Kate Harrison
Councilmember District 4

ACTION CALENDAR
July 9, 2019

To: Honorable Mayor and Members of the City Council

From: Councilmembers Harrison, Davila, Bartlett and Hahn

Subject: Adopt an Ordinance adding a new Chapter 12.80 to the Berkeley Municipal Code Prohibiting Natural Gas Infrastructure in New Buildings

RECOMMENDATION

1. Adopt an ordinance adding a new Chapter 12.80 to the Berkeley Municipal Code (BMC) prohibiting natural gas infrastructure in new buildings with an effective date of January 1, 2020.

2. Refer to the November 2019 budget process for consideration of allocating up to $273,341 per year from excess equity to fund a ~~new career~~two-year position in the Building & Safety Division of the Department of Planning and Development. The staff person will assist with implementing the gas prohibition ordinance and reach codes, and perform other duties as specified in the Financial Implications section of this item.

POLICY COMMITTEE TRACK

Facilities, Infrastructure, Transportation, Environment & Sustainability Policy Committee approved the ordinance, as amended, on June 17, 2019.

BACKGROUND

A. Previous Berkeley Efforts to Prohibit Natural Gas in New Construction

Natural gas is a leading source of green-house gas emissions (GHGs) in Berkeley, responsible for 27% of the GHGs released in the city. The only source sector with more local GHG emissions is the transportation sector.

In 2016, the Community Environmental Advisory Commission (CEAC) unanimously recommended that the Council consider phasing out natural gas appliances in new in

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buildings for climate, health and safety reasons.[1] That year, Council endorsed the recommendation and directed the CEAC and the Energy Commission to "develop and evaluate a proposal for requiring installations of new cooking, water heating, and/or building heating systems to use technologies which do not burn natural gas."[2]

The Berkeley Energy Commission subsequently investigated adopting an ordinance to achieve at least one of Council's goals—phasing out gas water heater systems in new buildings. Berkeley's commission concluded that requiring new buildings to use all-electric heat pump hot water heaters would constitute an amendment to the state energy code under Title 24, Part 6. Amendments to the energy code require approval from the California Energy Commission (CEC). Such amendments are commonly known as a 'reach' energy codes.

Until very recently, the state's efforts focused on increasing energy efficiency but did not consider the critical issue of reducing the GHGs that cause climate change. The models used by the state still vastly underestimate the cost of environmental and health impacts (discussed further below) caused by natural gas. At the time of the 2016 referral, the Berkeley Energy Commission concluded that CEC policies, particularly the lack of all-electric reference point and the laborious CEC requirement to demonstrate that electric systems are as cost-effective as gas designs under a regulatory environment that artificially favors fossil fuel by not considering externalities, convinced Berkeley commissioners to abandon the reach code strategy until the CEC reversed its policies.[3]

Berkeley's Office of Energy and Sustainable Development (OESD) continues to take a leading role with other cities in the region to present energy code amendments to state authorities that facilitate electric designs, and signed on in support of comments before the California Public Utilities Commission (CPUC) regarding utility incentives for fuel-switching in existing buildings.[4]

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[1] Phasing Out Natural Gas for Heating and Cooking, Community Environmental Advisory Commission, November 1, 2016, https://www.cityofberkeley.info/Clerk/City_Council/2016/11_Nov/Documents/2016-11-01_Item_10_Phasing_Out_Natural_Gas.aspx.
[2] Annotated Agenda Berkeley City Council Meeting, City Clerk's Office, November 1, 2016, http://www.cityofberkeley.info/Clerk/City_Council/2016/11_Nov/Documents/11-01_Annotated.aspx.
[3] *See* "Berkeley Support to Phase Out Fossil Fuels with Clean Electrification," OESD, CEC Docket 18-IEPR-09, June 28, 2018, https://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_Commissions/Commission_for_Energy/EC2018-07-25_Item%207c-Combined_Comments%20to%20CEC%20and%20CPUC.pdf; *See also*, "Comments of The Natural Resources Defense Council (NRDC) and Sierra Club On The Administrative Law Judge's Ruling Seeking Comments On The Three-Prong Test."
[4] "Berkeley Support to Phase Out Fossil Fuels with Clean Electrification," OESD, CEC Docket 18-IEPR-09, June 28, 2018, https://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-

B. Ordinance Overview: A New Approach

The state CEC is now beginning to model all-electric buildings. As of January, 2020, all-electric low-rise residential buildings (three and fewer stories) will be accepted under Title 24 and the CEC is hard at work modelling other building types and systems. Most of the building occurring in Berkeley is not low-rise residential. Instead of waiting for CEC policies model all-electric buildings for all building types to begin limiting natural gas, this ordinance provides the City with an immediate pathway to fossil free new buildings as building types and systems are approved by the CEC.

This ordinance differs from the reach code approach in that it leverages the City's authority under the California Constitution to prohibit installation of hazardous internal gas piping infrastructure when granting use permits for new buildings, and as a result avoids CEC regulations associated with asking permission to amend energy efficiency standards. It also does so without impinging on the CPUC's jurisdiction, whose gas regulatory authority ends at the building's gas meter, or point of delivery from within any given property.[5] The effect of this legislation will be that builders will be prohibited from applying for permits for land uses that include gas infrastructure—gas piping to heat water, space, food, etc.—as each building type and system is modelled for all-electric design by the CEC. Effective January, 2020, this restriction will apply to low-rise residential buildings and be implemented for each new building type or sub-system (e.g., water heating) as the CEC completes its work for that type.

This new approach would fulfil a key Berkeley Energy Commission climate action recommendation and has the endorsement of the current CEAC commission. In December 2018, the Energy Commission presented a draft response to the Council's proposed June 2018 Fossil Free Resolution. As part of a broader strategy to eschew fossil fuels from Berkeley, it recommended that the Council "[p]rohibit gas cooktops and dryers in new residences or a moratorium on new gas hook ups if possible."[6] On May 9,

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_Commissions/Commission_for_Energy/EC2018-07-25_Item%207c-Combined_Comments%20to%20CEC%20and%20CPUC.pdf. *See also*, "Comments of The Natural Resources Defense Council (NRDC) and Sierra Club On The Administrative Law Judge's Ruling Seeking Comments On The Three-Prong Test."

[5] Although the legislature empowered the Commission to "require each gas corporation to provide bundled basic gas service to all core customers in its service territory," it did not require customers to install fuel gas piping in or in connection with a building, structure or within the property lines of premises behind the gas meter. *See* California Code, Public Utilities Code - PUC § 963, https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=PUC&division=1.&title=&part=1.&chapter=4.5.&article=2.

[6] Fossil Free Berkeley Subcommittee Draft Report for 12/5/2018 Commission Meeting, Berkeley Energy Commission, December, 5, 2018, https://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-

2019 the CEAC Commission unanimously approved a letter to Council endorsing this ordinance, calling it "a cutting-edge environmental policy."[7]

Progress in Berkeley towards lowering emissions in new buildings has been encouraging but is still incremental. To date, the federal, state and local approach to energy use in new buildings has largely been to mandate greater building efficiency and energy conservation, which indirectly results in lower emissions, but does not directly phase out fossil fuel consumption in new buildings. Berkeley is in the process of adopting the ambitious, but voluntary, Deep Green Building Standards. The Deep Green Building Standards do not present a way to explicitly and directly limit constructing buildings with natural gas infrastructure, a potent and persistent source of greenhouse gas and other types of pollution.[8] The Green Building Standards regulations will also likely require additional energy reach codes to implement.

Gas-related emissions have increased because of regional population and job growth, leading to an 18% rise in Berkeley's population since 2000, as well as the multi-decade useful life of natural gas appliances.[9] According to the November 2017 Planning Department Bi-Annual Housing Pipeline Report, the City approved building permits for 525 residential units between January 1, 2014 and November 2017. An additional 952 units received their certificate of occupancy during the same period.[10] The new Adeline Corridor Plan calls for construction of another 1,400 housing units. Without intervention, the vast majority of these units would feature natural gas infrastructure.

As a result, the city has 'locked in' decades of additional carbon pollution, and stands to continue doing so with each new use permit approval. The persistence of fossil fuel industry marketing, fossil-fuel favoring regulations, the regional housing affordability crisis, and the associated effort to expand the housing stock will continue to drive local

_Commissions/Commission_for_Energy/FFB%20Draft%20report%20for%20Dec%205%202018%20Commission%20Meeting%20Final.pdf

[7] CEAC, Action Minutes Community Environmental Advisory Commission Regular Meeting of May 21, 2019, May 9, 2019, https://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_Commissions/Commission_for_Community_Environmental_Advisory/20190509_CEAC_Action%20Minutes.pdf; *See also*, CEAC, Community Environmental Advisory Commission Comments on Prohibiting Natural Gas Infrastructure in New Buildings, May 9, 2019, https://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_Commissions/Commission_for_Community_Environmental_Advisory/CEAC%20DRAFT%20Letter%20on%20Natural%20Gas%20042919.pdf.

[8] The forthcoming 2019 California Energy Code allows for significant natural gas usage.

[9] 2018 Berkeley Climate Action Plan Update, p. 1.

[10] Referral Response: Bi-Annual Housing Pipeline Report, Planning Department, November 11, 2017, https://www.cityofberkeley.info/Clerk/City_Council/2017/11_Nov/Documents/2017-11-28_Item_21_Referral_Response_Bi-Annual.aspx

and regional increases in natural gas infrastructure and consumption unless we act now.

This ordinance recognizes that all-electric heating technologies are cost-competitive substitutes to their natural gas counterparts (especially when installed during new construction) and seeks to halt the expansion of natural gas into new buildings to stave off the risk of locking in significant additional greenhouse emissions. In the interim, City staff has indicated it will continue to design and seek approval of all-electric codes to help guide home builders in constructing new buildings of a type not yet modelled by the CEC and in order to increase energy efficiency.[11]

This legislation will have the effect of ushering in all-electric new buildings, avoiding significant new greenhouse emissions and allowing the City to focus its climate fighting efforts and resources on other critical sources of emissions such as existing buildings and transportation.

The ordinance also includes some important exemptions. Internal ADUs (i.e., ADUs built in the basement or attic of an existing home) are exempt from this ordinance, because although those ADUs represent new construction, they will utilize whatever fuel is used in the existing home. There is also a public interest exemption, whereby minimally necessary and specifically tailored natural gas infrastructure may be allowed, provided that the staff, Zoning Adjustments Board and/or the City Council (whichever is responsible for entitling the project in question) establishes that the use of natural gas will serve the public interest.

C. The CEC: Cost-effective Energy Efficiency Measures vs. the Climate

The California legislature established the CEC in the wake of the energy crisis of the 1970s "in order to reduce the wasteful, uneconomic, inefficient, or unnecessary consumption of energy."[12] The aim of the CEC has been energy efficient building design at the lowest possible price. Its regulations set minimum efficiencies and cost-effectiveness standards for new buildings with which building developers must comply.

The CEC creates computer models for a range of energy systems that builders can use to demonstrate compliance with the minimum energy efficiency requirements. Before builders can receive their building permit from their local city building department, they must compare their proposed energy systems design against a typical building type

[11] OESD reported in December 2018 that "Berkeley has worked with other local governments to create a joint cost-effectiveness study request for the California Codes and Standards Program, seeking the maximum cost-effective efficiency for mixed-fuel and all-electric new construction over a representative sample of building sizes and uses…The findings from this cost-effectiveness study request are expected in early 2019 and will be [used] to evaluate options and opportunities for local amendments to promote deep energy savings and electrification." *See*, 2018 Berkeley Climate Action Plan Update, p. 12.
[12] Pub. Res. Code 25402.

established by the CEC, known as the baseline. A baseline can be thought of as a cost-effective maximum energy budget which builders cannot exceed. Every three years the CEC updates the energy codes through tightening the energy efficiency requirements for a range of building types, including low-high residential buildings and non-residential buildings such as commercial buildings.

Within each baseline, the CEC creates a theoretical typical building with a range of efficient and cost-effective energy systems such as water heaters and space heaters. For example, in creating a baseline for a single-family home, the CEC builds its typical virtual house with efficient water heaters and space heaters along with windows, ventilation systems, etc. in order to establish a desired energy budget for a typical single-family home. In designing their buildings, developers can either go with the CEC's recommendation for each system type, known as the prescriptive method, or can opt for more flexibility in choosing alternative systems and technology allowing for energy efficiency tradeoffs across the building design (e.g., more wall insulation but less efficient windows), known as the performance method.[13]

Fortunately, in response to state law's expanding focus on climate change, the California Energy Commission is gradually broadening its energy standard regulations to also minimize carbon emissions alongside energy inefficiencies at the lowest possible cost. The CEC will offer builders all-electric baselines for low-rise residential buildings with the commencement of the new code cycle, known as the "2019 Building Energy Efficiency Standards," on January 1, 2020. The CEC has not yet provided a timeline for an all-electric baseline for mid- to high-rise residential buildings, and commercial buildings; however, CEC officials intend to release them as soon as possible.

As a result, on January 1, 2020 builders choosing electric water and space heaters in mid- to high-rise residential and commercial buildings must still compare their electric designs to a baseline that is based on natural gas, and which favors natural gas. This is despite the fact that modern electric heat pump technology outperforms their gas counterparts in terms of both carbon emissions and total energy usage. Therefore, builders often have to take a slight penalty within their total energy budget when choosing all-electric heaters. However, this penalty can often be made up by improving performance in other areas of the code. For example, a builder might opt for more building insulation to make up for the unfair penalty of choosing an electric water heater, which is the best choice for the climate, energy efficiency and lifecycle cost.

The reach codes currently being explored by the City would incentivize all-electric design for building and system types not yet modelled by the CEC. Reach codes cannot disincentive the construction of buildings with hazardous gas stoves as the energy code

[13] For example, under the performance method, the CEC may choose a certain water heater in its baseline, but a builder may want a different model to achieve the specific design required by their clients.

does not regulate cooking equipment. Cities need an additional tool to decarbonize at an emergency pace.

D. A Revolution in All-Electric Design

Developers across the Bay Area and the state are already proving that all-electric design is feasible across all building types—even without an all-electric baseline. These projects are not only possible but profitable.

In 2018, the University of California implemented regulations prohibiting natural gas in new buildings. According to the university system, "[n]o new UC buildings or major renovations after June 2019, except in special circumstances, will use on-site fossil fuel combustion, such as natural gas, for space and water heating." Stanford University is exploring a similar policy.[14] It should be noted that large universities develop every kind of building type imaginable from low- to high-rise dormitories, dining halls, classrooms, libraries, laboratories, sports facilities etc. The UC system is acting regardless of CEC policies across this wide range of building types.

Over the past decade, innovative engineers, architects and developers have paved the way by building residential and commercial buildings all-electric, despite state policies favoring fossil fuel. A list of just some of these projects can be found in Attachment A.

F. The Climate Emergency

In June 2018 the Berkeley City Council declared a city-wide Climate Emergency (Resolution No. 68,486-N.S.), aimed at reviewing the City's greenhouse gas emission reduction strategies, commitments and progress in light of recent political, scientific and climatic developments.[15] A 2018 U.N. Intergovernmental Panel on Climate Change (IPCC) report suggested that in order to keep warming under 1.5 degrees Celsius, governments must initiate a dramatic 45% cut in global carbon emissions from 2010 levels by 2030 and reach global 'net zero' around 2050. The time for incremental

[14] Justin Gerdes, "California Universities Are Transitioning to All-Electric Buildings," Green Tech Media, September 24, 2018, https://www.greentechmedia.com/articles/read/california-universities-are-transitioning-to-all-electric-buildings#gs.j6pqs2.
[15] Resolution Endorsing a Climate Emergency, Berkeley City Council, June 12, 2018, https://www.cityofberkeley.info/uploadedFiles/Council_2/Level_3_-_General/Climate%20Emergency%20Declaration%20-%20Adopted%2012%20June%202018%20-%20BCC.pdf

emissions reduction strategies is over—policymakers must begin implementing "far-reaching and unprecedented changes in all aspects of society."[16]

Berkeley became a climate leader when voters overwhelmingly passed Measure G in 2006, calling for the City to reduce greenhouse gas emissions by 33% below 2000 levels by 2020, and 80% by 2050.[17] The City Council adopted the 2009 Berkeley Climate Action Plan, which was written through a community-wide process.[18] The plan identified buildings as major contributors to greenhouse gas emissions, representing 26% of community-wide emissions, and recommended the implementation of aggressive building codes favoring low carbon appliances/infrastructure in new buildings.[19] A 2018 Climate Action Plan progress update by Berkeley's OESD reported that "[c]ombustion of natural gas within Berkeley buildings accounted for 27% of total GHG emissions in 2016 and 73% of building sector GHG emissions."[20]

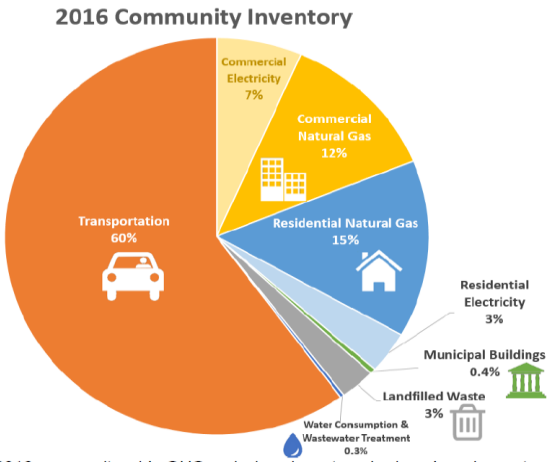


Figure 1: Pie chart of 2016 community-wide GHG emissions inventory, broken down by sector and fuel.

[16] IPCC Press Release, Summary for Policymakers of IPCC Special Report on Global Warming of 1.5ºC approved by Governments, 8 October 2018, http://www.ipcc.ch/pdf/session48/pr_181008_P48_spm_en.pdf

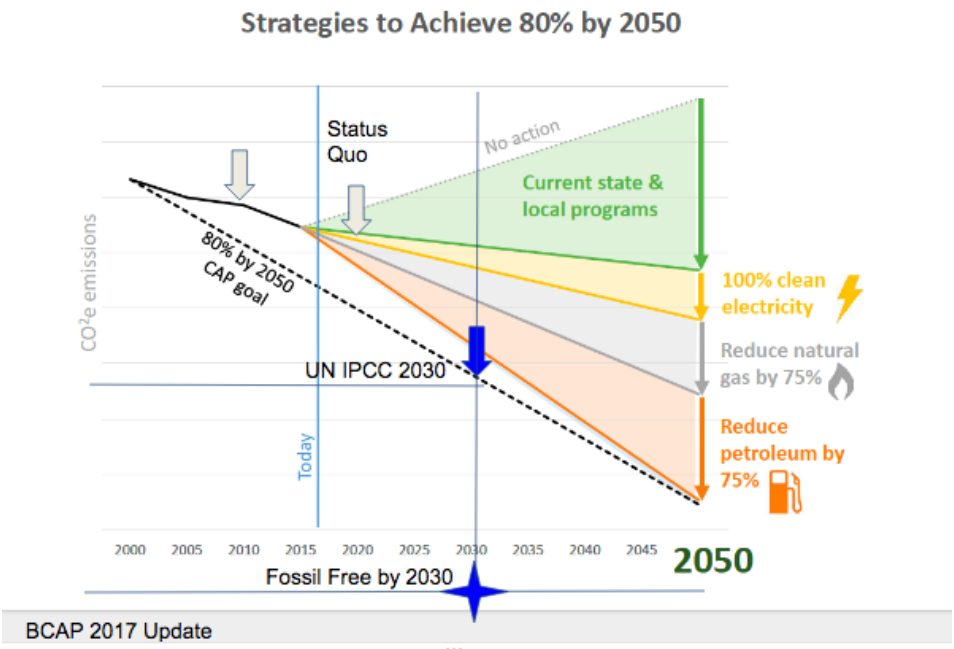
[17] Resolution Submitting Measure G, Berkeley City Council, July 18, 2006, https://www.cityofberkeley.info/citycouncil/resos/2006/63396.pdf; Ballotpedia, Berkeley Greenhouse Gas Emissions, Measure G (November 2006), November 7, 2006, https://ballotpedia.org/Berkeley_Greenhouse_Gas_Emissions,_Measure_G_(November_2006)#cite_note-quotedisclaimer-1

[18] Resolution No. 64,480-N.S.

[19] City of Berkeley, Berkeley Climate Action Plan, June 2009, https://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/Berkeley%20Climate%20Action%20Plan.pdf, p. 59.

[20] 2018 Berkeley Climate Action Plan Update, Office of Energy and Sustainable Development, December 6, 2018, https://www.cityofberkeley.info/Clerk/City_Council/2018/12_Dec/Documents/2018-12-06_WS_Item_01_Climate_Action_Plan_Update_pdf.aspx, p. 10.

The most current available data suggest that Berkeley's 2016 community-wide GHG emissions are approximately 15% below 2000 baseline levels, despite a population increase of approximately 18% in that same time period. The City is doing a good job in the face of population increases but remains approximately 18% behind its 2020 goal and will fall short of its ultimate goal of net zero emissions by 2050. The following diagram from the Berkeley Energy Commission demonstrates that, without accelerated efforts, the City will continue to be below its target. To reach the 80% goal, 75% reductions in natural gas and petroleum usage are needed.[21]



G. Existing Decarbonization Efforts

The proposed ordinance to phase out natural gas is one aspect of a larger effort by the City of Berkeley and the state of California to decarbonize buildings on a rapid and ambitious timeline. City staff from every department, most notably Planning, are prioritizing decarb~~in~~oization efforts in their work, including but not limited to phasing out natural gas,

AB 3232, passed in September 2018, mandates a 40% reduction in greenhouse gas emissions from California's building stock by 2030. Achieving these reductions in the next ten years will require combined efforts on building green new buildings and retrofitting existing buildings to reduce emissions. The proposed ordinance phasing out

[21] *Id.*, p. 2.

natural gas, combined with a reach code to incentivize all-electric design, both serve to create cleaner greener buildings through the building stage. For existing buildings, the City is looking into new programs to streamline and reduce cost for green retrofits. The Building Energy Savings Ordinance (BESO) is being reevaluated to include aspects of electrification. For decades, Berkeley has provided a rebate on the real property transfer tax for seismic retrofits, and, based on a Council referral, is now considering how that can -be expanded for green retrofits, including electrification, installing bioswales, and adding other green features. The Office of Environmental Sustainability and Development also hosted a successful Electrification Expo to educate on the benefits of decarbonization.

~~G~~H. The Negative Externalities of Natural Gas in Buildings

I. Catastrophic Methane Leaks

We have known for a long time that burning gas generates carbon dioxide, a greenhouse gas. New scientific studies suggest that in addition to combustion, there are significant additional carbon emissions stemming from gas leaks. When unburnt natural gas, known as methane (CH_4), is leaked into the atmosphere, it becomes one of the most potent greenhouse gases despite its short lifespan. Methane leaks, from within the building sector and across the gas supply chain, e.g. drill wells, pipelines etc., are literally and figuratively cooking the planet.

According to the EPA, "[p]ound for pound, the comparative impact of CH4 [methane] is more than 25 times greater than CO2 [carbon dioxide] over a 100-year period."[22] Methane is even more potent in the first two decades of its lifespan—20 years after it is release, methane has a global warming potential of 84 times that of carbon dioxide. Methane's enhanced potency, particularly in the short term, results in more immediate warming and thus warrants greater urgency. EDF estimates that "[a]bout 25% of the manmade global warming we're experiencing is caused by methane emissions."[23]

Substantial methane gas is released into the atmosphere through hydraulic fracking and other drilling methods.[24] A 2018 EDF study estimated that the equivalent of 2.3% of total annual domestic gas production leaks into the atmosphere each year from across the oil and gas supply chain.[25] These leaks do not include additional leaks at and behind the

[22] "Overview of Greenhouse Gases," U.S. Environmental Protection Agency, https://www.epa.gov/ghgemissions/overview-greenhouse-gases#methane
[23] "Methane: The other important greenhouse gas," Environmental Defense Fund, https://www.edf.org/climate/methane-other-important-greenhouse-gas.
[24] The Economics of Electrifying Buildings, p. 26.
[25] Ramon A. Alvarez et al., "Assessment of methane emissions from the U.S. oil and gas supply chain," Science Magazine, July, 13 2018. https://science.sciencemag.org/content/361/6398/186; However, EDF's

residential or commercial meter located on building premises. Leaks from natural gas infrastructure in the Bay Area are estimated at another 0.5%.[26] Given the global warming potential of methane over a 20-year period, from a purely climate change perspective, burning coal would produce less greenhouse gas emissions than natural gas.[27] This difference is even greater if you consider the global warming potential of methane over only a 10-year period.[28]

Cities cannot achieve their emissions reductions goals by expanding a building infrastructure system and upstream supply chain that is leaking massive amounts of methane. Consequently, the Rocky Mountain Institute calls upon cities to immediately "[s]top supporting the expansion of the natural gas distribution system, including for new homes."[29] While governments can and should try to regulate leaks in the short term, ultimately there does not appear to be a cost-effective technical solution to end all leaks. To truly stop methane leaks from buildings and the oil and gas supply chain, governments will have to consider abandoning natural gas as a source of energy.

II. Health Impacts

The ordinance will also improve indoor and outdoor air quality by eliminating toxic byproducts of natural gas. Unfortunately, the EPA does currently regulate indoor air quality, and emissions from natural gas stoves are likely toxic to building occupants.

A 2013 Lawrence Berkeley National Laboratory study found that "60 percent of homes in the state that cook at least once a week with a gas stove" produce toxic levels of nitrogen dioxide, formaldehyde and carbon monoxide exceeding federal standards for outdoor air quality. Although electric stoves generate some toxins from cooking, researchers found that gas stoves are more detrimental to indoor air quality because they produce significant fossil fuel combustion byproducts not associated with electric

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study was probably too conservative; an earlier Cornell study found that between the drill well and the consumer delivery point, conventional natural gas results in a 3.8% leak rate, and fracked shale gas results in a whopping 12% leak rate. *See* Robert Howarth, "Methane emissions and climatic warming risk from hydraulic fracturing and shale gas development: implications for policy," Dovepress, October 8, 2015, http://www.eeb.cornell.edu/howarth/publications/f_EECT-61539-perspectives-on-air-emissions-of-methane-and-climatic-warmin_100815_27470.pdf, p. 1 and p. 46.

[26] Julie Chao, "Bay Area methane emissions may be double what we thought,**"** Phys.org, January 17, 2017, https://phys.org/news/2017-01-bay-area-methane-emissions-thought.html.

[27] Environmental Defense Fund, "The climate impacts of methane emissions," April 2012, https://www.edf.org/climate-impacts-methane-emissions.

[28] Save the EPA, "Oil and Gas Fields Leak Far More Methane than EPA Reports," June 28, 2018, http://saveepaalums.info/2018/06/22/oil-and-gas-fields-leak-far-more-methane-than-epa-reports/ at fn. 5.

[29] The Economics of Electrifying Buildings, p. 10.

stoves.[30] This issue is compounded by state efficiency standards, which are designed to trap air indoors.

Researchers in the United States are Australia have begun to link the use of natural gas stoves with asthma attacks and associated hospitalizations. Asthma and its relationship to natural gas present profound questions about equity.[31] Researchers from the University of California, Berkeley, and the University of California, San Francisco found that the highest asthma rates in Berkeley and Oakland tracked areas that were redlined pursuant to racist housing policies.[32]

The true cost of "cheap" natural gas should include some portion of the massive societal and financial costs associated with respiratory illness the Bay Area.

Improvements in electric induction cooktop technology suggest that the City of Berkeley can simultaneously maintain its rich culinary culture while taking action to reduce fossil fuel emissions in new buildings.[33] Famous chefs across the country are turning to induction cooking and commercial restaurants, and all restaurants in LAX airports latest terminal are all-electric. Induction cooking equipment reduces chef burns and grease fires and provides enhanced temperature control.

III. Seismic/Fire Safety/Resiliency

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[30] "Pollution in the Home: Kitchens Can Produce Hazardous Levels of Indoor Pollutants," Julie Chao, Lawrence Berkeley National Laboratory, July 23, 2013, https://newscenter.lbl.gov/2013/07/23/kitchens-can-produce-hazardous-levels-of-indoor-pollutants/.

[31] A 2017 California Public Health Department report found that asthma is 30% more prevalent for African Americans and 40% more prevalent for Asian Americans and Native Americans than whites. Gay/lesbian and bisexual men and women have 40-60% higher asthma prevalence than straight men and women. Hispanics and Asians born in the U.S. are more than twice as likely to have current or lifetime asthma than Hispanics and Asians born outside of the U.S. *See* California Department of Health, "Asthma Prevalence in California: A Surveillance Report," January 2017, https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHIB/CPE/CDPH%20Document%20Library/Asthma_Surveillance_in_CA_Report_2017.pdf.

[32] UC Berkeley Public Health, "Historically redlined communities face higher asthma rates" May 2019, https://sph.berkeley.edu/historically-redlined-communities-face-higher-asthma-rates.

[33] While natural gas ranges are often regarded by home cooks as superior, modern induction range technology provides faster heat response, easier clean up and more temperature precision. *See e.g.*, Cooktop Showdown – Gas vs. Electric vs. Induction, A Finer Touch Construction, https://aftconstruction.com/cooktop-showdown-electric-vs-gas-vs-induction/. Appliance manufacturer Samsung introduced a new induction cooktop featuring a "virtual" LED flame that mimics a gas flame. *See also*, 36" Induction Cooktop with Virtual Flame™, Samsung US, https://www.samsung.com/us/home-appliances/cooktops-and-hoods/induction-cooktops/36--built-in-induction-cooktop-with-flex-cookzone--nz36k7880ug-aa/.

The ordinance will help prevent deadly home fires that start from an open flame and are fueled by gas lines. For example, the City of Santa Rosa is actively reconsidering the role of natural gas in new buildings because of the destructive 2017 Tubbs firestorm.[34] The explosion of PG&E's gas lines in San Bruno and San Francisco further illustrate the inherent danger of pumping fossil free at high pressure through streets and homes.[35] Gas fires cannot easily be extinguished with traditional firefighting techniques; they require shutting off the source valve, which can be extremely difficult during times of disaster.[36]

Perhaps the ultimate fire risk associated with natural gas infrastructure is illustrated by the 2017 U.S. Geological Survey conducted *HayWired Scenario* simulating "a 7.0 quake on the Hayward fault line with the epicenter in Oakland." The agency's report predicted that "about 450 large fires could result in a loss of residential and commercial building floor area equivalent to more than 52,000 single-family homes and cause property (building and content) losses approaching $30 billion."[37] The report identified ruptured gas lines as a key fire risk factor. This finding mirrors the reality of the destructive gas fires resulting from the Loma Prieta (1989) and Northridge (1994) earthquakes.

Gas negatively impacts the resiliency of cities because gas lines are more difficult to repair following disasters than electric infrastructure. In times of disaster, the fossil fuel supply chain will likely be disrupted. By comparison, electric appliances in conjunction with battery storage technology combined with renewable energy generation such as rooftop solar can operate absent the grid's electric supply chain.

Critically, gas prices are always subject to significant volatility due to natural disasters, as shown below:[38]

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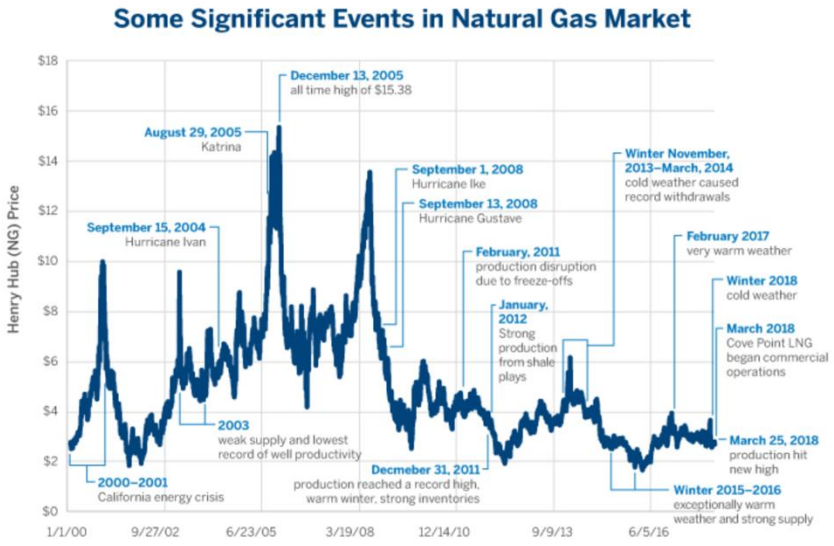
[34] Will Schmitt, Santa Rosa council considers requirement for new homes to be independent of natural gas, Press Democrat, November 10, 2018, https://www.pressdemocrat.com/news/8899687-181/santa-rosa-council-considers-requirement.
[35] *See e.g.*, Rebecca Bowe, Lisa Pickoff-White, Five Years After Deadly San Bruno Explosion: Are We Safer?, KQED, September 8, 2015, https://www.kqed.org/news/10667274/five-years-after-deadly-san-bruno-explosion-are-we-safer; *See also*, David Siders, Jerry Brown declares emergency around Southern California gas leak, January 6, 2016, https://www.sacbee.com/news/politics-government/capitol-alert/article53353615.html.
[36] Ronald T. Eguchi and Hope A. Seligson, "Practical Lessons from the Loma Prieta Earthquake (1994)," The National Academic Press, https://www.nap.edu/read/2269/chapter/7#141.
[37] "The HayWired earthquake scenario—Engineering implications," U.S. Geological Survey, April 18, 2018, https://pubs.er.usgs.gov/publication/sir20175013v2.
[38] Adila Mchich, "Are Crude Oil & Natural Gas Prices Linked?" CME Group, May 9, 2018, https://www.cmegroup.com/education/articles-and-reports/are-crude-oil-natural-gas-prices-linked.html.



39

By contrast, clean electricity from renewable generation is extremely cost effective and stable.

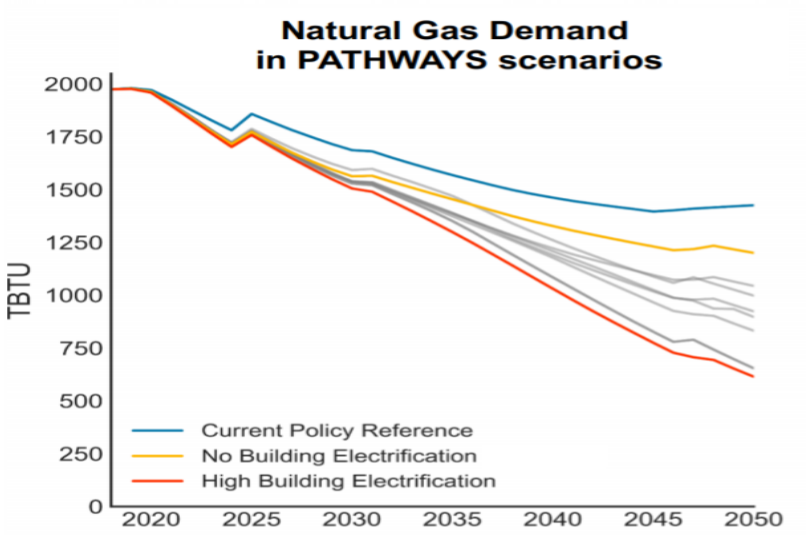
In case of electricity outages during a disaster or in preparation for high winds, neither new natural gas nor electric water heaters or stoves will function normally, because newer natural gas appliances require electricity to start. Thus, having more gas infrastructure as a backup will become increasingly less useful. Also electric heat-pump water heaters hold substantial amounts of hot water, ready to use in case of a disaster. In electrical power outages, it is thus advantageous to have electric hot water heating.

IV. Stranded Assets

A 2018 Rocky Mountain Institute report cautioned cities that natural gas "infrastructure will be obsolete in a highly electrified future, and gas ratepayers face significant stranded asset [financial] risk" by expanding the natural gas system.[40]

California Senate Bill 100 ensures that the California electric grid will be 100% greenhouse gas-free by 2045. Berkeley businesses and residents already have access to 100% carbon free electric plans through East Bay Community Energy at the same price as PG&E's standard rate, and many Berkeley electricity customers are placing solar on their residences, which further undercuts the market for gas. A 2019 draft report commissioned by the CEC shows plummeting demand for natural gas in coming years and precipitous cost increases for customers that remain on gas.

[39] *Id.*
[40] The Economics of Electrifying Buildings, p. 10.



[41]

In 2018, former Governor Jerry Brown issued executive order B-55-18, pledging that the California economy will be carbon neutral by 2045. Assembly Bill 3232 also requires the CEC to create a plan by 2021 to reduce building sector emissions by 40 percent below 1990 levels by 2030.[42] California's extremely carbon-intensive natural gas system will have to be decommissioned, all new buildings will have to be emissions-free and existing buildings will need retrofitting. These political developments along with ever-increasingly of the climate emergency foreshadows the likelihood of future state and federal emissions regulations will impact the gas sector.

Therefore, as customers continue to abandon gas in favor of clean electricity, the percentage of ratepayers paying gas corporations for service, and indirectly to maintain the drill wells, pipelines and distribution systems, will shrink over time. Absent a bailout by the state, those ratepayers will be left with the burden of paying much higher rates to support the system with assets that are no longer productive. Developers and their investors will also likely suffer as their buildings will lose value given that prospective tenants will face exorbitant rates to use energy in their leased space. Separately, building owners will find when they go to electrify their gas building in the future, their electric infrastructure will be undersized, which will cost them significant funds to rectify.

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[41] "Draft Results: Future of Natural Gas Distribution in California," California Energy Commission Staff Workshop for CEC PIER-16-011, June 6, 2019, https://www.energy.ca.gov/research/notices/2019-06-06_workshop/2019-06-06_Future_of_Gas_Distribution.pdf, p. 52-53.
[42] Pierre Delforge Merrian Borgeson, "Study: CA Needs a Safe, Managed Transition Away from Gas," NRDC, June 06, 2019, https://www.nrdc.org/experts/pierre-delforge/study-ca-needs-safe-managed-transition-away-gas.

In light of this reality, by preventing the unnecessary expansion of gas infrastructure into new buildings, this ordinance reduces the problem of future stranded assets.

~~H~~I. The Legal Case for Building Decarbonization

Under the California Constitution, Cities retain police powers to adopt building standards that provide for their community's health, safety and welfare.[43] This ordinance makes a series of climatic, geologic and health and safety findings.

The Berkeley City Attorney's office has reviewed the ordinance for legality with assistance from outside counsel. In addition, the City Attorney's office has reviewed the City's franchise agreements with the Pacific Gas & Electric Company.

~~I~~J. The Economic Case for Building Decarbonization

I. Cost Effectiveness of Electrification

The decarbonization approach outlined in this ordinance is borne out by recent economic analysis:

> A 2018 report by the Rocky Mountain Institute considered carbon emissions reductions and cost-effectiveness of all-electric space and water heating in new single-family homes in Oakland.[44] The report found that new single-family developments avoiding gas could "save $1,000 to more than $24,000 per single-family home, with a median value of $8,800."[45] Due to their design, space heating heat pumps function as both heaters and air conditioners. Air conditioning will become more critical for health and safety as Berkeley's climate continues to warm due to global warming. For new single-family buildings in Oakland, "[electric] heat pumps are universally more cost-effective" than natural gas space and water heaters due to their superior energy efficiency, cost-

[43] Article XI, Sec. 7. of the CA Constitution reads: "A county or city may make and enforce within its limits all local, police, sanitary, and other ordinances and regulations not in conflict with general laws."
[44] Sherri Billimoria, Mike Henchen, Leia Guccione, and Leah Louis-Prescott, "The Economics of Electrifying Buildings: How Electric Space and Water Heating Supports Decarbonization of Residential Buildings," Rocky Mountain Institute, June 14, 2018, https://rmi.org/wp-content/uploads/2018/06/RMI_Economics_of_Electrifying_Buildings_2018.pdf. The Oakland study is useful as Berkeley shares many of its characteristics, including its climate, architecture, the electric and natural gas utility, the Pacific Gas and Electric Company, and membership in East Bay Community Energy.
[45] *Id.*, p. 47.

competitiveness, and the avoided cost of connecting to the Pacific Gas & Electric Company's natural gas distribution system.[46]

- In 2017, Stone Energy Associates and Redwood Energy submitted letters to the CEC advising the commission of the significant net cost savings per unit in multi-family projects due to avoiding costly trenching and gas infrastructure.[47]

- A 2018 Natural Resources Defense Council-commissioned report found that all-electric new multi-family construction "sees upfront capital savings, partly [as] a result of not piping for gas."[48]

- A 2019 Energy and Environmental Economics, Inc. ("E3") report, jointly funded by Southern California Edison, Sacramento Municipal Utility District, and the Los Angeles Department of Water and Power found that all-electric low-rise construction results in lifecycle savings of $130 to $540/year. Furthermore, E3 found that "[a]s the carbon intensity of the grid decreases over time, these savings are estimated to increase to ~80% – 90% by 2050."

- Green buildings are profitable because clients and customers are willing to pay more to live and work in them.

Conventional wisdom says that gas is cheaper than electricity because the cost is lower per unit of energy. However, electric appliances are significantly more efficient than gas appliances and reduce the cost by using fewer units of energy. Electric heat pump water heaters are up to five times more efficient than gas water heaters.[49] The price per unit may be higher for electricity, but in using fewer units the price of operation is not necessarily higher. In addition, electric energy loads can be offset through rooftop solar or other local renewable sources, while gas will always need to be purchased from an outside source. All-electric buildings can achieve net-zero operational costs, which is impossible for mixed-fuel buildings.

[46] Id.
[47] CEC Docket No. 17-BSTD-01, Letter from Sean Armstrong, Redwood Energy, to CEC Re: 2019 Building Energy Efficiency Standards Pre-Rulemaking, October 11, 2017, https://efiling.energy.ca.gov/GetDocument.aspx?tn=221464&DocumentContentId=27248; CEC Docket No. 16-BSTD-06, Letter from Nehemiah Stone, Stone Energy Associates, to CEC Re: 2019 Building Energy Efficiency Standards Development, April 4, 2017.
[48] Asa S. Hopkins, PhD, Kenji Takahashi, Devi Glick, Melissa Whited, "Decarbonization of Heating Energy Use in California Buildings: Technology, Markets, Impacts, and Policy Solutions," Synapse Energy Economics, Inc., October 16, 2018, http://www.synapse-energy.com/sites/default/files/Decarbonization-Heating-CA-Buildings-17-092-1.pdf.
[49] https://www.sandenwaterheater.com/sanden/assets/File/SANDEN_CO2WaterHeater_5_19.pdf.

The idea that gas is de jure cheaper than gas neglects the issue of stranded assets. A 2018 Rocky Mountain Institute report cautioned cities that natural gas "infrastructure will be obsolete in a highly electrified future, and gas ratepayers face significant stranded asset [financial] risk" if the natural gas system is expanded.[50] In addition, electric energy loads can be offset through rooftop solar or other local renewable sources, while gas will always need to be purchased from an outside source. All-electric buildings can achieve net-zero operational costs, which is impossible for mixed-fuel buildings.

As explored in Section H, there are significant externalities to burning natural gas, particularly around climate change, public health, and earthquake and fire preparedness. The CEC's models do not consider the costs to public health or recovery from earthquakes or fires. When calculating cost-effectiveness, the CEC uses a very low price for the climate impact of carbon, $18 per ton. According to a 2013 CPUC study, carbon emissions should be priced at between $73 and $80 per metric ton in 2020, more than four times the price used in the CEC's models. When the full cost of carbon is considered, it is no longer accurate to say that natural gas is cheaper than increasingly renewable electricity.

II. Green Jobs

As new all-electric buildings come online as a result of this ordinance and broader trends in the economy, new jobs specializing in green building will continue emerge. In 2017, nationwide jobs in the clean energy sector eclipsed the fossil fuel industry, despite record fossil fuel exploration and recovery.[51]

While certain trades such as electricians and many other trades will see an expansion in demand for services as a result of prohibiting natural gas infrastructure in new buildings, other trades may see a decrease in work as gas infrastructure is phased out. It is incumbent upon the City of Berkeley to continue do everything it can to support workers in securing a just climate transition and living wages.

While electric loads will increase through electrification of buildings and cars, our Alameda County's community choice aggregator, East Bay Community Energy, is ramping up local electricity production, with a parallel- opportunity for increased local energy jobs.

OUTREACH, OVERVIEW, AND RESULTS

The ordinance has evolved over time thanks to the thoughtful input of both all-electric and mixed-fuel developers, climate activists, engineers, building applicants, and Planning Department staff. The Berkeley Energy Commission and the Community

[50] The Economics of Electrifying Buildings, p. 10.
[51] Lara Ettenson, "U.S. Clean Energy Jobs Surpass Fossil Fuel Employment," NRDC, February 01, 2017, https://www.nrdc.org/experts/lara-ettenson/us-clean-energy-jobs-surpass-fossil-fuel-employment.

Environmental Advisory Commission both unanimously approved the recommendations in the ordinance.

The Berkeley Energy Commission held two special meetings on the proposed ordinance to facilitate feedback from key stakeholders. The first meeting, held on April 24, 2019 focused on residential development while the second meeting, held on June 12, 2019, dealt with commercial and industrial development. In both meetings, energy consultants, developers, and architects who do all-electric design presented the technology and innovations that make all-electric design feasible, cost-effective, and attractive. There were then questions and discussion with developers and climate activists. At an outreach meeting to the Downtown Business Association on June 27, the most common question was regarding resilience in the face of electrical power outages. Research indicates that all-electric appliances actually offer more resiliency, as discussed further in section H.III. of this transmittal.

The intent of this ordinance is not to slow development, but to ensure that new development is safer, greener, and more resilient than ever before. Councilmember Harrison's office facilitated conversations among architects and electrical engineers to work with the California Energy Code's existing models and model all-electric buildings for all building types. These models, which are explained in more depth in section D of the background information, are intended for public consumption to assist developers through the process of electric buildings. This team has been in communication with the CEC to disseminate this information further.

Between the initial referral to the Facilities, Infrastructure, Transportation, and Environmental Sustainability Committee and the current form of the ordinance, the following changes were made:

- The prohibition on natural gas is now applicable at the time of entitlement rather than building permit..
- Rather than an outright ban, gas is phased out of building types and systems as the California Energy Commission creates models that allow developers to have their buildings approved. Though it would be feasible, cost effective and legally permitted to ban natural gas outright for all building types today, the CEC, the agency which establishes the models for buildings to be approved under Title 24, has not completed work on its models allowing electrification of all building types and systems.
- A provision providing that mixed-fuel buildings must be all-electric ready so that that adaptation would not have to be made at a later time, at much greater expense. The easiest, most cost-effective option for developers is to be prepared to switch away from natural gas, even when it is included in the initial development.

- A budget referral to fund a new FTE in the Building & Safety Division was added.

FINANCIAL IMPLICATIONS
Staff time will be necessary to implement the new permit regulations.

Staff estimates that the total annual staff cost for a ~~career~~ two year position to implement a gas prohibition ordinance and reach codes would be $273,341 per year~~,~~ funded from excess equity. The position would be in the Building & Safety Division of the Department of Planning and Development.

The staff person would also:

- assist the City of Berkeley in advancing its leadership in electrifying buildings;
- assist in development of future code amendments would be the lead staff for managing implementation of new energy-related ordinances and codes, including the Deep Green Building Standards;
- provide training to staff, and also assistance and consultation for permit applicants; and,
- assist property owners with incentives (e.g., anything offered under the Pathways to Green Buildings plan, the electrification transfer tax subsidy ordinance).

ENVIRONMENTAL SUSTAINABILITY
Prohibiting natural gas infrastructure in new buildings will prevent the release of significant additional natural gas-related greenhouse gasses from new buildings.

CONTACT PERSON
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Attachments:
1. Attachment A: Bay Area and California All-Electric Design Projects
2. Proposed Ordinance Adding BMC Chapter 12.80

Attachment A

Bay Area and California All-Electric Design Projects[52]

Residential	Commercial
UC Santa Cruz Student Housing West 750,000 square feet, 3,000 beds	**The David & Lucile Packard Foundation Headquarters** 49,200 square foot Office Building, San Jose, CA
UC Riverside Dundee Residence Hall 600,000 square feet**,** Riverside, CA	**IDeAs Z2 Design Facility** 6,557 square foot Office Building, San Jose, CA
UC Irvine Student Housing West 1,441 beds, Irvine, CA9	**The Exploratorium** 200,000 square foot science museum, San Francisco, CA
UC Davis Student Housing, Webster Hall Replacement 371 beds**,** Davis, CA	**Mark Day School** 14,574 square feet, Marin, CA
Casa Adelante, 2060 Folsom Affordable Housing 9-stories 127 Units, San Francisco, CA	**Golden Gate Park Tennis Center** San Francisco, CA
Maceo May Veterans Apartments, Treasure Island 105 units**,** San Francisco, CA	**Marin Country Day School** 11,500 square feet, Marin, CA
Balboa Upper Yard Family Apartments 120 units, San Francisco, CA	**Lick Wilmerding High School** 55,000 square feet, San Francisco, CA
Hunters Point Shipyard Block 52, 136 units, San Francisco, CA	**Sonoma Academy** Dining Facility, Sonoma, CA
Hunters Point Shipyard Block 54 136 units, San Francisco, CA	**UC Santa Cruz Cowell Ranch HayBarn** 5,000 square feet Office and Event Building, Santa Cruz, CA
681 Florida, 136 units, San Francisco, CA	**UC-Davis Jess Jackson Sustainable Winery Building** Davis, CA

[52] Scott Shell, Presentation, Berkeley Energy Commission, April, 24, 2019, https://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_Commissions/Commission_for_Energy/EC2019-04-24_Late%20Communication_Shell-Berkeley%20Electric%20Preso.pdf

Linda Vista, Mountain View 101 units, Mountain View, CA	**UC-Merced Administration Building** Merced, CA
Coliseum Place, 905 72nd Ave, Oakland 59 units, Oakland, CA	**Santana Row Lot 11** 236,000 square feet of office and retail space, San Jose, CA, US
Edwina Benner Plaza 66 units, Sunnyvale, CA	**270 Brannan,** 202,000 square feet of Class A office, San Francisco, CA
Stoddard Housing 50 units, Napa, CA	**SFO Admin Office** San Francisco, CA
2437 Eagle Ave, Alameda Affordable 20 Units, Alameda, CA	**SMUD Operations Office** Sacramento, CA
Station House 171 Units, Oakland, CA	**435 Indio Office Renovation,** 31,000 square feet Office Renovation, Sunnyvale, CA
Ice House, Oakland 124 Units (destroyed in arson fire)	**415 N. Mathilda Sunnyvale Office Renovation** 33,750 square feet, Office, Sunnyvale, CA
	AP+I Office Office Renovation 14,300 square feet, Office Renovation, Mountain View, CA
	380 N. Pastoria Office Renovation 42,000 Square Feet Office Renovation, Mountain View, CA
	J. Craig Venter Institute Laboratory 44,600 square feet, Research Lab, San Diego, CA
	Lawrence Berkeley National Lab Integrative Genomics Lab 81,000 square feet Lab, Berkeley, California
	BioEpic Laboratory, Lawrence Berkeley National Lab 70,000 square feet, Berkeley, California
	Kaiser Santa Rosa Medical Office 87,300 square feet, Santa Rosa, CA
	Bradley Terminal, LAX Los Angeles, CA
	All Electric Restaurants at LAX Los Angeles, CA