DECARBONIZING RESIDENTIAL BUILDINGS BY ELIMINATING NATURAL GAS USAGE

Report for Supervisor Gordon Mar

Presentation to:

LAND USE AND TRANSPORTATION COMMITTEE

BOARD OF SUPERVISORS
CITY AND COUNTY OF SAN FRANCISCO

July 26, 2021

SF Goal: Net-zero greenhouse gas emissions by 2050

38% SF's GHG emissions: natural gas combustion in buildings.

For residential buildings: emissions largely due to gas-fueled appliances:

- Furnaces
- Water heaters
- Ovens and cooktops
- Laundry appliances

Replacement of gas-fueled appliances with electric could significantly reduce SF's GHG emissions

Costs to retrofit SF residences from natural gas to electric

Estimated total costs for retrofitting 240,231 SF residences

	Low Cost		High Cost	
	Single family	Multi-family	Single family	Multi-family
Cost/housing unit	$14,363	$14,363	$34,790	$19,574
# Housing Units	76,470	163,761	76,470	163,761
Subtotal	$1.098 Billion	$2.352 Billion	$2.660 Billion	$3.205 Billion
Grand Total: all housing	**$3.450 Billion**		**$5.866 Billion**	

Sources: Low: Navigant Consulting, prepared for California Building Industry Association
High: E3 Consulting, funded by SCE, SMUD, & LADWP

Current state: less costly to replace natural gas appliances with same

	Single-Family House, Pre-1978 Electric Retrofit	Single-Family House, Pre-1978, Gas Replacement	Four-Unit Building, Pre-1978, Electric Retrofit (Per Unit)	Four-Unit Building, Pre-1978, Gas Replacement (Per Unit)
Cooktop	$2,295	$1,510	$2,118	$1,510
Dryer	2,944	1,805	2,118	1,805
HVAC	20,633	16,793	8,343	7,276
Water Heater	4,662	2,598	4,251	2,461
Electric Panel Upgrade	4,256	-	2,744	-
Total	**$34,790**	**$22,706**	**$19,574**	**$13,052**
Difference: Gas vs. Electric	**$12,084**	**($12,084)**	**$6,522**	**($6,522)**

Source: E3 Consulting (high-cost scenario)

Current state: electricity > natural gas costs. *Future*: could reverse.

Average Prices (2009-2019)	
Electricity	Natural Gas
$0.22/kWh	$1.209/therm
Conversion	
1 therm of natural gas = 29.3 kWh of electricity	
$6.50 for electricity equivalent of 1 therm vs. $1.209	

However…

- Energy specialists forecast: cost advantage could be reversed in coming years
- Natural gas costs could increase by 2050 by 127 – 1,399% vs. electricity 20-40% (*source: E3 Consulting*)
- Electric appliances more efficient (heat pumps)
- Electricity costs can be offset through solar panels/renewables; natural gas can only be provided through utility pipelines

More building electrification over time = higher natural gas rates

- Baseline price: $1.32/therm

Scenario	2050 Natural Gas Rates Per Therm (2018 Dollars)
State emissions reduction goal not met by 2050	$3.00
Emission reduction goals met by 2050 through renewable gas & transportation electrification but no change in building energy use	$5.50
Slower Building Electrification	$5.70
Faster Building Electrification	$19.00

*

**** Natural gas rates above $3.40 would mean electricity less costly ongoing***

Cost Favorability Changes to Electricity as Natural Gas Rates Increase

	All-Electric	Natural Gas (Low-Cost Estimate)	Natural Gas Cutoff point	Natural Gas (High-Cost Estimate)
Energy Usage	5,314 kWh	454.5 Therms	454.5 Therms	454.5 Therms
Energy Rate	$0.289/kWh	$3.00/Therm	$3.40/Therm	$19.00/Therm
Cost	$1,533.62	$1,363.50	$1,545.30	$8,635.50
Difference (Compared to Electric)	N/A	($170.12)	$11.68	$7,101.88

Barriers to residential retrofitting: high cost; who pays?

- If property owners pay under mandate:
  - ➢ High costs incurred by individual owners
  - ➢ Equity issues

- If City funds all or a portion of costs:
  - Substantial City costs; could be covered by issuing bonds
    - All at once or phased over time
  - Combine debt issuance with rebates, incentives, and some property owner contribution to reduce costs incurred by City

Cost vs. time to reduce emissions: alternatives & impacts

City mandate alternative	GHG Emission Impact	Cost Impact
Retrofit of all residences	Major reduction: all 240,231 gas-fueled housing units retrofitted.	High costs at once ($14,363 to $34,970/unit). Incurred by property owners &/or City.
Retrofitting as appliances are naturally replaced	Appliances can last 20-40 years; multi-decade process	Only incremental costs of retrofitting incurred ($2,674 - $12,084/unit).
Electric appliances for all new construction	No impact on existing residences (only 4,044 units added in 2020).	No City impact: construction costs passed on to developers.
Electric appliances required at transfer of ownership	Estimate 2,464 SFH units sold/yr. Decades before all housing retrofitted.	No City impact: retrofitting costs passed on.
Emission fee to property owners based on energy use & source	Potentially large impact depending on fee.	Property owners incur costs; could pass on to tenants.

Reducing retrofitting costs/potential funding support

Reduce retrofit costs
Rebates
Low amperage appliances
Obtain volume discounts for program by pre-qualifying contractors and appliance manufacturers
Noticing requirements

Potential funding sources
Impose a residential utility users tax
Impose building emissions limits
State Cap-and-Trade funding (AB 1477)
Bay Area Regional Energy Network (BayREN)
Low-income Weatherization Program
Financing programs for property owners (e.g., PACE)

California rebate program examples

Organization	Max. rebate	Source
Sacramento Municipal Utility District	Up to $13,750/household	Ratepayer revenue set-aside
Marin County	Up to $4,500/household	BAAQMD grant
City of San Jose	Up to $3,500/household	BAAQMD grant
City of Palo Alto	Up to $1,500/household	Ratepayer revenue

Other considerations

Job creation: Retrofit program would generate an estimated 423-774 construction jobs/year in San Francisco.

Electrical grid capacity: PG&E states it has capacity for increased electrical.

Pruning the natural gas grid (redirect gas line maintenance $ to electrification efforts): PG&E states considering this approach but no official policy at time of report.

Questions and comments

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