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# San Francisco Electric Preferred Ordinance

## Summary

To encourage the substantial benefits of all-electric design, the ordinance proposes no new requirements for newly constructed all-electric buildings in San Francisco. Modern all-electric design can improve public safety, benefit public health, minimize or eliminate operational greenhouse emissions, and improve resilience. Cost of all-electric construction can be lower than mixed fuel, or similar.

For projects which opt to incorporate natural gas infrastructure and systems (mixed-fuel buildings), the ordinance would require significantly greater energy efficiency compared to Title 24 2019 – saving energy, utility costs, and climate-changing emissions. Investment in additional high-efficiency mixed-fuel design beyond complying with code is cost-effective. Available data indicates all-electric new construction that is more efficient than Title 24 2019 has the lowest lifecycle cost, though this option is not proposed as mandatory.

## Context

To address risks to health, safety, economy, resilience and equity posed by climate change, in 2008 San Francisco set citywide greenhouse gas emissions limits culminating in an 80% reduction by 2050.[1] In 2019, Mayor London Breed committed to ensure new buildings in San Francisco generate no operational emissions no later than 2030.[2] The proposed ordinance offers significant progress toward this goal.

### *Safety*

All-electric buildings avoid hazards of combustible gas distribution and utilization. On average in the United States, a gas or oil pipeline catches fire every 4 days, results in an injury every 5 days, explodes every 11 days, and leads to a fatality every 26 days.[3] For example, on February 6, 2019, a gas line explosion at Geary Street and Parker Avenue in San Francisco burned 5 buildings.[4] On February 21, a gas leak on Bryant St prompted the City's Hall of Justice to shelter in place.[5] In 2010 the explosion of a gas pipeline in San Bruno resulted in eight fatalities.[6] Inside the home, gas cooking appliances emit nitrogen dioxide, carbon monoxide, and formaldehyde. In winter, 1.7 million Californians are estimated to be exposed to carbon monoxide levels exceeding standards for ambient air due to insufficient utilization of

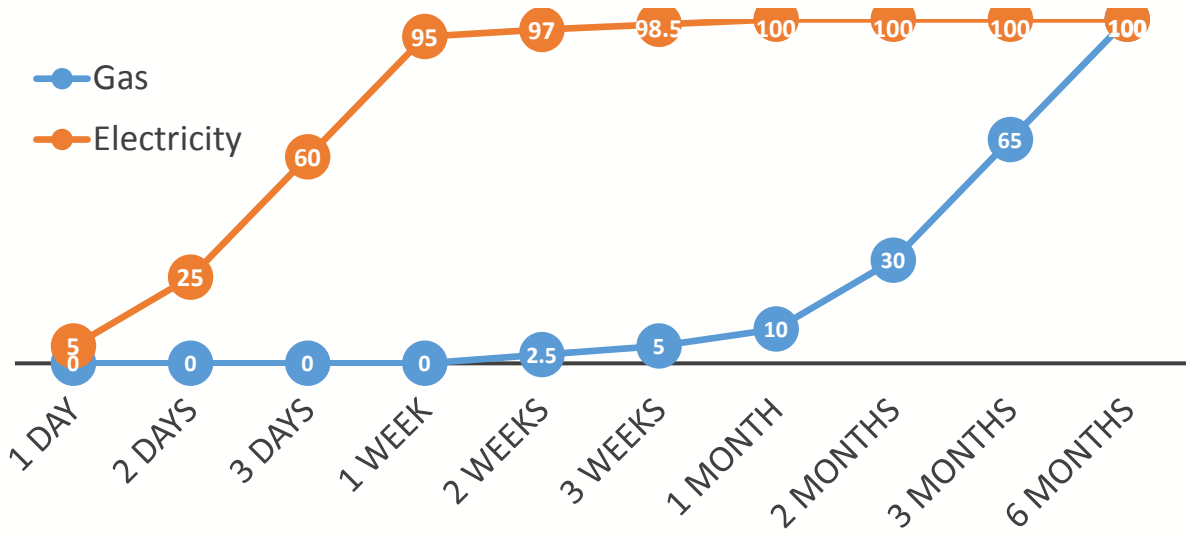
[1] San Francisco Environment Code Chapter 9 (2008) http://bit.ly/SFGHGLIMITS
[2] Net Zero Carbon Buildings Declaration (2019) c40.org/other/net-zero-carbon-buildings-declaration
[3] Kelso (2018) "Pipeline Incidents Continue to Impact Residents" www.fractracker.org/2018/12/pipeline-incidents-impact-residents/
[4] ABC 7 News (2019) NTSB releases preliminary report on gas line explosion in San Francisco. abc7news.com/ntsb-releases-preliminary-report-on-gas-line-explosion-in-san-francisco/5160531/
[5] Sernoffsky/SF Chronicle (2019) www.sfchronicle.com/bayarea/article/Gas-leak-prompts-shelter-in-place-at-SF-Hall-of-13634340.php
[6] Wikipedia (2019) en.wikipedia.org/wiki/San_Bruno_pipeline_explosion

venting range hoods while cooking.[7] Children living in a home with gas cooking have a 34% increased risk of asthma.[8]

***Resilience***

US Geological Survey estimates a 72% probability of a magnitude 6.7 or greater earthquake in the San Francisco Bay Region by 2043. Pacific Gas and Electric Company estimated that in the event of a magnitude 7.9 earthquake striking near San Francisco, electricity service can be substantially restored to 95% of customers in San Francisco within one week, while restoration of gas service is likely to require 6 months, as shown in Figure 1.

*Figure 1: Estimated Time to Restore Utility Service after 7.9 Magnitude Earthquake[9]*
*(Values reflect percentage of customers with restored service)*




At the time of writing, PG&E has instituted Public Safety Power Shutoffs (PSPS) to reduce fire risk during weather conditions deemed high-risk for conflagrations similar to those experienced in 2017 and 2018. On October 9, 2019, PG&E cut electric power to 800,000 customers across the greater Bay Area. San Francisco was not directly affected by this event, in part because fire risk for an urban area at the tip of a peninsula is different from surrounding areas.

In newly constructed buildings, neither the energy code nor this proposal would ensure continuity of function in a blackout. Modern, efficient gas appliances require electricity to operate fans such as

[7] Nicole (2014) Cooking Up Indoor Air Pollution https://ehp.niehs.nih.gov/doi/pdf/10.1289/ehp.122-A27
[8] Lin, Brunekreef, Gehring (2013) Meta-analysis of the effects of indoor nitrogen dioxide and gas cooking on asthma and wheeze in children. academic.oup.com/ije/article/42/6/1724/737113

[9] San Francisco Lifelines Council (2014) "Lifelines Interdependency Study" sfgov.org/orr/sites/default/files/documents/Lifelines%20Council%20Interdependency%20Study.pdf

"power vents", controls, and ignitors. As a result, the impact of blackouts on new construction is not dependent on the medium of energy utilized, but on installation of battery storage and appropriate switchgear for temporary operation independent from the grid.

### *Climate Change*

San Francisco is experiencing the impacts of climate change, and will continue to. Climate change impacts on San Francisco to date have included extreme tides requiring modifications to wastewater infrastructure; reduction in annual snow accumulation and increased effects of drought in Sierra Nevada watersheds that feed the Hetch Hetchy water system; extreme concentrations of toxic air pollutants in the City due to fires in Northern California in 2017 and 2018; and increases in peak temperature, frequency, and duration of extreme heat events.

Natural gas is the source of 82% of climate changing emissions from buildings citywide.[10] That may be an underestimate, because leakage of uncombusted natural gas has a powerful impact on climate change. Methane, the primary component of natural gas, traps 86 times more heat than carbon dioxide.[11] Leakage from the natural gas distribution system has been conservatively estimated at 4.5% of total consumption[12] – increasing buildings' effective natural gas emissions in San Francisco by 21%.

By contrast, emissions from electricity use in San Francisco declined 81% from 1990 to 2017.[13] Energy efficient building codes and incentive programs have helped; commercial electricity use has declined since 1990 while the city's economy has more than doubled. In addition, California's Renewable Portfolio Standard requires all load-serving entities to supply escalating amounts of electricity generated from renewable sources. California policy aims to ensure that by 2045, all electricity supplied statewide will be emissions-free.[14] San Francisco is aiming to achieve this goal by 2030, and emissions-free electricity is available today in San Francisco at a modest premium from two load serving entities (CleanPower SF and PG&E), and at emissions-free electricity is available from SFPUC to new buildings at a lower cost than PG&E's default offering. On-site solar electric systems offer an additional benefit: supplying electricity at a set cost for an extended period; using solar electric and all-electric systems reduces utility cost exposure if rates increase for either electricity or natural gas.

#### ***Introduced Legislation***

Three ordinances were introduced to the Board of Supervisors in September:

- (SFBoS File 190964 – Carrying forward existing requirements) Repeal 2016 San Francisco Green Building Code and enact SFGBC 2019 consisting of the 2019 California Green Building Standards Code

[10] San Francisco Climate Dashboard (2019) sfenvironment.org/sf-climate-dashboard
[11] Intergovernmental Panel on Climate Change (2014) "Climate Change 2014: Synthesis Report".
[12] San Francisco Department of Environment (2017) Methane Math: How cities can rethink emissions from natural gas" sfenvironment.org/sites/default/files/fliers/files/methane-math_natural-gas-report_final.pdf
[13] San Francisco Climate Dashboard (2019) sfenvironment.org/sf-climate-dashboard
[14] CEC (2019) California agencies lead way to clean energy future. calenergycommission.blogspot.com/2019/09/california-agencies-lead-way-to-clean.html

as amended by San Francisco. This ordinance serves to carry-forward current requirements into subsequent code cycle.

- (SFBoS File 190972 – Ban on natural gas in municipal projects) Amend Environment Code to require new construction and major renovations of municipal buildings to exclude natural gas and include exclusively all-electric systems.

- (SFBoS File 190974 – Electric Preferred Ordinance) Establish energy performance requirements for certain new building construction in the 2019 San Francisco Green Building Code

*Review of Each Ordinance*

***SFBoS File 190964 – Carry Forward existing requirements***

- Endorsed by the Building Inspection Commission in July 2019.
- Two policies in the ordinance may change energy use:
    - Residential Green Building Rating System: Sections 4.103.1.1 and 4.103.2.1 require residential projects to achieve LEED Silver certification or the GreenPoint Rated designation. GreenPoint Rated is most commonly selected. GreenPoint Rated minimum energy performance criteria are
        - Mixed fuel residential ≥4 occupied floors: Design to use at least 10% less energy than the maximum allowed by Title 24 Energy Standards.
        - Mixed fuel residential ≤3 occupied floors and single family: Achieve Total Energy Design Rating of 14 or less.
        - All-Electric: Design to use no more energy than allowed by Title 24 Energy Standards.
    - Solar Electric, Solar Thermal, or Living Roof:
        - Section 4.201.2 requires newly constructed R occupancy buildings of 4 floors or more, up to 10 floors, to establish a solar zone area for installation of solar photovoltaics, solar thermal, or living roof, and install any or all of these three options.
        - Similarly, Section 5.201.1.2 requires newly constructed buildings of any non-residential occupancy, 10 floors or less, and where the building is 2,000 square feet or greater in gross floor area, must establish a solar zone area, and install any or all of these three options.
        - If living roof is selected, the compliance path is considered a stormwater management measure; the installation of a living roof may have negligible effect on energy consumption due to San Francisco's mild climate and significant roof insulation requirements under Title 24 for most occupancies.

**SFBoS File 190972 – Ban Natural Gas in Municipal Projects**

- This ordinance is a requirement the City is imposing solely on the City's own buildings. It is not an energy standard.

**SFBoS File 190974 – Electric Preferred Ordinance**

This ordinance sets energy performance requirements for newly constructed buildings:

- Non-residential mixed-fuel (excluding F, L, and H occupancies): Design to use at least 10% less energy than the maximum allowed by Title 24 Energy Standards.
- Mixed fuel residential ≥4 occupied floors: Design to use at least 10% less energy than the maximum allowed by Title 24 Energy Standards.
- Mixed fuel residential ≤3 occupied floors and single family: Achieve Total Energy Design Rating of 14 or less.
- All-electric, all occupancies: Design to use no more energy than allowed by Title 24 Energy Standards.

***Cost Effectiveness***

Locally adopted energy standards are not enforceable under California law until the California Energy Commission approves. The biggest considerations for CEC approval of a local ordinance are:

- Buildings affected by the ordinance will use no more energy, or less, than buildings built to the unmodified 2019 Title 24 Energy Standards
- Requirements are found to be cost-effective

Two cost-effectiveness studies were performed, providing a comprehensive analysis of building prototypes representative of new construction statewide. Engineering analysis was performed for the full range of climate conditions across the state. For each occupancy studied, prescriptively compliant building energy models were prepared with mixed-fuel systems, then with all-electric. Scenarios analyzed for each mixed-fuel vs. all-electric pair included:

- Minimum compliance
- Additional energy efficiency measures appropriate to that occupancy
- Same energy efficiency measures, and in addition solar PV and/or battery electricity storage

Researchers developed cost data by acquiring commercially available construction cost data, interviewing contractors, interviewing utilities regarding connection costs, and incorporating multi-year rate increases for both gas and electricity that were pending before the California Public Utilities Commission.

The studies are quite robust, but two aspects of San Francisco policy required supplemental analysis by Department of Environment. For the purpose of this analysis, all projects were assumed to exclusively use photovoltaics to comply with San Francisco's Better Roofs requirements. This assumption is conservative, since some projects will opt for living roof or solar thermal. Department of Environment

analysis drew directly from the source data, financial analysis, and energy performance simulation results prepared by the engineers who performed the study. The two issues that required minor additional modeling were:

- Mixed fuel buildings (excluding low-rise residential): San Francisco's Better Roofs requirements required a larger PV array than the mixed-fuel efficiency-only scenarios, but less PV than the PV-maximizing scenarios. PV costs and benefits for Better Roofs compliance were scaled on a cost & generation per square foot basis.
- All-Electric buildings (excluding low-rise residential): San Francisco's Better Roofs requirement applies. Therefore all-electric scenarios presented below refer to a building with energy efficiency design sufficient to comply with Title 24 2019, which additionally selects installation of PV as the means of compliance with the Better Roofs requirement.

Results are summarized in Table 1 below.

***Table 1: Incremental cost and benefit normalized by building floor area (e.g. cost per square foot), all-electric vs. mixed-fuel.***

| | All Electric | | | Mixed Fuel | | |
|---|---|---|---|---|---|---|
| Use | Requirement Beyond Code | Additional Construction Cost ($/Sq Ft) | Lifetime Savings | Requirement Beyond Code | Additional Construction Cost ($/Sq Ft) | Lifetime Savings |
| Single Family | 0% | -$5.01 | $3.62 | 28% | $2.01 | $0.81 |
| Multifamily 3 floors or less | 0% | -$1.18 | $4.64 | 11% | $2.62 | $0.13 |
| Multifamily 4 floors or more | 0% | Same as current requirement (See Hotel) | | 10% | Same as current requirement (See Hotel) | |
| Hotel | 0% | -$29.79 | $0.09 | 10% | $0.49 | $3.23 |
| Retail | 0% | -$0.98 | $6.37 | 10% | $0.23 | $8.27 |
| Office | 0% | -$1.54 | $1.09 | 10% | $1.24 | $4.43 |

Negative numbers for construction cost indicate construction cost below baseline (prescriptively compliant mixed fuel). Positive numbers for lifetime savings indicate financial benefit.

*Summary of Table 1*

- All-electric buildings generally cost the same or less to construct than gas. Lifecycle costs for all-electric are less.
- High-efficiency buildings that perform better than code may cost more to build, in return for lower utility cost.