloped roofs shall be oriented between 90 degrees and 300 degrees of true north.

   A. No obstructions, including but not limited to, vents, chimneys, architectural features, and roof mounted equipment, shall be located in the solar zone.

   B. Any obstruction, located on the roof or any other part of the building that projects above a solar zone shall be located at least twice the distance, measured in the horizontal plane, of the height difference between the highest point of the obstruction and the horizontal projection of the nearest point of the solar zone, measured in the vertical plane.

   EXCEPTION to Section 110.10(b)3: Any roof obstruction, located on the roof or any other part of the building, that is oriented north of all points on the solar zone.

   C. The solar zone needs to account for shading from obstructions that may impact the area required in 110.10(b)1B. When determined by the Building Official that conditions exist where excessive shading occurs and solar zones cannot be met, a performance equivalency approved by the Building Official may be used as an alternative.

4. Structural Design Loads on Construction Documents. For areas of the roof designated as solar zone, the structural design loads for roof dead load and roof live load shall be clearly indicated on the construction documents.

   NOTE: Section 110.10(b)4 does not require the inclusion of any collateral loads for future solar energy systems.

(c) Interconnection Pathways.
   1. The construction documents shall indicate a location reserved for inverters and metering equipment and a pathway reserved for routing of conduit from the solar zone to the point of interconnection with the electrical service.
   2. For single family residences and central water-heating systems, the construction documents shall indicate a pathway for routing of plumbing from the solar zone to the water-heating system.

(d) Documentation. A copy of the construction documents or a comparable document indicating the information from Sections 110.10(b) through 110.10(c) shall be provided to the occupant.

(e) Main Electrical Service Panel.
1. The main electrical service panel shall have a minimum busbar rating of 200 amps.
2. The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future solar electric installation. The reserved space shall be permanently marked as “For Future Solar Electric”.

SECTION 5: EXEMPTION FROM CEQA. The City Council finds, pursuant to Title 14 of the California Administrative Code, Section 15061(b)(3) that this Ordinance is exempt from the requirements of the California Environmental Quality Act ("CEQA") on the grounds that these standards are more stringent than the State energy standards, there are no reasonably foreseeable adverse impacts and there is no possibility that the activity in question may have a significant effect on the environment.

SECTION 6: SEVERABILITY. If any part of this Ordinance is held to be invalid or inapplicable to any situation by a court of competent jurisdiction, such decision shall not affect the validity of the remaining portions of this Ordinance or the applicability of this Ordinance to other situations.

SECTION 7: EFFECTIVE DATE. This Ordinance shall become effective following approval by the California Energy Commission, but in no event before January 1, 2020.

SECTION 8: POSTING. Within fifteen (15) days of its adoption, the Ordinance shall be posted in three (3) public places within the City of Menlo Park, and the Ordinance, or a summary of the Ordinance prepared by the City Attorney, shall be published in a local newspaper used to publish official notices for the City of Menlo Park prior to the effective date.

INTRODUCED on this tenth day of September, 2019.

PASSED AND ADOPTED as an ordinance of the City of Menlo Park at a regular meeting of said City Council on this __________ day of __________, 2019, by the following vote:

AYES:
NOES:
ABSENT:
ABSTAIN:

APPROVED:

________________________
Ray Mueller, Mayor

ATTEST:

_________________________
Judi A. Herren, City Clerk
<table>
<thead>
<tr>
<th>Meeting date</th>
<th>Building Type</th>
<th>Staff recommendation</th>
<th>Outcome/Direction</th>
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<tbody>
<tr>
<td><strong>Environmental Quality Commission meeting</strong>&lt;br&gt;(February, May, June 2019)</td>
<td>Residential buildings (single family and three stories or less multifamily)</td>
<td>All new buildings to be at minimum electrically heated (space conditioning and water appliances) and in addition, for nonresidential new buildings to produce minimum amount of on-site solar power</td>
<td>EQC Commissioners unanimously advise City Council to approve staff’s recommendation</td>
</tr>
<tr>
<td><strong>City Council Meeting</strong>&lt;br&gt;(July 16, 2019)</td>
<td>Residential buildings</td>
<td>At minimum, must be electrically heated or all-electric</td>
<td>City Council agreed. No further direction.</td>
</tr>
<tr>
<td>Nonresidential buildings and high-rise multifamily buildings</td>
<td>At minimum, must be electrically heated and install minimum amount of on-site solar power</td>
<td>City Council provided further direction to: &lt;br&gt;- Require new nonresidential buildings be all-electric &lt;br&gt;- Explore all-electric options for life science buildings &lt;br&gt;- Include exception for for-profit restaurants to allow natural gas stoves</td>
<td></td>
</tr>
<tr>
<td><strong>City Council Meeting</strong>&lt;br&gt;(August 27, 2019)</td>
<td>Residential buildings</td>
<td>At minimum, must be electrically heated or all-electric</td>
<td>City Council provided further direction to require: &lt;br&gt;- All-electric clothes dryers &lt;br&gt;- Pre-wiring for electric stove and fireplaces</td>
</tr>
<tr>
<td>Nonresidential buildings and high-rise multifamily buildings</td>
<td>- Remove the exception for for-profit restaurant use of natural gas stoves &lt;br&gt;- Must be all-electric with two exceptions (a) life science buildings for space heating (b) emergency operations centers &lt;br&gt;- Install minimum amount of on-site solar power</td>
<td>- Agreed with staff’s recommendation, but provided further direction to: &lt;br&gt;- allow appeal process for nonresidential kitchens to use natural gas stoves &lt;br&gt;- Pre-wiring for electric appliances for all buildings where natural gas is allowed through exceptions or appeal &lt;br&gt;- Explore floor area ratio (FAR) exclusions for high-rise residential to allow for innovative water heating systems</td>
<td></td>
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</tbody>
</table>
MEMORANDUM

To: Gabriel Taylor, Peter Strait (California Energy Commission)
From: Farhad Farahmand, Abhijeet Pande (TRC), Rafael Reyes (Peninsula Clean Energy)
Re: Interpretation of Cost Effectiveness Analysis as it Relates to Menlo Park Reach Code Proposal

As part of an amendment to the California Building Standards Code, the City of Menlo Park is seeking a requirement for all new construction buildings to be all-electric but allows for several exceptions. For residential buildings, the City is proposing to allow natural gas to be used for cooking and decorative fireplaces. For nonresidential buildings, certain categories of buildings such as public safety buildings, designated emergency centers as well as commercial buildings containing scientific laboratories that require natural gas for operational and process reasons are proposed to be exempted.

This memo serves to clarify the cost-effectiveness justification of these proposals as required by California Code of Regulations (CCR), Title 24, Part 1, §10-106 and request the Energy Commission's preliminary approval of this justification. If approved, an updated version of this interpretation will be included with Menlo Park's application to the Energy Commission.

The statewide investor owned utility codes and standards program developed a new construction cost effectiveness analysis for all California climate zones which included all-electric measures as part of multiple packages. These analyses have been attached, and:

- Were performed for both residential and nonresidential buildings
  - The residential prototypes included 4 end-uses in analysis: space heating, water heating, cooking, and clothes drying. These assumed savings from avoided natural gas infrastructure to and within the residence.
  - The nonresidential prototypes included 2 end-uses in analysis: space heating and water heating.
- Found that it is cost-effective to construct all-electric buildings compared to the 2019 Standards ACM baseline, including all end-uses analyzed, partially due to upfront cost savings associated with foregoing a natural gas connection to the building.

Menlo Park’s code proposal would allow the construction of all-electric buildings which has been shown to be cost-effective using the TDV cost-effectiveness metric.

We seek your preliminary confirmation that the existing cost effectiveness studies completed are sufficient to support Menlo Park's proposal, considering further that:

- In residential buildings, a proposed building with electric space- or water-heating is already compared to a standard building with these electric end-uses. Thus, no cost effectiveness criteria are explicitly required for the electrification of these end-uses. The exemption for gas to
be allowed for cooking or decorative fireplaces is a voluntary choice to be made by a homeowner/builder and as such does not need to be shown to be cost-effective. Additionally, the cost to add pre-wiring for cooktops/ovens is minimal at the time of new construction since there is an electrical outlet present even for gas cooktops since they are electronic/electric ignition and have other electronic components like fans and lights that need electricity supply. So, the pre-wiring for future induction cooktops only requires upsizing the wire gauge (a minimal cost at time of construction) and a different outlet (also a minimal upgrade cost). A recent cost-estimate provided by Scott Shell at EHDD Architects (based on data provided by tbd consultants) estimates this cost to be $280 at the time of new construction. Retrofitting an existing electrical line with an upsized one that can power induction would cost $930. So, it is inherently cost-effective for the lesser expense be done at time of construction as opposed to spending more year or more later to add the capability.

♦ The cost-effectiveness study conducted by TRC for the Statewide Codes and Standards Team at the Investor Owned Utilities (IOU) used a hotel prototype for establishing cost-effectiveness for both hotel as well as high-rise residential applications. This is partly because there was no high-rise residential prototype available and the Title 24 compliance tools lack modeling of central water heating systems. Since the Title 24, part 6 requirements for hotel/motel guestrooms are the same as those of high-rise residential dwelling units, and because the prototype was modeled with individual space and water heaters, we believe the use of the hotel prototype is appropriate to represent high-rise residential as well. Further, any nonresidential spaces modeled for the hotel prototype would have to be modeled with same/similar systems if those same end uses exist in a high-rise residential building. Thus, we are confident that the hotel prototype is sufficient for high-rise residential applications.

♦ In nonresidential buildings, the prototypes examined in the cost effectiveness analysis only included space heating and water heating electrification. Other end uses targeted in the Menlo Park ordinance are unregulated appliances such as cooking, clothes drying which are not explicitly modeled in Title 24 compliance calculations. Adding requirements for these end uses to be electric does not impact the TDV budget for the building or compliance with Title 24. These will however impact the overall first cost of the all-electric building as well as operational impacts. These impacts however are not likely to be significant compared with the overall cost savings of around $25,000 for offices and retail and almost $1M for hotel occupancies. Electric cooking and clothes drying first cost difference compared to natural gas versions are between $800-$2000 per appliance. Operational cost increases are around $2,000 per appliance over the building’s lifetime. Thus, the added first and operation costs for electric appliances are unlikely to be greater than the significant cost savings resulting from eliminating natural gas infrastructure.

We thus propose that existing cost-effectiveness studies should be sufficient to justify Menlo Park requirements. Any guidance on this approach and/or code language format is much appreciated.
The Cost Effectiveness of Building Electrification

Comments from Bay Area Architects & Engineers

August 21, 2019

Scott Shell, FAIA, Principal
Malcolm Harris, Principal

**MITHŪN**

We have a number of all-electric multifamily housing projects. I’m a huge, huge fan of this change to all-electric multifamily housing. It is better in every way, a great simplification of the system. Less expensive, higher performance, less maintenance, more sustainable.

**It is a major cost saving move that pays for a lot of other upgrades.**

At Maceo May we saw big savings from eliminating gas fired hydronic heating, the gas connection, and the solar thermal required by T24.

The savings paid for continuous exterior insulation, energy recovery ventilators (eliminating Z-ducts), electric resistance heat, and PVs. With these upgrades we are beating Title 24 by 20%, getting more Green Points, and lower GHGs on a grid that’s getting cleaner.

The occupants get better indoor air quality benefits from the energy recovery ventilators.
Overall the system is just much simpler—there is just one energy system—electrical, rather than two.

The gas fired boiler & hydronic systems are very problematic at every step from design to construction to maintenance. During construction there are often leaks. Commissioning is a constant challenge, and there are lots of tenant complaints in first few months. Operations is challenging as maintenance staff are not equipped to operate the digital BMS system.


**Maceo May** 105 residential units, in permitting. Chinatown Community Development Center, Swords to Plowshares.

**Balboa Upper Yard Family Apts** 120 residential units, in design development. Developer Mission Housing Development & Related California.

**Hunters Point Shipyard Block 52** 136 residential units total, Design Development. Developer McCormack, Baron, Salazar.

**Hunters Point Shipyard Block 54** 136 residential units total, Design Development. Developer McCormack, Baron, Salazar.

**681 Florida** 136 residential units total, In Design Development. Developers: TNDC & MEDA
Hormoz Janssens, Principal

Almost all our projects are all-electric, I have only been using gas systems where required by the client.

Electric is almost always less expensive or cost neutral. Very rarely is it more expensive. Often it is our value engineering option.

Most project types work just fine. We are doing a 500,000 sf all electric office for Microsoft, with major cost savings using heat pumps vs a central plant.

We do lots of detailed cost analysis with developers to find the most cost-effective solution. For example, at Bay Meadows our all electric design for 1 million sf of development was significantly less expensive than a traditional rooftop package unit + boiler + reheat system.
Hormoz Janssens, Principal

The space requirements are smaller for all-electric, instead of having two to three separate systems for space heating, cooling, and hot water, we can do it with a single heat pump system, that space can be used for other things or the building made smaller for more savings.

Maintenance is less than most conventional systems because you have just one system. Maintenance is just like an air-conditioning system, it’s the same thing in reverse, and you eliminate the boiler.

A huge benefit for heat pumps is reducing water use. Using an air source heat pump for cooling rather than a cooling tower has large water savings.

We’ve done several all electric commercial food service projects that have been very successful. The Chef’s quite skeptical at the beginning, but now say they will never go back to cooking on gas.
The University of California has committed to carbon neutrality by 2025. We are prioritizing all-electric new buildings (required starting June 2019), and then electrifying existing buildings & systems over time.

Our studies show that all electric mechanical equipment capital costs are comparable for academic & lab buildings, and the costs are lower for residential buildings. Twenty year life cycle costs are comparable for Academic and labs buildings, and lower for residential buildings.

UC has many all-electric housing projects, office buildings, and laboratories now in place and many more in design.

UC’s carbon neutrality strategies are pragmatic: don’t allow growth to increase carbon emissions; and then transition existing buildings and systems off fossil fuels over time.

Decarbonizing Your Campus thru Electrification, SCUP 2019
Scott Shell, Principal

We have completed a dozen or so all electric buildings. 10-15 years ago it was not common in California, and we saw some cost premium on those early projects.

In the last 5-7 years all-electric has become much more common on our projects which are primarily commercial and educational. It is now generally cost neutral or less expensive. There are more manufacturers providing equipment, and the subcontractors are more familiar with installing it.

Last year we had an all-electric project go to bid and the total cost came back higher than expected. In an attempt to reduce cost, we asked the mechanical contactors to price a standard gas heating system instead. They came back with no cost savings between gas and all electric, so the client decided to stay with the preferred all-electric option.
Scott Shell, Principal

When the University of California, one of our largest clients, decided to prohibit gas in new projects that really got our attention. It now seems irresponsible to recommend gas to our clients who may then have to retrofit them before that equipment reaches the end of its life in order to meet their carbon goals or local mandates to decarbonize. We don’t want to be saddling our clients with stranded assets.

Last year I interviewed seven leading mechanical engineers that we work with asking if the building industry is ready to go all electric. They agreed that the vast majority of buildings can go all-electric, and the cost is competitive with a few exceptions.

Most of our all electric projects also include PVs, it is LESS expensive for our clients to get their electricity from PV than from their utility. With a power purchase agreement there is no out of pocket cost. Some clients decided to fund the PVs themselves since it provides a favorable financial return. Ten years ago solar was seen as an expensive solution for projects with big budgets. It is amazing to see how quickly that has flipped.
Shawn Oram, Principal

Ecotope has completed 26 central heat pump water heating projects since 2008, mostly 100-500 unit projects. Partial list:

**Mid Rise | 50-400 dwelling units**
- Stream - 134 units - (2) 10T Colmac Air-Source HP in below-grade parking
- Sunset Electric - 92 units - Colmac in below-grade parking
- Stackhouse - 120 units - Colmac in underground parking deck
- Augusta Apartments - 224 units - Colmac in below-grade parking
- Batik Apartments - 195 units - Colmac in underground parking deck
- Yesler 3 - 227 - Colmac in underground parking deck
- Jackson Apartments - 526 units - Colmac in underground parking deck
- Colina Apartments - 132 units, Sanden - Decentralized
- The Vale Apartments - 134 units - Versati 2, Multi-Pass
- Waterfront Place - 137/135 units - Versati 2, Multi-Pass
- Hopeworks - 67 units, Sanden CO2 Stacks

**High Rise | 200-450 dwelling units**
- 4100 Brooklyn - 284 units - Colmac with VRF Temp Maintenance
- Cascade - 430 units - Colmac with VRF Temp Maintenance
- 1200 45th - 245 units - In Design
We have several current all-electric multi-family projects. In our experience it has been indispensable to have a knowledgeable energy/Title 24 consultant on the team to help guide both analysis and design.

It is critical to share information about best practices and lessons learned. By sharing best practices we can reduce mistakes.

We work with both non-profit and for-profit housing developers that own and operate lots of buildings. It is important to make sure everyone is aware of the potential challenges that come with new technology.

The life span of the current generation of heat pump water heaters may be less than the traditional gas fired boilers, depending on operating conditions. We expect the life span will increase as the market becomes deeper and more sophisticated, but we try to be open about this reality with our clients. With that in mind provide access for maintenance and future replacement down the road.
All-electric construction consistently reduces construction costs and ongoing utility bills.

It saves between $2,500 and $5,000 per residence for the developer to not plumb gas. When infrastructure and appliance costs are added up, a recent study done by Rocky Mountain Institute found a median increased cost of $8,800 more per house for gas infrastructure, piping, purchasing appliances and venting.

Only education is preventing developers from profiting from the technological innovations available in the all-electric domain.

Developers have been choosing all electric construction because it costs less to build and that trend has been going on for 24 years now.

New construction is easy technically and financially and because the construction cost savings justify going all-electric.
New construction is easy technically and financially and because the construction cost savings justify going all-electric.

Because an all-electric building can achieve higher mechanical system efficiency than a gas burning building, it is lower cost for developers building all-electric to comply with the Title 24 Energy Code. We documented this is our report A Zero Emissions All-Electric Multi-family Construction Guide, see the graphic on page 7.

https://fossilfreebuildings.org/ElectricMFGuide.pdf
Peter Rumsey, Principal

There are great examples of all electric buildings for virtually every building type that are cost effective. It is very easy for our firm to design these systems, we are very familiar with them.

For Multifamily projects we are seeing a lot of developers use electric heating with high levels of insulation in apartments that don’t need cooling.

All electric air-cooled VRF heat pumps are very common on multifamily projects up to ten stories where cooling is needed; this is very cost effective.

Developers are using VRF systems on small to medium sized commercial buildings. Production home builders have been using central heat pump heating and cooling units for many years. And we are seeing a surge in the use of larger heat pumps for generating hot water systems. Central hot water systems can have a cost premium, but it is very small as a percentage of the building cost.
Large 20 story multifamily high-rise require a water source heat pump and that equipment still has a cost premium.

Cooking remains a hard sell in many cases, a lot of people are very skeptical of giving up gas. Technically this isn’t a problem, the experts at the Food Service Technology Center in San Ramon say an electric fryer provides better and more even heat than gas. Induction ranges are excellent.

The market for all electric buildings and heat pumps has been making significant inroads in California, and this had gotten the attention of manufacturers. General Contractors and mechanical subcontractors are getting more familiar with this approach as well.

Title 24 used to discourage electric heating of all types and is now more neutral on the issue. I understand that future versions of title 24 are going to be more encouraging of some types of electric heating.
Ted Tiffany, Principal

We have designed quite a few all electric buildings. The Goldman School of Public Policy is as designed all-electric and construction cost compared favorably to gas. This also allowed for individually metered apartments so tenants paid their own utility bills.

The UCOP did a robust cost analysis of various building types and in almost all cases it found lower life cycle costs with all-electric buildings. It is important to manage TOU rates. First cost savings are partly dependent on if you can eliminate the gas service, which in most cases you can; if you do this generally makes the construction cost less than mixed fuel buildings.

Ted Tiffany, Principal

For most building types and sizes, there is no technical reason preventing the industry from shifting to all-electric buildings.

Laboratories and Hospitals can be more of a challenge as all electric due to the high outside air loads, demands for sterilization, and high hot water loads. They are possible, but more challenging.
Integral currently has dozens of all-electric buildings recently complete, in construction, and in design. There has been a big sea change in recent years towards all-electric. Around 50% of our work is currently electric.

There is a lot of momentum in Multi-family Residential and in Commercial projects moving to electric systems.

Comparing the construction cost of all-electric to gas depends on what you are comparing it to. If comparing to a high-performance design such as LEED Gold then all-electric is cheaper. If comparing to moderate performance building then all-electric is cost neutral. If comparing to the most basic design, there may be a small cost premium.

There are some significant code changes in California energy code in 2019 that will make all electric even more cost competitive, especially for multifamily.
All electric has several big advantages:

- Electric equipment takes up significantly less space and that space can be used for other things. At 1700 Webster the gas option filled the roof with equipment, while the heat pump option had much less equipment so they were able to put a nice deck and pool on the roof.
- Getting gas service to the equipment, and a flue out through the building can be challenging problems and cost money. Getting make-up air to gas boilers can be challenging.
- For large multi-family projects heat-pump dryers avoid all the problems associate with venting.
- There have been good advances in heat pump choices in recent years. Aermec and Climacool make excellent equipment, that can heat and cool simultaneously with robust controls.
- There are huge climate benefits to shifting from gas to electric. London is completely redoing it’s 10 year old decarbonization plan which was drafted when they had a dirty electric grid. Their grid is much cleaner now so they are quickly revising the plan to promote electrification.
Nick Young

In multifamily buildings with individual heating and hot water systems for each unit it’s a no-brainer to go all-electric, from a cost, modeling, technology, and code compliance perspective. **All-electric should be the standard design for these projects.**

For Multifamily buildings with central domestic hot water there are also excellent options using electric heat pumps. We are seeing these projects go with Sanden, Colmac, and Nyle heat pumps.

A significant challenge is that Title 24 doesn’t have a modeling pathway for central hot water systems. The CEC is working on fixing this, targeting the 2019 code cycle.

Our all-electric multi-family projects include: Edwina Benner Plaza in Sunnyvale, 2437 Eagle Ave in Alameda, St Paul’s Commons in Walnut Creek, Stoddard Housing in Napa, Casa Adelante in San Francisco, and Maceo May in San Francisco.
MEMORANDUM

Date: 8/27/2019
To: Mayor and Members of the City Council
From: Rebecca L. Lucky, Sustainability Manager
Re: Reach Code high rise residential stakeholder feedback and recommendation

On July 16, the City Council directed staff to bring forward an all-electric Reach Code for new nonresidential buildings for adoption on August 27. A high-rise residential building more than three stories is considered nonresidential under the state building codes. Therefore, the proposed Menlo Park Reach Code would require new high-rise residential buildings to be all-electric. All-electric means no gas infrastructure inside the building. Appliances used for space heating, water heating, and cooking must be electric.

This is a cutting edge policy that has positioned Menlo Park at the forefront of local Reach Codes in the state to reduce greenhouse gas emissions from the building sector. The policy is driven by the amount of potential new development that may be realized in the next three years that would lead to increased community greenhouse gas emissions if allowed to use natural gas. This would create challenges in meeting existing and future Climate Action Plan goals to reduce emissions. Using only electricity in new buildings provides a solid foundation to reducing and curbing local greenhouse gas emissions. Menlo Park’s electricity is anticipated to be 100% greenhouse gas free by 2021.

The proposed policy has also raised concerns by high rise residential development stakeholders related to electric water heating. The traditional industry practice is to use a central natural gas water heating system (boilers) to provide hot water to a large number of units within a building.

Stakeholders identified two main issues in converting to an electric water heating system for high rise residential:

1. At this time, the state codes do not provide a pathway for a large central electric water heating system to be used for compliance. The California Energy Commission is working on updating its model over the next 12-18 months to allow for a large central electric water heating system.

2. Large electric central water heating systems (heat pumps) are not commonly used and can have technical issues.

Staff followed up with the cost effectiveness study technical consultants (TRC), the California Energy Commission, and building department to investigate the concerns.

Although the state codes do not provide a pathway for larger central electric water heating systems, the state codes do provide two other pathways for compliance, which are to:
1. Provide individual electric water heating systems to each unit; or

2. Use a smaller scale electric central water heating system that serves up to eight units. This is referred to as "mini-plants."

These alternative pathways are feasible for high rise residential. The operational cost between a central natural gas water heating system and a smaller scale central electric water heating system are similar.

These alternative pathways are not common practice, and require careful and thoughtful design in order to achieve desired results of efficiency and cost effectiveness. It is also equally important to choose the most environmentally friendly electric heat pump. Heat pumps use refrigerants that have an environmental impact and not all heat pumps are created equally. There are product guides available to help consumers and developers make the best choices.

As stated previously, the proposed all-electric policy is cutting edge, and is intended to drive new innovative thinking and leadership in designing hot water systems. In addition, it requires consumers and developers to make smart appliance decisions that will further save on costs while reducing environmental impacts.

There are educational forums and workshops to help support developers in transitioning to all-electric buildings occurring in October. Redwood Energy has also provided a Zero Emissions All-Electric Multifamily Construction Guide. Examples of high-rise all-electric residential buildings include:

- **Edwina Benner Plaza by MidPen Housing** in Sunnyvale is a four story residential building. Hot water is provided by two innovative central heat pump water heating plants paired with large storage tanks to shift heat pump loads away from peak periods.

- **205 Jones Street Apartments in San Francisco** is a retrofit by Mercy Housing (affordable home developer). This project replaced central natural gas boilers with electric central heat pump domestic water heaters.

- **St. Mark Hotel Apartments in Oakland** is another retrofit that replaced 80% efficient natural gas boilers with 400% efficient electric centralized heat pumps. Resulted in considerable site energy savings.

- **Coliseum Place in Oakland** will be a six story high rise residential development, and will be using a “mini-plant” hot water system design. Water heating for the units will be provided by individual Rheem or 80-gallon heat pump water heaters (3.55 UEF) where multiple units share one tank. To compensate for the length of piping to farthest resident in the “mini-plant” design, 3/8 piping was used to reduce hot water wait time. This saves on construction cost by not having to install recirculating piping.

- **Hillandale Gateway, Silver Spring, MD** is an 11 story tall apartment complex also using a “mini-plant” hot water approach. Apartments share 80-gallon electric heat pump tanks among two to four apartments (centralized), but without energy loses of a recirculation system.

- **Casa Adelante, San Francisco** will be a nine story affordable housing building. Electric central colmac air source heat pumps will be used for hot water heating with solar thermal power and it also provides some space
heating.

- **Quetzal Gardens, San Jose** are six story mixed use affordable rental apartments. Water heating is provided by NEEA-Rated, Rheem electric heat pump water heaters in 50, 65, and 80-gallon tanks for each bedroom unit type.
- Other all-electric high rise residential buildings include: Maceo May Veterans Apartments (Treasure Island), Balboa Upper Yard Family Apartments (San Francisco), 681 Florida Apartments (San Francisco), UC Santa Cruz Student Housing West, UC Irvine Student Housing West, Linda Vista (Mountain View).

Staff has provided these findings to the high rise residential stakeholders.

**Recommended Action**

Based on alternative pathways provided in the state codes for electric water heating, current technology, and supporting examples of all-electric high rise residential buildings, staff recommendations that the City Council move forward with requiring all-electric for high rise residential.

**Alternative Action**

Exempt high-rise residential from water heating until the state codes provide a pathway for larger centralized electric heat pumps.