Cost Impacts of Electrification on San Francisco Municipal Capital Improvement Projects

This memo summarizes the 2022 report, "Planning for Building Electrification: Understanding Impacts on San Francisco Municipal Capital Improvement Projects", by DNV for San Francisco Department of the Environment in partnership with San Francisco Public Utilities Commission (SFPUC). It is organized into four sections: (1) background; (2) cost of replacing natural gas equipment with efficient and electric equipment; (3) cost of electrical upgrades; and (4) unit cost of electricity compared to natural gas.

1. Background

In alignment with San Francisco's goal to reach net-zero emissions by 2040 and the City's 2021 Climate Action Plan, the Municipal Green Building Task Force has recommended that requirements be added to Municipal Green Building Requirements (Environment Code Chapter 7) for a building's natural gas-using appliances to be electrified at the end of their useful life. Should an increase from existing electric service capacity be necessary, the proposed policy also indicates that the upgraded electric service infrastructure must be sufficient to accommodate the new equipment as well as future replacement and electrification of the building's remaining gas-using equipment, and electric vehicles if applicable.

2. Cost of Replacing Natural Gas Equipment with Efficient and Electric Equipment

While incremental capital expenditures related to procurement and installation can be minimized by requiring that electrification occur at time of replacement, the transition in existing buildings will generally require investment above-and-beyond the costs of replace-in-kind strategies. Key considerations include:

- Increased capital costs of some equipment
- Changes to ductwork or plumbing systems
- Changes to building electric distribution systems

The table below reflects typical scenarios for the electrification of popular municipal building natural gas end-uses:

	Air-conditioned buildings	Pool heating	Small domestic water heating	Basic packaged rooftop units	Boiler replacement
Capital Costs	+	++	+	=	+++
Energy Use	- -	- - -	- -	- -	- -
Emissions*	None	None	None	None	None
Service Upgrades	No	Yes	No	No	Depends

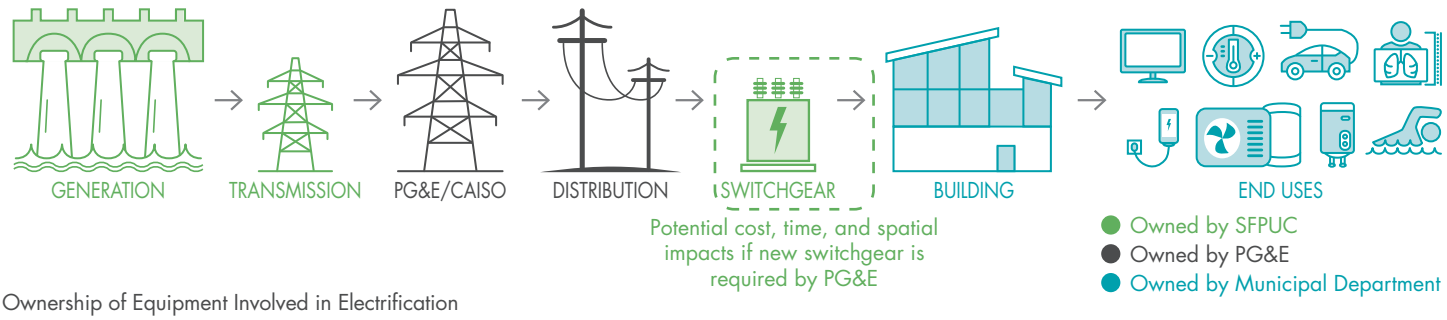
Key: +++ Varying degrees of increase | - - - Varying degrees of decrease | = Neutral

* SFPUC's Hetch Hetchy Power System, SF Power, supplies 100% greenhouse gas-free power to municipal facilities

3. Cost of Electrical Upgrades

Project design intent can be met (including electrification) in many cases without an electric service upgrade as outlined in the table above and process flow diagram on the following page. It is important to anticipate whether service must be upgraded because PG&E equipment requirements represent a significant cost for the City department and SFPUC, and complicate construction schedules. When service must be upgraded, it is ideal to limit the iterations of expansion. Benefits of a single intervention include reduced staff burden, faster project completion, and cost savings. Planning today for future electrical loads is also likely to be less intrusive to building managers and occupants in the long term.

The assets involved in generating, transmitting, and consuming power are typically owned and controlled by three different entities: SFPUC, PG&E, and the City of San Francisco's various municipal departments (illustrated in diagram below).



Ownership of Equipment Involved in Electrification

In the current arrangement, PG&E is responsible only for the transmission and distribution of power from Hetch Hetchy Power generation. SFPUC is responsible for the generation and transmission to the PG&E/CAISO transmission system and the Intervening Facilities located between PGE's distribution infrastructure and the switchgear located at the end-user. The Intervening Facilities and equipment that consume the power are owned by SFPUC and the City of San Francisco.

SFPUC's quarterly report on the status of PG&E service applications[1] has compiled data on recent electric infrastructure upgrades to determine costs and time impacts on construction of recent PG&E interconnections. There is no trend between the size of utility equipment needed and the cost of the project. The average total cost of the interconnections reviewed in this study was $283k. Total costs ranged $30k to $2.5m. However, under current PG&E Interconnection rules the average total cost range is expected to increase; with interconnection costs expected to range between $300k and $2.5m, not including the primary switchgear. According to SFPUC, customers should budget a minimum of ~$800k for primary switchgear where needed. The estimate excludes the cost of studies, trenching, and other equipment. These additional costs vary based on existing circuit capacity and proximity to the point of interconnection.

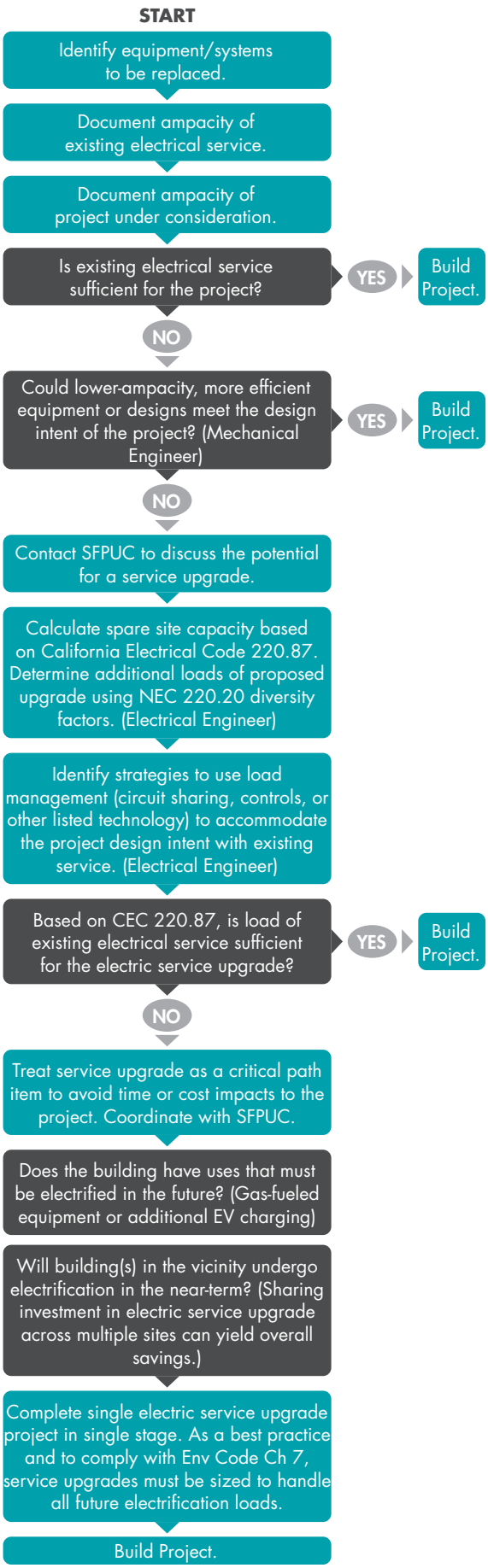
There can be a protracted and costly delay due to PG&E's process when a SFPUC service upgrade is requested for San Francisco's municipal projects. Based on a list of projects documented by SFPUC[2], this process can take from 10 months to 4 years, with projects commonly seeing 2-3 year wait periods.

The process flow diagram (opposite) navigates the fundamental steps for an electrification project to assess if there is sufficient capacity or plan for an upgrade, starting with a comprehensive inventory of existing equipment and expected remaining life for each.

4. Unit Cost of Electricity Compared to Natural Gas

There is the possibility of utility costs increasing with electrification, at least in the short term. This can be due to the increased overall usage that comes with the introduction of new functionalities, as well as the currently higher unit cost for electricity compared to natural gas. However, it is projected that the cost of natural gas will significantly increase over time – far surpassing electricity costs – especially with accelerated electrification activities: An analysis completed for the California Energy Commission forecasted that natural gas costs could increase between 127%–1,339% by 2050, whereas electricity costs are projected to increase 20%–40% in that same period.[3] Electricity costs may also be reduced with the implementation of energy efficiency retrofits and onsite energy generation, especially when factoring in the increased efficiency of electric appliances compared to their natural gas counterparts (e.g., high efficiency heat pumps can be 3-5 times more efficient), and the competitive electric rates provided by SFPUC.

1 https://bit.ly/sfpucreport210423
2 https://www.publicpowersf.org/obstruction
3 https://www.ethree.com/at-cec-e3-highlights-need-for-gas-transition-strategy-in-california



Navigating an Electrification Project From Beginning to End